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Essays on formal and informal care, multidimensional measures of vulnerability and social exclusion

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The undersigned Ludovico Carrino, in his quality of doctoral candidate for a Ph.D. degree in Economics granted by the Advanced School of Economics of Ca' Foscari University of Venice, attests that the research exposed in this dissertation is original and that it has not been and it will not be used to pursue or attain any other academic degree of any level at any other academic institution, be it foreign or Italian.

ABSTRACT

This dissertation addresses two main challenges for the Economics of social protection in Europe, namely, the measurement of multidimensional vulnerability conditions and the interplay between the public and the family support to population in need. The first two chapters focus on availability, accessibility and utilization of long-term care (LTC) among vulnerable elderly adults in Europe. We review assessment-of-need and eligibility frameworks for public home-care benefits (in kind or in cash) in European countries and regions, and show that coverage of formal LTC systems is significantly affected by cross-countries and within-countries heterogeneities in the definition and the measurement of vulnerability conditions. Accounting for regulations heterogeneity in empirical analyses allows us to identify individual characteristics that affect access to home-care among the eligible individuals. Indeed, an important role of (low) education is found, as a predictor of potential LTC failures, i.e., situations in which individuals do not receive any public formal assistance, although being eligible for it.

The second chapter investigates the trade-off between formal and informal home-care for vulnerable elderlies in Austria, Belgium, Germany and France. We focus on a direction of causality of high policy-relevance, i.e., whether an increase (decrease) in the formal provision of home-care would crowd out (be substituted by) informal caregiving. Although theoretical frameworks have been proposed, showing that a complementary relationship could arise when the Elderly exhibit an excess demand of care, empirical evidence is scarce, due to the endogenous nature of formal-care decisions. We propose an instrumental variable approach with a novel instrument: a variable that capture individuals' eligibility status to the LTC domiciliary programmes implemented in their own nation or region. That is, a dummy variable - being eligible or not - which has individual variation and which is grounded on the LTC regulative context at national or regional level. We are able to estimate an instrumented two-part model using waves 1 and 2 from SHARE, for non-institutionalised individuals in Austria, Germany, France and Belgium. Our results point at the lack of crowding-out of the informal- by the formal-care, thus suggesting the existence of a substantial unmet demand of LTC among the Elderly, which is supplemented with a combination of both formal and informal assistance.

Finally, the third chapter goes back to the methodology and rationale of measuring multi-dimensional socio-economic phenomena. In particular, we focus on the concept of Social Exclusion (defined by the European Council), a multi-faceted condition of weakness that prevents groups of individuals from taking part to an active social and working life in a community. Basing on a flexible CES framework, we show how different methodological approaches generate contradictory measures of Exclusion at regional level in Europe, primarily because of different strategies (and hidden shadow prices) in data normalization and aggregation. In particular, we argue that normalization is among these *implicit* forms of weighting and that it is often not made transparent enough, both in terms of how it is performed and in terms of its (economic) implications on the trade-offs which are intrinsic to any multidimensional measure. We then propose and develop an alternative measure of Social Exclusion at European regional level, with normalization parameters elicited through a survey conducted among the Ca' Foscari Alumni of the Departments of Economics and Management in Venice.

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"Si non per portas,
per muros"

Ludwig van Beethoven (1770-1827)
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PREFACE

This dissertation addresses two main challenges for the Economics of social protection in Europe, namely, the measurement of multidimensional vulnerability conditions and the interplay between the public and the family domiciliary support to elderly population in need. These two subjects are strictly connected, since most public programmes of care embody in their regulations a definition of a "minimum objective vulnerability level" which represents the target of their benefits and which is, inherently, multidimensional. The first two chapters discuss the way in which old-age vulnerability is defined and exploit these information to perform an empirical analysis on the relationship between formal and informal-care provision among the Elderly in Europe. The third chapter presents the results of an on-going work that discusses the rationale, the limitations and the opportunities embedded in the task of measuring multidimensional phenomena.

Any analysis on the Economics on Long-Term Care for the Elderly requires an acknowledgment of the unprecedented process of population ageing which is currently driving the demand of care by elderly Europeans with age-related vulnerability conditions. Besides population dynamics, fluctuating birth rates and reduced fertility, the ageing process is a consequence of the compression of mortality (longer life expectancy) in the last four decades, which in turn is the result of reduced incidence of fatal cardiovascular diseases driven by improved lifestyles, prevention and treatment processes. In the words of Rechel *et al.* (2013), "population ageing can be described as both an outcome of, and a challenge for, European health systems". The extent to which the ageing process poses pressures on the public Welfare States depends on the future "paths" (or profiles) of ageing and healthy ageing. The theory of "compression of morbidity", introduced by James Fries in 1980, states that increased longevity would have postponed the age of chronic illnesses' first appearance more than the age at death, therefore shortening the lifetime in disability. Nevertheless, there is evidence of increasing incidence rates of disorders common in older people (cancer, fractures, strokes, dementia, diabetes, and functional limitations), while Eurostat data from 2013 show that, especially for Eastern European countries, longevity in good health has indeed risen less than life expectancy at birth.

With tightening public expenditure budgets, declining number of people in working age and socioeconomic changes in family contexts, substantial challenges on the supply of formal and informal Long-Term Care (LTC) need to be faced and are the subject of current policy debate. Indeed, the risk that the demand of care would fail to be met by effective, responsive and good-quality forms of social protection is high and worrisome. Proactive programmes of formal-care, especially home-based, are being introduced to promote health-literacy, prevention, rehabilitation, re-enablement, as well as age-friendly environments, ultimately fostering financial sustainability, effectiveness and adequacy of the systems. This would help elderly individuals to better adapt to the ageing process, thus delaying the occurrence of frailty and disability. Demand of LTC would grow slower, while investments in the "Silver Economy" would increase the supply of LTC from healthy-aged informal and formal caregivers.

Utilization of formal LTC requires some degree of interaction between the elderly applicant and the institution providing the benefit or the service. We can disentangle this interaction under three components: the *availability* of the service, its *accessibility* and its *utilization* (i.e. realized accessibility) by the applicant. *Availability* pertains to the existence of any supply of LTC in the nation / region / community where the applicant lives. With respect to the public framework, this points to the existence of official legislations that regulate one or more programmes. *Accessibility* refers to the circumstances determining whether an individual can or cannot benefit from a programme, given her health-

and socio-economic characteristics. *Utilization* (or *realized accessibility*) refers to the *extent* to which an individual can benefit from a programme, given that entitlement was granted. These three aspects, taken as a whole, can provide a picture of the degree of social protection for old-age risk in a specific territorial unit (e.g., at the country level, rather than at the regional level or at the community level).

Chapter One deals with the issues of availability and, particularly, access to the public programmes of domiciliary long-term care for older adults.

Although being affected by individuals circumstances[1], the main determinants of access to LTC reside in the eligibility rules characterizing each programme. As reviewed in Section 1.5, main public LTC programmes in European countries define access to service in two sequential steps. First, an assessment-of-need is performed in order to build a "vulnerability profile" of the elder applicant; second, a decision on her eligibility status is taken by comparing the vulnerability profile with a set of eligibility rules defined by the legislation (this holds also for main private LTC insurances, which often borrow their eligibility criteria from the public regulations). Furthermore, the eligibility status conveys two sorts of information: at the extensive margin it discriminates between eligible and non-eligible individuals (i.e., having *access* to the program, or not) while at the intensive margin it characterizes the individual degree of eligibility and, therefore, the extent to which a recipient can benefit from the programme (i.e., the *utilization* of the service). What need to be stressed is that assessment and eligibility criteria act as compulsory gateway to long-term support in all countries, while they also perform other functions in some cases, such as acting as a pathway to reablement or to care planning. Hence, these regulations' characteristics are likely to be crucial factors in determining individuals' access to and utilization of formal home-based care in Europe.

The absence of a unique, standardized, medical definition of vulnerability (Section 1.2), together with its multidimensional nature, has important consequences in the policy-regulative fields that design programmes of long-term-care assistance at national, regional or community level. Besides being different in financing models, degree of universalism and centralization, LTC systems differ in how they define and assess vulnerability conditions, and therefore in the definition of a minimum level of need that allows someone to be eligible to a programme of care. Heterogeneities in the assessment-of-need processes and the eligibility conditions are, indeed, the ultimate manifestation of distinct "views" of the vulnerability process. In Chapter One, we look at how these issues are regulated and formalized in European's main LTC programmes. Overall, the analysis could be summarized by the "one-size does not fit all" motto. Relevant heterogeneities exist among countries (and even within countries, when multiple nationwide programmes are implemented) on the very issue of defining vulnerability. Even when restricting the perspective to a comprehensive set of functional (mostly ADL and iADL tasks) and cognitive limitations[2], it appears that there is almost no regulation that includes them altogether in the assessment-process, to detect a vulnerable condition. Moreover, the health-outcomes are often un-equally weighted within an assessment-scale: some limitations are given more importance than others in determining eligibility, and there are legislations that characterize some deficit

[1] E.g., having higher income or wealth allow to sustain higher care-costs; educational attainment can improve or impede access to care among "objectively vulnerable" elders, as shown in Section 1.4

[2] Although medical literature describes frailty as determined by a larger set of symptoms, nearly all studies on frail individuals report deteriorations in ADL and iADL, that are therefore considered to be effective measures of the need-of-assistance (Pel-Littel *et al.* (2009)).

as necessary and/or sufficient for being granted the benefit. An individual with a given medical-profiles may well result to be eligible for LTC services under one legislation while being ineligible under others, and this should be taken into account when analysing seniors' observed choices in terms of LTC utilization.

We contribute to the existing literature on Economics of LTC which often recognised, yet rarely addressed, the peculiarities of assessment and eligibility frameworks for elderly care. Our analysis does not aim to evaluate the efficiency or the performance of countries' LTC, yet we hope that providing insights on the regulative contexts could contribute to the empirical economic analysis, which has been mainly limited, so far, to the inclusion of country dummies in order to account for cross-country differences.

In *Chapter Two*, we investigate the interplay between formal-care utilization (i.e., realized accessibility) by European seniors and informal-care provision by their children, relatives, friends and neighbours. In particular, the paper's research question relies on the consequences that an increase (or a decrease) in the utilization of formal home-care can have on the informal-care provision, and therefore on the overall amount of home-care. This is a relevant issue since policy can, broadly speaking, intervene on LTC availability (by implementing new programmes or terminating existing ones), and accessibility (e.g., on programmes' coverage, typically by changing eligibility rules). Moreover, a policy can intervene on the intensity of the utilization offered to eligible individuals, through changes in the amounts of cash-allowances/reimbursements or in the amount of care provided in-kind through nurses, social workers or affiliated NGOs.[3] Anyway, after institutional changes have taken place, elderly individuals will be faced with either a reduced or an increased supply of formal-care. Our main question relates to how this potential change would affect the overall long-term care received by the dependent adult, that is wondering whether a, say, increase in the formal-care provision would: (1) substitute for the existing informal-care already being provided by family members, friends and neighbours, or; (2) be complemented by the family pillar of social protection, therefore raising (or not decreasing) the overall amount of care.

Although theoretical frameworks have been proposed, showing that a complementary relationship could arise when the Elderly exhibit an excess demand of care, applied analysis on this topic is limited, due the (theoretically grounded) endogenous nature of the formal-care utilization choice with respect to the informal-care. In empirical terms, this implies the need of relevant and exogenous instrumental variables that could correct for this potential bias. So far, this task has proven to be problematic and demanding, and most of the economic studies focused on the opposite direction of causality, i.e., the effect that a modification in the informal-care provision (usually, by children only) reflects in formal-care utilization.

We propose an instrumented two-part model with a novel instrument, namely, a variable that capture individuals' eligibility status to the LTC domiciliary programmes implemented in their own nation or region. Basing on the regulative context reviewed in Chapter One, we build an individual dummy variable - being eligible or not - which takes value 1 if the individual fulfils the minimum requirements of at least one LTC programme implemented in her

[3] Exempli gratia, as we write, a debate is ongoing in Italy on the alleged forthcoming reduction of the national funding for regional Long-term care programmes (Fondo per la non-autosufficienza 2015). (http://ilreferendum.it/2014/10/30/governo-renzi-la-legge-di-stabilita-taglia-ancora-fondi-per-malati-e-disabili/ , http://www.ilfattoquotidiano.it/2014/10/24/legge-stabilita-associazioni-disabili-mobilitate-contro-taglio-fondi/1169933/)

region/country of residency (i.e., she is *eligible* to public LTC home-care services) and 0 otherwise. This variable would then be used to instrument our potentially endogenous regressor (annual hours of formal home-care utilization).

We argue that information on the eligibility status to LTC home-based care can provide strong identification power to our analysis, when used as instrument of formal home-care utilization, for several reasons. First, the eligibility status is exogenous, in that it is determined by a medical team following clear-cut regulations and based solely on medical-status. In this respect, being eligible or non-eligible should not influence informal-care provision per se (our dependent variable). Second, eligibility is relevant to formal-care utilization for the aforementioned reasons and does not perfectly match the endogenous utilization of formal-care (a perfect-overlapping instrument would raise endogeneity issues), given the existence of non-compliers, i.e., eligible individuals who do not receive formal-care. Third, eligibility has variability across countries or regions, so that the same individual may be labelled as eligible under one legislation while being non-eligible under others and, fourth, it is defined at the individual level in our sample.

Our results may be summarized as follows. First, endogeneity of the formal-care decision is detected when attention is paid to the aggregate supply of informal-assistance from respondents' children, relatives, friends and neighbours. Second, we show that changes in the formal home-based care utilization by elderly adults positively and significantly affect informal home-care provision from family and/or friends. This positive effect, that ultimately increases the individual's overall care-utilization, suggests the existence of a substantial unmet demand of LTC among the Elderly, which is supplemented with a combination of both formal and informal assistance.

The *third chapter (Chapter Three)* goes back to the methodology and rationale of multi-dimensional measurements, which is particularly relevant not only in topics of health but also on socio-economics issues as poverty, social inclusion and, more generally, quality of life (which includes health-vulnerability as a dimension). The number of composite indicators proposed in the recent years has rapidly grown, not only on the topic of wellbeing but also on other aspects of performance measurement. Many authors have debated on the strength of the theoretical foundation behind multidimensional measures of performance or efficiency, and their empirical robustness. Indeed, it is well known that arbitrariness exists with respect to the choice of the dimensions to be included in a composite index, the normalization of the variables, the choice of the aggregation function and its parameters (see, e.g., Ravallion (2012a) Decancq and Lugo (2013)). We argue that the major focus of many applied works is devoted to the definition of the dimensions' weights, while little attention is devoted to the role played by normalization in influencing the final results, often presented as a necessary (and non-influential, or *neutral*) step.

We focus on the concept of Social Inclusion, a multi-faceted condition of weakness that prevents groups of individuals from taking part to an active social and working life in a community, defined by the European Council. We build a synthetic index for 58 administrative regions in Europe between 2004 and 2012, basing on a flexible CES aggregation function (using Eurostat data for Belgium, Germany, Italy and Spain). We show that normalization is a crucial stage where an "early" weighting takes place, which can strongly affect the overall results of the multidimensional analysis. Our claim is that the unavoidable arbitrariness inherent to the choice of the normalization function should be made transparent to the reader. Moreover, since the standard procedures characterize the rescaling stage as a mainly statistical operation (data-driven normalization), implicit trade-offs and shadow prices thus generated have weak economic justification. We propose an expert-based normalization strategy which allows to relieve these trade-offs from concerns

related to data availability, and makes the source of subjectivity (which is inevitably present also in the data-driven strategy) explicit and more transparent, albeit raising other methodological difficulties.

CHAPTER ONE

Eligibility and inclusiveness of Long-Term Care Institutional frameworks in Europe: a cross-country comparison[4]

ABSTRACT

Although economic literature has recently started to concentrate on the design, the scope and the regulations of main public programmes of Long-Term-Care in Europe, no analysis have, so far, compared different systems in terms of their degree of inclusiveness with respect to vulnerable elderly's health status. Focusing on several European countries, this paper investigate how LTC regulations assess vulnerability, as well as how they define a minimum level of objective-dependency that would entitle individuals to receive public benefits (in-kind or in-cash) for home-based care. Our contribution is threefold. We provide detailed information on assessment and eligibility frameworks for eleven LTC programmes in Europe. We show that substantial heterogeneities exist both at the extensive margin (the health-outcomes that are included in the vulnerability-assessment) and at the intensive margin (the minimum vulnerability threshold that defines benefit eligibility) of the assessment strategies. Building on this information, we compare LTC programmes in terms of their degree of inclusiveness, i.e., we investigate the extent to which each programme is able to cover a population of elderly individuals facing functional and cognitive limitations. The comparison is performed following both a directly- and an indirectly- adjusted strategy on a standard population built from SHARE data. The paper performs also an empirical analysis aimed at highlighting the determinants in the access to formal home-care in 4 European countries (Austria, Belgium, France, Germany). Using data from SHARE, we identify two peculiar sub-populations, namely, those who are – or are not – eligible to at least one LTC programme in their own country. By estimating two reduced-form probit models for each population, we show that the two groups substantially differ in the important predictors of the probability of receiving care. Among other factors, individuals' (low) educational attainments (via ISCED levels) are highly significant in determining the lack of access to care among vulnerable eligible Elderly (i.e., a "no-care zone" outcome). This remarks the importance of accounting for elderly's health and bureaucratic literacy level in designing programmes, in order to prevent access failures.

[4] With Cristina Orso (Università Ca' Foscari Venezia, Dipartimento di Economia)

1.1 INTRODUCTION

Long-Term-Care policies aim at covering the higher vulnerability risk that specifically affects the elderly population, when poor health conditions may become prevalent. Older adults have a higher propensity to suffer from multiple and concurrent deficits which can, in turn, quickly deteriorate their autonomy and independence in carrying out basic activities and, therefore, affect their ability to maintain an acceptable level of well-being. Although a discussion on the notion of well-being per-se is well beyond the scope of our analysis, the last five words – acceptable level of well-being – encompass the broad rationale of this paper: what constitutes acceptability (and, therefore, its failure), who should define it, and what are the economic consequences of these choices.

When does acceptability fall is, ultimately, a medical and a philosophical issue, often related to the concept of dignity (Brock, 1989; Gallagher *et al.*, 2008; Nordenfelt, 2004; Nussbaum & Sen, 1993). As an example, the OECD acknowledges that "protecting the right to a life in dignity of frail older people is becoming a major policy challenge" (OECD (2013a)). What we are referring to is not a universal human dignity, i.e., a specifically human value (*Menschenwürde*), which cannot be taken from the human being as long as he or she is alive. Rather, the focus is placed on the, so-called, "dignity of identity", related to the integrity of the subject's body and mind (Nordenfelt, 2004), which starts to deteriorate as long as the vulnerability process progresses. Indeed, although frailty conditions, and vulnerability in general, are undesirable conditions, they are not directly observable. This points to the need of developing methods to measure and operationalize them, with the ultimate goal of preventing or delaying their occurrence. The medical literature has produced a rich and extensive debate on the nature of vulnerability (see, e.g. Markle - Reid and Browne (2003) who also address the discord between uni- and multi-dimensional approaches) and proposed a number of definitions and instruments to measure it (e.g., De Vries *et al.* (2011)).

Nevertheless, no gold-standard emerged so far, and this lack of a unique medical definition quickly emerges as a relevant policy and economic issue, when the perspective switches to the role that public institutions play in implementing Long-Term Care (LTC) programmes whose target are, as already mentioned, individuals with unacceptable levels of well-being. In other words, regulations need to draw a line in the vulnerability continuum, identifying *when* the individual-specific conditions are severe enough to provide him with a benefit from the public sector (either health-care or social-care). Indeed, paraphrasing what stated few lines above, our research will try to answer questions on what constitutes vulnerability, who defines it, and what are the economic consequences of these choices, in the main public programmes in Europe. We thus contribute to the existing literature on Economics of LTC, which often recognised, yet rarely addressed, the peculiarities of assessment and eligibility frameworks for elderly care. It is our hope that providing insights on the heterogeneity in regulative contexts could also contribute to the empirical economic analysis, which has been mainly limited, so far, to the inclusion of country dummies in order to account for cross-country differences (Bakx *et al.*, 2014; Eleftheriades & Wittenberg, 2013).

Long-Term Care is defined as a range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent for an extended period of time on help with basic activities of daily living. This personal care component is frequently provided in combination with help with basic medical services such as nursing care (help with wound dressing, pain management, medication, health monitoring), as well as prevention, rehabilitation or services of palliative care. Long-term care services can also be combined with lower-level

care related to domestic help or less demanding tasks.[5] LTC can be provided at the recipient's own dwelling (*home-based care* / *domiciliary care*) rather than in nursing-homes or residential care-facilities (*residential-* / *institutional care*). In this chapter, we will concentrate on the LTC programmes that offer in-kind or in-cash benefits for home-based care, the so-called *formal-care* provided by professional nurses or social workers (as opposed to the *informal-care* provided by the dependent's family and friends) (OECD, 2013a).

Utilization of formal LTC requires some degree of interaction between the applicant and the institution providing the benefit (in-kind rather than in-cash). A commonly adopted approach describes this interaction under three perspectives: the *availability* of the service, its *accessibility* and its *utilization* (i.e. realized accessibility) by the applicant (see Levesque *et al.* (2013) for a detailed review of this approach and its variants). *Availability* pertains to the existence of any supply of LTC in the nation / region / community where the applicant lives. With respect to the public framework, this points to the existence of official legislations that regulate one or more programmes. *Accessibility* refers to the circumstances determining whether an individual can or cannot benefit from a programme, given her health- and socio-economic characteristics. *Utilization* (or *realized accessibility*) refers to the extent to which an individual can benefit from a programme, given that entitlement was granted. These three aspects, taken as a whole, can provide a picture of the degree of social protection for old-age risk in a specific territorial unit (e.g., at the country level, rather than at the regional level or at the community level). In this Chapter, we will deal with the first two aforementioned features, namely, availability and accessibility of LTC programmes, having as geographical reference the continental Europe.[6]

In the following Sections we will discuss the role and the characteristics of the vulnerability-assessment frameworks in LTC programmes, and we will detail how eligibility criteria are defined. We will provide some insights on how differences in regulations can affect the target population of a programme, thereby determining heterogeneities in theorical coverage rates and in access to care (Colombo & Mercier, 2012; Eleftheriades & Wittenberg, 2013).

The role of public formal home-based assistance is highly relevant in the current policy and economic debate in the LTC field. It is believed that this source of protection should play a crucial role in promoting the practice of healthy (and active) ageing (Rechel *et al.*, 2013; van Leeuwen *et al.*, 2014). Indeed, a proactive formal-assistance could prevent the age-related loss of autonomy, thus reducing LTC demand and increasing its supply (e.g., by healthier youngest-old caregivers[7]), and boost an efficient, cost-effective care provision in home-based care (European Commission, d. o. E., Social Protection Committee, 2014). Besides population dynamics, fluctuating birth rates and reduced fertility, the ageing process is a consequence of the compression of mortality (longer life expectancy) in the last four decades, which in turn is the result of reduced incidence of fatal cardiovascular diseases driven by improved lifestyles, prevention and treatment processes. In the words of Rechel *et al.* (2013), "population ageing can be described as both an outcome of, and a challenge for, European health systems". The extent to which the ageing process poses pressures on the public Welfare States depends on the future "paths" (or profiles) of ageing adopted in the simulation exercises (Costa-Font *et al.*, 2008; de la Maisonneuve & Martins, 2013; EUROSTAT, 2012; OECD, 2013b). What matter, indeed, are the perspectives in terms of healthy ageing rather than of "ageing" itself: the theory of "compression of morbidity", introduced by James Fries in 1980, states that increased longevity would have postponed the age of chronic illnesses'

[5] The ADL taxonomy (as well as the iADL) is discussed in paragraph 1.2 as well as in the Appendix 1.7.1
[6] LTC utilization will be covered in Chapter Two.
[7] See, e.g., Lakdawalla and Philipson (2002)

first appearance more than the age at death, therefore shortening the lifetime in disability Fries *et al.* (2011). Other theories postulate the "expansion of morbidity", in which the proportion of elderly adults good health would shorten, or a "dynamic equilibrium" in which it would remain more or less constant.[8] Compression of morbidity should be enhanced by an effective and proactive formal care. Nevertheless, there is evidence of increasing incidence rates of disorders common in older people (cancer, fractures, strokes, dementia, diabetes, and functional limitations), while Eurostat data from 2013 show that, especially for Eastern European countries, longevity in good health has indeed risen less than life expectancy at birth. In general, medical studies report mixed evidence for compression of morbidity theory and its alternatives (Crimmins and Beltrán-Sánchez (2011), (European Commission, d. o. E., Social Protection Committee, 2014; Rechel *et al.* (2013)).

The remainder of this Chapter is structured as follows: Section 1.2 briefly reviews the medical perspectives on the concept of vulnerability in old-age, and introduces the review of LTC regulations in Europe. Section 1.3 performs an overall comparison of eleven main LTC programmes for home-based care (either in-kind or in-cash) in seven European countries. Section 1.4 includes a simple empirical analysis that highlights some peculiar determinant of access to care (or lack of access) for elderly individuals whose medical status meet the definition of "vulnerability" of their own country's or region's regulations. Finally, Section 1.5 provides the actual review of LTC regulations.

1.2 THE CONCEPT OF VULNERABILITY: MEDICAL VS POLICY PERSPECTIVE

Access to public formal home-care is not fully discretionary for older adults in Europe. Every main public LTC programme across countries or regions requires applicants to meet certain criteria in order to become eligible to the benefits, i.e., a condition of "objective vulnerability" must be ascertained (this holds also for main private LTC insurances, which often borrow their eligibility criteria from the public regulations). As we will detail in the following Sections, the definition of "objective vulnerability" is highly heterogeneous among programmes (both within and between countries). This regulative heterogeneity is mirrored, at least partially, by a lack of a unique and agreed *medical* practice to measure and define vulnerability.

Being vulnerability an inherent characteristic of the ageing process, public health-care systems, and geriatricians in particular, are trying to cope with a growing population of elderly people which need frequent and multiple assistances and treatments that could, in turn, overlap with each other. The multi-dimensional nature of vulnerability (De Vries *et al.*, 2011; Markle-Reid & Browne, 2003; Pel-Littel *et al.*, 2009) requires a medical- and policy-approach not primarily disease-oriented (i.e., focusing on specific diseases or health-conditions). What is needed is a perspective that that takes into account the inter-play between single diseases and limitations, while accounting for genetic, environmental, psychological, social, and other factors in order to design a better tailored care-plan (the so-called "end of the disease era" described by Tinetti and Fried (2004)).

With respect to this peculiar population, two major challenges emerge. The first one, which is mostly on the side of geriatric physicians, is to operationalize vulnerability into a clinical framework, disentangling it into different degrees of functional (and cognitive) impairments in order to provide patients with an accurate clinical status and prescribe them proper treatments. The second challenge, which relies on the policy-side, is to offer the vulnerable Elderly an

[8] Rechel *et al.* (2013)

effective and efficient formal assistance (particularly, home-based assistance) that could enhance healthy ageing, meet their need-of-care, delay the vulnerability process and prevent the incurrence of new disabilities or diseases (Colombo & Mercier, 2012; van Leeuwen *et al.*, 2014). Assistance should be designed taking into account the patients' vulnerability level, as well as their specific economic, social and family situations conditions.

The medical literature has well documented the complex nature of vulnerability, which is often referred to as the result of conditions of *frailty, disability/dependency* and *comorbidity*. It is useful to briefly report here some definitions for these three terms since they all represent, to a great extent, the physiological changes that generate demand for LTC. According to Fried *et al.* (2004), *comorbidity* is "the concurrent presence of two or more medically diagnosed diseases in the same individual, with the diagnosis of each contributing disease based on established and widely recognized criteria". *Disability* is defined as "difficulty or dependency in carrying out activities essential to independent living, including essential roles, tasks needed for self-care and living independently in a home, and desired activities important to one's quality of life". The state of *frailty* is the toughest one to describe: it is "a clinical syndrome characterized by multiple characteristics including weight loss, and/or fatigue, weakness, low activity, slow motor performance, balance and gait abnormalities", together with a potential cognitive deficit.[9]

A pair of one-dimensional tools for functional assessment gained extensive diffusion among researchers in the last forty years: the list of Activities of Daily Living (ADL) developed by Katz *et al.* (1970) and the list of Instrumental Activities of Daily Living (iADL) developed by Lawton and Brody (1969). Both of these tools are used in medical fields as warning measures to highlight potential (or already established) conditions of dependency. Moreover, as it will be discussed in Sections 1.3 and 1.5, they constitute the core measures of LTC-need in most legislations in Europe. Further details on ADL and iADL can be found in Appendix 1.7.1. Indeed, although symptoms of frailty are many and various, the most prevalent are loss of autonomy in ADL and iADL, together with the occurrence of limitations in mobility, deterioration in nutritional status, cognition and endurance. Further determinants are weight loss, lowered serum cholesterol levels, and increasing sensitivity to change (see, e.g., Pel-Littel *et al.* (2009) for a detailed analysis). It is generally agreed that frailty is a state of high vulnerability for adverse health outcomes, including disability, dependency, falls and mortality.

Medical literature often highlights the difficulty of diagnosing vulnerability and summarizing its nature into a single, encompassing, measure (e.g., for eligibility purposes). First of all, *frailty*, *disability* and *comorbidity* are distinct but overlapping concepts. Frailty and comorbidity are jointly predictors of disability which, in turn, can exacerbate frailty and comorbidity. The latter, itself, contributes to increase frailty (Fried *et al.*, 2004). Moreover, "the physiological changes that underlie frailty and disabilities do not always achieve disease status, so that some people, usually very elderly, are frail without having life-threatening illness" (Rockwood & Mitnitski, 2007). As for the demographic determinants, frailty is not a necessary nor a sufficient condition for ageing or death. Furthermore, it shows similarities, but is not identical nor inevitable to the ageing process, which should not be considered a disease per se: the association between vulnerability and ageing is strong, and yet not all elderly adults are vulnerable (De Vries *et al.*, 2011; Pel-Littel *et al.*, 2009). Finally, frailty is considered a pre-disability state and therefore, unlike disability, it is reversible (there is "potential for intervention", in the words of Conroy (2009)).

[9] See also Fried *et al.* (2001).

The complex interactions between many risk-factors imply also that not every combination of deficits and not every comorbidity is equal in terms of the generated vulnerability (Fried *et al.* (2004), Fulop *et al.* (2010), Sourial *et al.* (2010), Pilotto and Ferrucci (2011), Rodríguez-Mañas *et al.* (2013)). As argued in De Vries *et al.* (2011), "disability is influenced by other than biological or physiological factors, for example personal characteristics including psychological state, emotional state and coping style. There is also an interaction with the physical and social environment, which can stimulate or hinder participation in activities. Therefore, in the last few years, frailty is acknowledged to be not only a biological or physiological state, but also a multi-dimensional concept".

Although there is no "gold-standard" in the medical literature, current research is actively focused on producing reliable tools that could help identifying (and predicting) vulnerability. Useful reviews of existing measuring-tools are Clegg *et al.* (2013), Pel-Littel *et al.* (2009) and De Vries *et al.* (2011) while a review on screening tools for frailty in primary health care is Pialoux *et al.* (2012). Among others, the *frailty-index* in Mitnitski *et al.* (2001) and Rockwood and Mitnitski (2007) link the condition of frailty to the accumulation of deficits, while Pilotto *et al.* (2013) develop and validate a multi-dimensional index of vulnerability and mortality based on a multidimensional assessment schedule (SVaMA) adopted in several Italian regions.

World Health Organization has also stressed the need for standardized tools to predict service needs and levels of care and, ultimately, to set up efficient and effective health-planning. "The presence of a disease or a disorder [is not] an accurate predictor of receipt of disability benefits, work performance, return to work potential, or likelihood of social integration. This means that if we use a medical classification of diagnoses alone we will not have the information we need for health-planning and management purposes. What we lack is data about levels of functioning and disability".[10] In response to this need, WHO started to develop an instrument – the International Classification of Functioning (ICF) – that should provide States with a "consistent and internationally comparable" tool to collect data on vulnerability. ICF follows a bio-psychosocial perspective, in that it sees vulnerability as "a complex phenomena that is both a problem at the level of a person's body, and a complex and primarily social phenomena. Disability is always an interaction between features of the person and features of the overall context in which the person lives, but some aspects of disability are almost entirely internal to the person, while another aspect is almost entirely external. In other words, both medical and social responses are appropriate to the problems associated with disability; we cannot wholly reject either kind of intervention".

1.2.1 A preliminary classification

The absence of a unique, standardized, definition of vulnerability has important consequences in the policy-regulative fields that design programmes of long-term-care assistance at national, regional or community level. Besides being different in financing models, degree of universalism and centralization, LTC systems differ in how they define and assess vulnerability conditions, and therefore in the definition of a minimum level of need that allows someone to be eligible to a programme of care (see, e.g., Eleftheriades and Wittenberg (2013)). Heterogeneities in the assessment-of-need processes and the eligibility conditions are, indeed, the ultimate manifestation of distinct "views" of the vulnerability process, and it is on this sort of heterogeneity that we have put the focus of this and of the following Sections, by looking at how these issues are regulated and formalized in European's main LTC programmes.

[10] WHO (2002)

As a preliminary step, we propose a simple classification of the main LTC programmes in Europe, based on two criteria related to the properties of the vulnerability-assessment processes and to the existence of an eligibility threshold.

The first criteria relates to how analytic the vulnerability assessment-tool is. Some LTC programmes adopt a "detailed" evaluation of vulnerability (*analytic evaluation*), which includes a high number of medical conditions and/or limitations. Conversely, other assessments rely on a much smaller set of dimensions that, in turn, might or might not be implicit compounds of more specific limitations (*synthetic evaluation*).

The second criteria splits LTC programmes according to whether they account or not for a specific threshold of vulnerability that allows an individual to receive some care benefits, therefore making him/her *eligible* to LTC services. Furthermore, we differentiate between those regulations whose eligibility rules are mainly (or solely) based on functional and/or cognitive limitations ("carer-blind" assessments), and those who consider a broader set of dimensions, e.g., the family or the neighbourhood environment, the social-network of the patient, the availability of informal care ("carer-sighted" assessments). In particular, we operate a selection according to the presence (or absence) of a well-defined minimum eligibility level (*objective threshold of vulnerability*) based on functional/mental status: a quantitative or qualitative measure of vulnerability, explicitly defined in the legislation, that can be computed (almost) directly from the assessment-of-need scale. Alternative frameworks (*subjective/broader threshold*), that either do not fix a specific minimum eligibility level, thus relying (almost entirely) on subjective evaluations by the evaluator team, or include in the analysis bio-psychosocial (non-medical) factors, will be excluded from this papers' review.

By combining these two criteria, it is possible to categorise LTC regulations on a bi-dimensional matrix in which the columns represent the alternative between analytic and synthetic evaluations while the rows discriminate between programmes with or without an objective definition of eligibility. Table 1-1 report the result of our review for 15 main LTC programmes in 10 European countries (Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden). There are countries (Belgium, France) in which more than one nationwide program is in place and others (Belgium, Italy) in which region-specific programmes are implemented. The Italian framework is highly fragmented, with a national cash-benefit allowed to highly severe vulnerability conditions (*Indennità di accompagnamento*, not included here and discussed later), and independent regional programmes.[11] The table reports the name of the programmes and an additional information on the benefit's nature (in-cash, in-kind, or both).

Table 1-1, Preliminary classification of LTC programmes

	Analytic evaluation			**Synthetic evaluation**		
Eligibility threshold *and* carer-blind	Austria	*Pflegegeld*	*C*	Belgium	*APA* *INAMI/RIZIV*	*C* *K*
	Belgium (Flanders)	*Vlaamse zorgverzekering*	*C*	France	*Allocation Personnalisée d'Autonomie* *Action Sociale*	*C/K* *C/K*
	Czech Rep.	*Příspěvek na péči*	*C*	Italy (FVG)	*Contributo Aiuto Familiare*	*C*
	Germany	*Pflegeversicherung*	*C/K*	Italy (Toscana)	*Progetto di Assistenza Continua*	*C/K*

[11] On the Italian LTC framework see, e.g., Tediosi and Gabriele (2010) Ranci and Pavolini (2012) and Gori (2013).

	Spain	*Promoción de la Autonomía Personal*	*C/K*	
No threshold *or* carer-sighted	Sweden	*Social services for the Elderly*		
	Italy – ER	*Assegno di Cura / Assistenza domiciliare*	*C/K*	
	Italy – VE	*Impegnativa di Cura Domiciliare*	C	
	Netherland	*AWBZ*	*C/K*	

C= in cash K=in-kind

Five programmes appear in the top-left box, corresponding to those regulations that adopt an analytical carer-blind assessment-of-vulnerability and introduce a specific minimum threshold of medical-conditions that gives access to the benefit. Among these are the Austrian federal *Pflegegeld* cash-benefit, the Belgian *Vlaamse zorgverzekering* cash-benefit implemented only in the Flemish (and Bruxelles) region, the Czech cash-benefit *Příspěvek na péči*, the federal German program *Pflegeversicherung* which in principle could be both in-cash and in-kind, the Spanish national in-kind *Promoción de la Autonomía Personal*.

Four programmes, included in the bottom-left box, are characterized by "carer-sighted" need evaluations. The Italian home-care programme Domiciliary Help Agreement (*Impegnativa di Cura Domiciliare,* ICD), implemented by the Veneto region [12], adopts a highly detailed multi-dimensional assessment scale (the SVaMA, *Scheda di VAlutazione Multidimensionale dell'Anziano,* Multidimensional evaluation of the elderly) which encompasses both functional and mental limitations, together with other domains as the housing/neighbourhood environment, the availability of informal care and the economic conditions of the patient.[13] The assessment is conducted by a multidisciplinary team, who then develops a personalised project of care and determine the patient's entitlement status. There are no fixed guidelines describing the eligibility rules. Another Italian region, Emilia-Romagna, implements several programmes of home-care for vulnerable elderly, e.g., a cash-benefit (*Assegno di cura per anziani*) and an in-kind home-care service (*Assistenza domiciliare per anziani*), regulated by the Regional Fund for vulnerable individuals (*Fondo regionale per la non autosufficienza*)[14]. The assessment-of-need focuses on an individual's social-enivronment (through the "*Scheda Sociale*", Social Assessment Scale) as well as her functional and cognitive status (through the *BINA* scale, *Breve Indice di Non Autosufficienza*, Short index of vulnerability). The social-environment assessment mainly covers the socioeconomic characteristics of the patient's family network, while the BINA scale assesses the patient's functional and cognitive limitations, as well as the availability of an informal-network of caregivers and the quality of the housing and the

[12] Recently reorganized with the regional decree (*decreto)* 149/2013 - *Istituzione dell'Impegnativa di Cura Domiciliare*

[13] "The SVaMA is the officially recommended assessment schedule used by the health personnel of the National Health Care System […] introduced by the Veneto Regional Health System since 2000 to establish accessibility to some health care resources. Reliability, accuracy, and calibration of the SVaMA have been previously tested and validated. At present, the SVaMA is the officially recommended multidimensional assessment instrument used in most regions in Italy (ie, Veneto, Trentino, Puglia, Molise, Sicilia, Campania, Basilicata, and Valle D'Aosta) […]", Pilotto *et al.* (2013). The SVaMA is available on-line at: http://www.ulss12.ve.it/docs/file/modulistica/SVAMA.pdf

[14] Regional Law LR n. 27/2004; see also AGENAS (2014) and the Regional Bulletin n.61/2007 (*Bollettino Ufficiale Regione Emilia-Romagna*).

neighbourhood.[15] The eligibility condition is subjectively determined by the medical assessment team. In Sweden the home-care services are managed at the municipality level, who are legally obliged to meet the social service, nursing and housing needs of the elderly. "The need is determined through a process of need assessment, which is carried out by a municipal care manager. Access to services is not means-tested and there are no national regulations. The municipality decides the service level, eligibility criteria and range of services provided" (Socialstyrelsen, 2009).[16] Finally, the Netherlands' AWBZ (*Algemene Wet Bijzondere Ziektekosten*, Exceptional Medical Expenses Act) is a Social Insurance aimed at assisting long-term hospitalised persons, elderly people, disabled persons and mentally disabled persons with chronic illness.[17] The assessment of need is performed by the Care Needs Assessment Centre (*Centrum Indicatiestelling Zorg*, CIZ), who impartially, objectively and thoroughly determines the individual's need-of-care. Functional and cognitive limitations are evaluated, as well as environmental factors and characteristics of the patient's family, including the availability of informal care. The legislation sets no unique eligibility rules or minimum dependency thresholds.

Six programmes are listed in the top-right box, corresponding to those systems that allow for a synthetic vulnerability assessment together with a clear eligibility threshold, which defines a minimum vulnerability level. Among these are the federal Belgian programmes APA (Aide à la Personne âgée) and the Home-Nursing Services reimbursed by the National Institute for Sickness and Disability Insurance (Institut National d'Assurance Maladie-Invalidité/Rijksinstituut voor Zieke – en Invaliditeitsverzekering - INAMI/RIZIV), the French in-kind care services covered in the APA (allocation personnalisée d'autonomie) and in the Action Sociale des caisses de retraite.

This classification is just a first step into the analysis of the heterogeneity that characterizes the supply of LTC in Europe. Our aim is to get to a higher detailed stage of the analysis, showing how the definitions of vulnerability differ from one programme to another. We would like to offer some comparability between different frameworks, not just in terms of their organizational features but also in terms of how their differences affect systems' inclusiveness (or, the potential demand of formal care).

In view of this comparative analysis, we concentrate on eleven programmes (in Austria, Belgium, Czech Republic, France, Germany, Spain and two Italian regions, Friuli – Venezia Giulia and Toscana), which are characterised by clear-cut objective definition of an eligibility threshold. In all of these countries the assessment-of-vulnerability is *carer-blind*, i.e., need-tested through validation of ADL- iADL- and cognitive limitations, while no role is played by other factors like informal-care availability, quality of family or neighbourhood environment, social-network of the patient.[18] Systems with subjective assessment-of-need are less suitable for a comprehensive comparison, since they define the components of vulnerability (therefore detailing also the assessment-of-need process) but set no minimum vulnerability requirement and no rule to characterize eligibility.

The next Section provides a comparison of assessment and eligibility frameworks in the aforementioned eleven LTC programmes, while a comprehensive review is included in Section 1.5, where each programme is separately detailed.

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[15] Both assessment-scales are available at: http://informa.comune.bologna.it/iperbole/media/files/delibera_ausl_1132006_3.pdf
[16] On the Sweden LTC framework see also Szebehely and Trydegård (2012), Fukushima *et al.* (2010) and Colombo *et al.* (2011).
[17] See (Bakx *et al.* (2014); Colombo *et al.* (2011); MISSOC (2014); Mot and Aouragh (2010))
[18] Monetary resources are sometimes taken into account for redistributive purposes (determining the monetary amount of the benefits), but they do not have discriminatory power to define eligibility. See Eleftheriades and Wittenberg (2013) for a discussion on the implications that adopting "carer-blind" rather than "carer-sighted" eligibility rules might have for the equity and efficiency of the care system, for incentives to provide unpaid care and for costs.

1.3 COMPARING LTC PROGRAMMES' RATIONALES AND INCLUSIVENESS

Health outcomes like functional or cognitive impairments usually serve as explanatory variables in studies aimed at identifying causal relationships and determinants of processes related to individuals' health-care utilization or labour market participation, as well as at estimating trends in health expenditure at various levels, e.g., national and regional (Colombo *et al.* (2011), de Meijer *et al.* (2011), Costa-Font *et al.* (2008), Pickard *et al.* (2007)). Objective measures of dependency, e.g., limitations in ADL and iADL, are adopted as covariates in many empirical analysis[19], often in the form of *counting* or *dummy* variables to capture the number of deficits reported by individuals, or using individual dummies for each limitation.[20] Other studies follow a different strategy and adopt the presence of any objective functional-limitations as a proxy for vulnerable conditions.[21] In general, the aforementioned works all find that "disability indicators have an important predictive power in the formal care equations of both PDH [paid domestic help] and NC [nursing home-care] models. In particular, the probability and quantity of care increase with severity in ADL indicators" (in the words of Balia and Brau (2013)).

Besides individuals characteristics, researchers often stress the importance of accounting for the characteristics of the institutions which implement care-programmes for the elderly, especially when performing international analysis. Riedel and Kraus (2011), Kraus *et al.* (2010) and Genet *et al.* (2011) provide a review of public and private European LTC frameworks, Da Roit and Le Bihan (2010) focus on some cash-benefits for care while Ranci and Pavolini (2012) concentrate on the reforms processes undergone in the last decades. Recent reviews are Verbeek - Oudijk *et al.* (2014) and OECD (2013a). Eleftheriades and Wittenberg (2013) and Bakx *et al.* (2014) are the only recent works that specifically address institutional differences in assessment-of-need and eligibility rules. The former offers a review on Australia, France, Germany, The Netherlands, New Zealand and United Kingdom, while the latter focuses on the regulation differences between the German and the Dutch LTC systems, showing that they have important consequences on formal home-care utilization by old adults. To account for heterogeneities in institutional frameworks it is common to include country (or regional) dummies in the empirical models' specification (Brugiavini *et al.* (2010) where the authors offer also a brief taxonomy of LTC systems, Bolin *et al.* (2008), Bonsang (2009), Balia and Brau (2013), Kalwij *et al.* (2014), Jiménez-Martín and Prieto (2012) where dummies for place-of-residence are included in the analysis of the relationship between formal- and informal-care in Spain).

The synthetic analysis in Section 1.2 hinted at some distinctive features of the LTC programmes, which do not always coincide with some of the implicit assumptions made in empirical health-economic analysis (a comprehensive review is included in Section 1.5). In particular, even though both medical and economic literature often assume that vulnerability is signalled by several health-outcomes indicators, the aforementioned regulations mainly focus on functional limitations as ADL and iADL, plus mental/cognitive impairment. Moreover, when ADL and iADL (or other functional deficits) are included in an empirical model in terms of the number of limitations experienced by a

[19] A recent exception is Bolin *et al.* (2008), where the authors use SHARE data and include several self-reported health conditions (both objective and subjective) as covariates in their empirical analysis, leaving out both ADL and iADL.
[20] E.g., Balia and Brau (2013), although the authors ultimately drop the iADL dummies because of collinearity issues with another disability indicators. Among other variables, Bonsang (2009) includes iADL and ADL limitations to build a synthetic dependency-index at the individual level. See also Jiménez-Martín and Prieto (2012), de Meijer *et al.* (2011).
[21] Brugiavini *et al.* (2010) investigate the determinants of formal-care utilization by splitting their sample population according to the presence of at-least-one limitation in ADL.

patient (e.g., "number of ADL lost" ,"number of iADL"), it is implicitly assumed that each loss of ADL or iADL carries the same weight in determining the latent vulnerability condition. Although theories on accumulation of diseases[22] tend to provide ground for it, these issues are less straightforward in LTC regulations. As it will be pointed out, not every limitation is always included as relevant outcome in the vulnerability assessment; moreover, weights associated to each deficit are often likely to differ, and some limitations are sometimes characterized as necessary or sufficient for eligibility, e.g., there are sorts of *veto* or *favor* criteria (Marichal, 2004).

In other words, although the medical literature provides some guidelines to economists in terms of which are the major health-outcomes that could signal a latent condition of vulnerability and therefore affect individual behaviour in terms of health-care utilization, there is not a unique definition for "objective dependency" in LTC regulations. Thus, individuals with equal medical-profiles and with a similar latent vulnerability condition, could be labelled as "objectively dependent" by one LTC framework but not by others, and therefore could be facing quite different choices in terms of care-utilization, depending on the country (or region) they live in.

Section 1.5 offers a review of the main features characterizing several LTC programmes in Europe, with a specific focus on the definition and the assessment of vulnerability conditions, as well as on the eligibility rules that give entitlement to care-services or benefits. In this section, we intend to offer a broad picture of these systems, with an extended perspective that could foster comparability and emphasize differences as well as similarities.

As already mentioned, the analysis in this and the following sections cannot be exhaustive for at least two main reasons. First, we focus on the sub-set of LTC programmes that feature an explicitly defined eligibility threshold based on carer-blind limitations. All of these regulations define an algorithm or a set of weights that allow to "compute" and "interpret" the result of the assessment-of-need in terms of the eligibility status. Although a considerable degree of subjectivity remains on the medical team (nurse, doctor, social workers) who conducts the assessment and on the medical/institutional committee (if provided by the law) who interprets it and comes to the final decision, having a regulation-set guideline provides us with a rather objective insight on how vulnerability is defined in a specific system. This is not the case for those programmes that either have a very broad approach on the vulnerability-assessment process (e.g., an assessment that covers also an individual's social and familiar environment) or do not specify minimum-requirements for eligibility. When a programme defines the need of long-term care for each individual separately, its inherent flexibility prevents us from effectively identifying (for comparison purposes) a minimum-vulnerability level, simply because there is not a unique one.

Secondly, we are aware that almost every LTC institutional framework is vertically organized among government-levels, with a number of small care-programmes implemented at provincial and community levels, which have separate regulations and a subsidiary nature with respect to the main national or regional programmes. Since providing a comprehensive review of all these programmes falls out of the scope of this paper, our perspective focuses on national / regional programmes, in line with the recent literature.

The following paragraphs are organized as follows: we first provide an overall view of the LTC programmes briefly described in the previous section, highlighting differences and similarities in vulnerability definitions and eligibility rules. We then describe the SHARE Project (Survey on Health, Ageing and Retirement in Europe), whose data we use

[22] Rockwood and Mitnitski (2007), Sourial *et al.* (2010).

in order to perform comparative analyses between LTC frameworks. Indeed, in the last paragraph we offer some insights on how these programmes compare in terms of their inclusiveness rate, i.e., which are those regulations that can cover a higher share of population, after controlling for health-conditions.

1.3.1 Dimensions and main outcomes of vulnerability

The aim of this paragraph is to highlight differences as well as similarities between the LTC programmes with respect to how vulnerability is defined, i.e., which are the limitations (health outcomes) adopted as signals of a potential vulnerable condition (extensive margin). Among those outcomes, we investigate whether, in each LTC programme, there are un-equal weighting schemes, i.e., whether there are limitations which are relatively "more important" than others in determining a patient's need-of-care (intensive margin).

Even when legal definitions of "dependency" or "need-of-care" are provided in the LTC regulations, they are usually generic and do not provide details on the specific outcomes (limitations) that are supposed to signal the presence of a certain loss of autonomy in an elderly individual[23]. Conversely, the assessment-of-need scales are the ultimate realization of a legislation's take on the complex concept of vulnerability (see the introductions to Sections 1.2 and 1.3).

As far as the assessment stage is concerned, all the programmes reviewed in this paper adopt some sub-set of the ADL and the iADL limitations, plus other specific tasks including cognitive/mental deficits. Many programmes, such as the Austrian, the Flemish, the Czech, the German and the Spanish, include both the ADL and the iADL. Others, such as the Belgian home-care programme (INAMI), both of the French programmes, and the two Italian regional schemes considered, exclude iADL from the assessment set[24]. Finally, the Belgian cash-benefit APA include an incomplete list of both taxonomies, even grouping them together in compound items[25]. Besides ADL and iADL, all programmes include cognitive and mental abilities in their assessment-of-need: this is the case for Austria, the three Belgian programmes, the Czech Republic and, France[26]. Other systems, as the German and the two Italian regional Friuli – Venezia Giulia and Toscana, include significant mental limitations and cognitive impairment as sufficient conditions for eligibility. Two regulations, the Austrian and the German, consider also some specific limitations related to post-surgery conditions or to advanced self-medication procedures (sections 1.5.1 and 1.5.6). Besides functional and mental limitations, the age-variable plays a role in various LTC regulations who are specifically designed for elderly population

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[23] We refer explicitly to the "elderly" population because the focus of this research is on LTC. As mentioned in the previous section, though, some programmes do not require a specific age in order to be eligible to care-services.

[24] As noted in the previous section, the French AGGIR scale include iADL tasks as "informative" variables that do not contribute at the definition of a patient's vulnerability condition.

[25] For example, the scale-item "nutrition" encompasses both the food-ingestion (an ADL) and the meal-preparation tasks (an iADL), see

Table 1-16 and

Table 1-41.

[26] France adopts the same assessment tool (AGGIR scale) for both the LTC programmes considered here. The presence of cognitive impairment determines eligibility to the APA program.

and therefore set minimum age-requirements for eligibility (60 years old for the French APA, 65 for the French Aide Sociale, the Belgian APA, Friuli – Venezia Giulia's CAF and Toscana's PAC).

As mentioned in Section 1.2.1, different approaches to the vulnerability assessment might include other dimensions as elements of interest. As an example, the role of informal care, namely the possibility to receive assistance from family members or relatives, is included in the vulnerability evaluation in the Netherlands[27], in Sweden[28] and in the Italian programmes who adopt the SVaMA scale[29]. More generally, these programmes assess more explicitly a patient' social network and living-environment, rather than primarily focusing on functional and cognitive deficits, and are usually labelled as *carer-sighted* approaches (see note 18).

When performing an assessment-of-need, the medical team has to evaluate each item, in order to acknowledge the extent to which a patient can autonomously perform that specific task. As it will be highlighted in Section 1.5, strong heterogeneity exist in the evaluation-strategies adopted by each programme. There are those, as the Austrian and the German, in which each limitation is characterized with a time-measure (hours per month / minutes per day) representing the estimated amount of care needed to provide assistance for the specific task[30]. The eligibility threshold will therefore depend on the patient's overall time-requirements. In the Spanish system, each task carries a score between 1 and 100. The sum of the scores corresponding to the tasks in which the patient is limited constitutes the overall vulnerability score[31], whose value will determine the eligibility status (the total score must be higher than 25). The reformed Czech programme Příspěvek na péči and the CAF programme in the Italian Friuli-Venezia-Giulia region include several items whose evaluation is made on a binary scale (1 = patient is not autonomous / 0 = patient is autonomous); the minimum eligibility threshold is a fixed number of limitations (3 for the Czech system, 2 for the Italian one).[32] In the French AGGIR scale each item is evaluated on a three-level scales (full/medium/no dependence) and the eligibility-status depends on the total number of limitations, even though not all the items carry the same weight. The three Belgian and the Toscana (Italy) programmes follow a common strategy for evaluating activities of daily living: each item included in the assessment can be evaluated on a multiple-value scale (from 0 to 3, rather than from 1 to 4) according to the severity of the loss-of-autonomy in each particular task. The sum of these scores produce an overall vulnerability index, and the eligibility status depends on whether this index is above or below a fixed threshold, even though in the Belgian in-kind programme (INAMI/RIZIV) weights are not equal among items, similarly to what happens in the AGGIR scale. It is worth recalling that in both the Belgian's INAMI, the German *Pflegeversicherung*, the French APA and the Toscana's PAC, eligibility can be determined by significant cognitive impairment and/or behavioural issues, even when functional limitations are light.

After having briefly summarized which are the dimension that are included or excluded from the assessments-of-need in our 11 LTC programmes, we now turn our attention on what happens inside each scale. Are there some items that have relatively more "importance" than others in the determination of a vulnerability level? Are there some limitations

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[27] Bakx *et al.* (2014), de Meijer *et al.* (2011).
[28] Szebehely and Trydegård (2012)
[29] Pilotto *et al.* (2013).
[30] In both programmes the regulations provide nationwide fixed guidelines to ensure comparability in the evaluation across the country.
[31] If the loss of autonomy is partial, the item-specific score is multiplied by a 0.9 factor.
[32] The original Czech scale had 34 items with a minimum threshold of 12 limitations.

that are necessary and/or sufficient in order for an individual to reach the minimum eligibility threshold? The answers to these two questions appear, again, highly heterogeneous throughout different LTC systems. Among those programmes that consider both ADL and iADL, the Austrian and the German explicitly indicate that at least one limitation has to occur in each of the two groups of items in order for eligibility to be determined. A partial exception concerns cognitive and mental limitations in Germany, since they are sufficient conditions for eligibility.[33] Moreover, both programmes assign un-equal weights to the health outcomes included in the assessments-of-need: in the Austrian *Pflegegeld* losses of autonomy in washing, dressing and using the toilet are given a higher value (in terms of time requirements) than other ADLs, while cooking and doing household-tasks are the most important limitations among the instrumental activities. In Germany the highest weights are given to dependency in washing and eating, as well as to being incontinent. Out of the three Belgian programmes, the APA is the one that gives all its items the same weight. The Flemish Insurance is characterized by higher weights allocated to household- and cognitive- related dimensions.[34] Finally, the assessment-scale for the Belgian in-kind home-care assistance consider both washing and dressing as necessary and sufficient for determining a loss-of-autonomy condition. The AGGIR scale adopted in France labels an individual as in need-of-care if she suffers from mental and cognitive limitations, regardless of the presence of physical limitations. As for the set of ADL items (plus "moving inside the house"), the eligibility conditions (categorization GIR 4) is triggered by the presence of any two limitations.[35] The *Aide Sociale* programme, although based on the AGGIR evaluation, has a more generic definition since it aims at helping those with no problems in dressing or moving, but who need help with washing themselves, or with cooking or with daily tasks as shopping for groceries and small housework.[36]

[33] This rule was introduced with the 2012 reform (Law on Realignment of Care / *Pflege-Neuausrichtungs-Gesetz*), see Table 1-29.
[34] Although each single item has equal weight in the BEL-scale, the household-management and the cognitive/mental tasks are more numerous and detailed, thus resulting in a higher weight allocated to these two dimensions of vulnerability.
[35] Except for "moving inside the house", which is not a sufficient limitation for eligibility when the only other loss-of autonomy concerns the "transferring" task. When the "moving" limitation is selected, one among "using the toilet", "dressing", "eating" or "washing" will be sufficient for eligibility.
[36] See the website of the French Administration: http://vosdroits.service-public.fr/particuliers/F245.xhtml .

Table 1-2, summary of LTC regulations

Country	Program (scale)	#items	ADL	iADL	Others	Eligibility threshold	main ADL	main non-ADL
AT	*Pflegegeld*	*21*	✓	✓	M, C	60h/month+	washing, dressing, WC	cooking, housework
BE	*APA*	*7*	p	p	C	7 points	-	-
	INAMI/RIZIV (BESADL)	*6*	✓		C	washing & dressing / cognition	washing / dressing	cognition
	Vlaamse zorgverzekering (BEL profielschaal)	*25*	✓	✓	C	35 points	-	housework, cognition
CZ	*Příspěvek na péči*	*10 (34)*	✓	✓	C	3 (12) deficits	-	-
DE	*Pflegeversicherung*	*15*	✓	✓	M, C	90m/day+ cognition	washing, eating, continence	cognition
ES	*Promoción de la Autonomía Personal*	*9*	✓	✓	C	25 points	eating, WC	-
FR	*APA (AGGIR)*	*8*	✓*	**	C	2 ADL / cognition	-	cognition
	Action Sociale (AGGIR)	8	✓*	**	C	washing / cooking / housework	washing	cooking, housework
IT (FVG)	*CAF (KATZ)*	*6*	✓		C	2 ADL, cognition	-	cognition
IT (TO)	*PAC (MDS-HC)*	*7*	✓*		C	2 ADL & cognition	-	cognition

C = cognitive limitations; M = advanced medication procedures; p = partial coverage
** Incontinence not included; ** iADL do not enter the algorithm for GIR classification; + Austria: at least one ADL and one iADL limitations must occur. Germany: out of the 90m of need, at least 45m must come from ADL limitations.*
For Czech Republic, numbers in brackets refer to old legislation.

The Spanish Insurance system gives, among ADLs, a higher importance to loss-of-autonomy in eating and in using the toilet. Equal weighting is kept among ADL tasks in the Czech scale, while among the iADLs the household management-tasks are split in two items, therefore assigning them a potential higher weight. [37] In the two Italian regional programmes ADLs are given equal weights, except for the "transferring task" which is split in two items in the Toscana scale, therefore giving it a potential higher weight.

Table 1-2 summarizes and clarifies the aforementioned comparisons.

[37] The Czech assessment-of-need (Table 1-20) accumulates some ADL or iADL in the a same scale-item. Some unequal weighting, with respect to the ADL and iADL, could therefore arise between those tasks that are compounded together in a single item with those who are not, since each item in the Czech scale has the same weight regardless of it being a compound or not.

In order to provide a better understanding of the heterogeneity at the extensive margin (which limitations are included/excluded from the vulnerability assessment) as well as at the intensive margin (which limitations have higher importance within each scale) of vulnerability evaluations, we need to implement the eligibility rules on a proper set of micro-data. This task, performed in paragraph 1.3.3, requires us to consider a comprehensive vector of functional and cognitive limitations, which we can obtain from the SHARE dataset, and which will constitute the common ground of medical-conditions over which the comparison exercise will be performed. This vector, whose elements exhaust the vulnerability outcomes covered by the assessment scales previously described, is primarily based on the ADL and iADL taxonomies by Katz et al. (1970) and Lawton and Brody (1969) described in Appendix 1.7.1. As mentioned in Section 1.2 and detailed in Section 1.5, these lists of limitations provide a good representation of the dimensions included in the various assessments-of-need of the eleven LTC programmes hereby considered.[38]

Table 1-3 summarize the elements of this vector, grouped in an ADL and a non-ADL subsets. Among the ADL set, we split the ambulation item in the "moving" and the "transferring" tasks (the latter being originally present in the ADL list), since they are often assessed separately in actual LTC regulations. Albeit the original ADL + iADL taxonomies, two additional categories are included, which are: "behavioural / cognitive impairment" and "hygiene for post-surgery conditions or advanced medications". The former concerns patient's depression, mental stability and coherence, (coherence and mental impairment are included – to various extents – in a conspicuous number of regulations); the latter refers to those patients who have difficulties in performing advanced medications ("advanced" with respect to taking pills or following medical prescriptions) like enemas or maintenance of tubes/bags resulting from surgical operations. Furthermore, additional mobility limitations are included, as crouching and walking down stairs.

Table 1-3 shows, for each limitation (or group of limitations), the availability of a comparable individual information in the SHARE micro-dataset which will be described in paragraph 1.3.2. As shown, SHARE lacks information on just one group of tasks, namely the limitation in self-performing advanced medications like enemas or tube/bags maintenance.

[38] Besides, use of ADL and iADL as symptoms of vulnerability is justified in the medical literature. In the words of Pel-Littel *et al.* (2009), "the symptoms of frailty are many and various, but the most prevalent symptoms are deterioration of *Activities of Daily Living* (ADL) and *Instrumental ADL* (iADL), mobility, nutritional status, cognition and endurance".

Table 1-3, summary of health-limitations included in assessment-of-need scales

ADL	Non ADL
Bathing & hygiene ✓	Communication ✓
Dressing ✓	Shopping for groceries/medicines ✓
Using the toilet ✓	Cooking ✓
Transferring ✓	Housekeeping ✓
Continence ✓	Doing laundry ✓
Feeding ✓	Moving outdoor ✓
Moving indoor ✓	Responsibility for own medications ✓
Hygiene for post-surgery conditions or advanced medications ✗	Behavioral/Cognitive impairment ✓
	Other mobility limitations ✓

✓ = information available in SHARE; ✗ = information missing from SHARE
The underlined tasks do not belong to the Katz's ADL scale, but are treated as basic activities of daily livings in the LTC regulations that include them.

1.3.2 Data

In this section we will make use of micro-data from the second wave (2006) of SHARE[39] (Survey on Health, Ageing and Retirement in Europe), a European multidisciplinary survey on individuals aged 50 or older and on their spouses. Data were collected in 2004 and 2006, respectively, through a computer assisted personal interviewing (CAPI) program; they cover a wide variety of disciplines, such as demography, economics, epidemiology, psychology and sociology. The second wave of SHARE include 35.595 observations from 13 European countries, plus Israel. The design of SHARE is based on the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). We refer to Börsch-Supan *et al.* (2005) and Börsch-Supan and Jürges (2005) for a detailed review of the survey, its methodological details and the sample procedures.

SHARE provides detailed information about respondent's morbidity and disability status, based on self-reports of objective limitations and health conditions.[40] In particular, it contains a set of questions that allow us to build, for each individual, a simplified medical-profile (Table 1-3) comparable with the LTC regulations of the countries in our sample (see the next paragraph and Appendix 1.7.3). Respondents are asked to report their dependency status in performing fourteen activities of daily livings[41], which conform to the ADL and iADL taxonomies by Katz *et al.* (1970) and Lawton

[39] This paper uses data from SHARE wave 1 and 2 release 2.6.0, as of November 29 2013 (DOI: 10.6103/SHARE.w1.260 and 10.6103/SHARE.w2.260). The SHARE data collection has been primarily funded by the European Commission through the 5th Framework Programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th Framework Programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5- CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th Framework Programme (SHARE-PREP, N° 211909, SHARE-LEAP, N° 227822 and SHARE M4, N° 261982). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11 and OGHA 04-064) and the German Ministry of Education and Research as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions).

[40] All the questions are worded in order to be comparable across countries.

[41] These are: (i) dressing, including putting on shoes and socks; (ii) walking across a room; (iii) bathing or showering; (iv) eating, such as cutting up one's food; (v) getting in and out of bed; (vi) using the toilet, including getting up and down; (vii) using a map

and Brody (1969). Furthermore, the survey includes ten specific questions on *mobility limitations*[42]. All the aforementioned tasks are assessed on a dichotomous scale: a limitation can either occur or fail to occur, but no intensity is measured.

Depression and loss of orientation are covered by two different set of variables. *First*, the questionnaire assesses a set of 12 mood- and behaviour-related conditions (pessimism, depressed mood, suicidal thoughts, guilt, trouble sleeping, loss of interest, irritability, fatigue, inability to concentrate, lack of appetite, incapacity of enjoyment, tearfulness), that are then summarized in the EURO-D scale[43], whose values range from 0 to 12 depending on the number of occurring symptoms. A EURO-D value of 4 (or higher) has been demonstrated to be associated with a clinically significant level of depression.[44] *Secondly*, four questions on mental orientation and coherence ask respondents to report the current date, month, year and day of week; the number of correct answers is summarized in a generated variable (*orientation*) whose values range from 0 to 4 (the higher the better oriented). We choose to label as impaired (*orientation impairment*) those respondents who gave zero or one correct answers.[45]

The survey also includes information on *chronic conditions* and *symptoms* that the individual may suffer from,[46] her subjective well-being and life satisfaction as well as on other forms of health-care utilization (e.g., visiting the GPs or the dentist) and health-related behaviors (e.g., smoking, drinking, doing physical activities). Labour-market variables and economic variables are collected, e.g., details on current and past occupations, job opportunities in retirement age, sources and composition of income and wealth, as well as consumption and saving choices. Further socio-economic characteristics include education (both the ISCED classification[47] and the number of years of completed education), involvement in social activities, as well as information on respondents' children.

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to determine how to get around in a strange place; (vii) preparing a hot meal; (ix) shopping or buying groceries; (x) making telephone calls; (xi) taking medicines, following medical prescriptions; (xii) doing work around the house or garden; and (xiii) managing money, such as paying bills and keeping track of expenses. An additional question covers the dependency over incontinence, or the involuntary loss of urine. Details on ADL and iADL are included in Appendix 1.7.1.

[42] The tasks covered are: (i) walking 100 meters; (ii) sitting for about two hours; (iii) getting up from a chair after sitting for long periods; (iv) climbing several flights of stairs without resting; (v) climbing one flight of stairs without resting; (vi) stooping, kneeling, or crouching; (vii) reaching or extending your arms above shoulder level; (viii) pulling or pushing large objects like a living room chair; (ix) lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries 10; (x) picking up a small coin from a table.

[43] Prince *et al.* (1999).

[44] Colombo *et al.* (2011). Primary reference: Dewey and Prince (2005).

[45] Verbeek - Oudijk *et al.* (2014) perform and validate a Mokken analyses for cognitive impairment on SHARE data, resulting in a scale ranging from less to more impaired. They show that not being able to remember the name of the current month or year are the most severe signals of impairment.

[46] The chronic conditions should have previously been diagnosed to the respondent by a doctor. They include: (i) heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; (ii) high blood pressure or hypertension; (iii) high blood cholesterol; (iv) stroke or cerebral vascular disease; (v) diabetes or high blood sugar; (vi) chronic lung disease such as chronic bronchitis or emphysema; (vii) asthma; (viii) arthritis, including osteoarthritis, or rheumatism; (ix) osteoporosis; (x) cancer or malignant tumor, including leukaemia or lymphoma, but excluding minor skin cancers; (xi) stomach or duodenal ulcer, peptic ulcer; (xii) Parkinson disease; (xiii) cataracts; (xiv) hip fracture or femoral fracture. Other reported symptoms (if they were present for the 6 months before the interview) include: (i) pain in the back, knees, hips or any other joint; (ii) heart trouble or angina, chest pain during exercise; (iii) breathlessness, difficulty breathing; (iv) persistent cough; (v) swollen legs; (vi) sleeping problems; (vii) falling down; (viii) fear of falling down; (ix) dizziness, faints or blackouts; (x) stomach or intestine problems, including constipation, air, diarrhea.

[47] For details on the 1997 International Standard Classification of EDucation, see OECD (1999).

Our sample consists of the eleven countries, namely Austria, Belgium (Flanders, Wallonia and Bruxelles), Czech Republic, Germany, Italy (FVG and Toscana only), France and Spain (whose LTC programmes were commented in paragraph 1.3.1), plus Denmark, The Netherlands, Sweden and Switzerland. Moreover, since our analysis focuses on the elderly population, we restrict our data to those individuals aged 60 or more. Furthermore, we excluded observations with missing information across all ADL, iADL and mental/cognitive items. The resulting population is made of 17,442 individuals. The average age is 70.8 years old, with the 25-th percentile at 64 years old, the median age at 69 and the 75-th percentile at 76. Females account for 53.7% of the overall population, while retired individuals and homemakers are, respectively, 75.6% and 12.5%. As far as the health-conditions are concerned, statistics show that limitations in iADL are more frequent than ADLs. On average, 20.6% of population have lost at least one iADL while 18.8% have at least one ADL limitation. A reason for this is that iADL require a more complex neuropsychological organization and a higher involvement of cultural and environmental influences, and therefore are more likely to be the first to "fall" in the context of the vulnerability process (LaPlante, 2010). We also report the share of individuals with at least two ADL lost, as well as those with at least two iADL lost; additionally, we include the jointly occurrence of these two kinds of disabilities, i.e., when any of them are present (1+ ADL or iADL loss) as well as when they are both present (1+ADL and 1+ iADL losses). Among the ADL and iADL taxonomies there are some deficits that appear more frequently in the population: limitation in dressing and in washing are the most frequent ADL, while difficulties in doing housework, cooking and moving outdoor are the most frequent iADL. This is, again, due to the different intrinsic complexity of the single tasks and on the hierarchical nature of the ADL and iADL.[48] Regarding mental limitations, average scores for the EURO-D and the "orientation" scale are reported. The following table summarizes some descriptive statistics of our sample.

[48] See footnote 134.

Table 1-4, Descriptive statistics on SHARE population, wave 2

	Standard population	AT	BE		CZ	F	DE	IT*	ES	DK	NL	CH	SE
			FL*	WAL									
N	17,442	884	1,204	643	1,648	1,767	1,677	225	1,490	1,500	1,520	882	1,897
Age (mean)	70.8	70.6	70.8	71.3	69.7	71.4	69.9	69.8	71.8	70.8	70	70.7	70.9
Age (p25)	64	65	65	64	63	65	64	64	65	64	63	64	64
Age (p50)	69	69	70	70	68	70	69	68	71	69	68	69	69
Age (p75)	76	76	77	76	75	77	75	75	77	77	75	76	77
Females	53.7%	58.4%	52.3%	56.6%	57.2%	57.5%	51.2%	52.7%	53.2%	54.1%	51.9%	54.1%	51.3%
Retired	75.6%	82.0%	72.0%	75.3%	94.6%	84.6%	79.9%	78.6%	54.9%	80.7%	60.9%	65.7%	78.3%
Homemaker	12.5%	13.6%	19.8%	15.6%	**0.0%**	9.1%	9.2%	13.6%	32.1%	1%	23.8%	12.6%	0.7%
Health conditions:													
1+ ADL	18.8%	16.4%	17.6%	27.4%	16.3%	18.6%	15.6%	20.4%	22.8%	15.3%	14.2%	12.8%	19.4%
1+ iADL	20.6%	22.6%	19.2%	30.9%	22.3%	23.6%	15.9%	19.5%	26.9%	17%	18%	12.5%	15.4%
2+ ADL	7.9%	7.2%	7.1%	11.2%	6.6%	7.8%	7.5%	8.1%	12.4%	5.5%	5.4%	4%	5.7%
2+ iADL	10.7%	12.0%	9.4%	16.8%	11.6%	12.3%	9.2%	12.2%	15.4%	8.8%	7.7%	4.6%	7%
1+ ADL or iADL	27.4%	28.1%	26.2%	38.8%	28.7%	30.2%	21.8%	27.2%	33.4%	22.7%	23.8%	19.3%	26.3%
1+ ADL and iADL	11.3%	10.9%	10.5%	19.5%	9.9%	11.9%	9.7%	12.7%	16.3%	9.6%	8.3%	5.9%	8.5%
1st most freq. ADL	D 9%	D 9.3%	W 9.6%	W 15%	D 6.7%	D 11%	D 9%	D 10%	D 13%	I 7.2%	I 6.4%	I 5.1%	I 12.3%
2nd most freq. ADL	W/I 7.9%	W 6.9%	D 8%	D 14%	W 6%	W 8%	W 7%	W 9%	W 12%	D 6.8%	D 5.8%	D 5.3%	D 7.1%
1st most freq. iADL	HW 14%	HW 16.7%	HW 14%	HW 24.7%	HW 16%	HW 17%	HW 12%	HW 13.6%	HW 19%	HW 11.7%	HW 11.8%	HW 6.9%	HW 11%
2nd most freq. iADL	MO 9.2%	MO 10%	MO 8.7%	C 13.6%	MO 11.3%	C 10.7%	C 8%	C 12%	MO 17%	C 7.7%	MO 6.2%	MO 5.1%	C 5.4%
EURO-D score		2.1 (2.1)	2.1 (2)	3 (2.4)	2.26 (2.2)	2.75 (2.3)	2 (2)	2.88 (2.5)	2.98 (2.7)	1.7 (1.8)	1.8 (1.9)	1.7 (1.8)	1.8 (1.8)
Orientation score (0-5, the highest the better)		3.84 (0.5)	3.7 (0.7)	3.64 (0.7)	3.67 (0.7)	3.64 (0.89)	3.78 (0.68)	3.79 (0.67)	3.34 (1.18)	3.74 (0.67)	3.73 (0.71)	3.86 (0.5)	3.8 (0.64)

Data: SHARE wave 2, individuals aged 60+.
C = limitation in cooking; D = limitation in dressing; I = urinary incontinence; HW = limitation in doing housework; MO = limitation in moving outdoor

1.3.3 LTC inclusiveness: cross-country & cross-program comparisons

Many recent studies highlight the numerous and substantial heterogeneities existing among the LTC systems in Europe, but few of them focus on the assessment and eligibility frameworks. Colombo and Mercier (2012), as well as Eleftheriades and Wittenberg (2013), argue that different LTC-coverage schemes are the outcome of heterogeneous policy objectives, philosophies and institutional frameworks. We are now interested in gaining some insights on the degree of inclusiveness that these programmes-of-care exhibit with respect to a comprehensive set of medical conditions. In other words, we would like to investigate the consequences of applying different sets of rules on the

same medical profile (a combination of health-outcomes), in terms of the eligibility status. As highlighted in the previous paragraph, all the assessments-of-need reviewed so far cover a more or less comprehensive list of vulnerability outcomes that belong either to the ADL or to the iADL taxonomies, or to the mental-illness dimension. Furthermore, the LTC programmes define eligibility basing almost exclusively on the results of these assessments (with age being a seldom requirement and income being a factor that often proportionally reduces the amount of the granted allowance).

Colombo and Mercier (2012) highlight the importance of the determination (by the LTC institution) of the population-profiles which should be the target of LTC services. Their argument is not only referred to the opportunity of proportionally reducing the granted allowances according to the recipient's income, thus giving relatively higher priority to individuals with lower resources, but also to the choice of which limitations should be prioritized by a LTC system, in order to give appropriate assistance to those who are more "vulnerable". Elaborating on the trade-off between cost-sustainability and adequacy of the provided benefits, they observe that "on cost-control grounds, support for domestic care and help with so-called instrumental activities of daily living (iADL) […] should not be included in a basic package […]. In practice, however, distinguishing between personal and domestic help can provide incentives for higher assessment-of-need and can be difficult to make, especially where services are jointly provided". Discussing on the choice of including rather than excluding iADL from LTC eligibility conditions, they add a comment that refers to the hierarchy structure between ADL and iADL[49]: "coverage of support for some iADL activities, as in Sweden, Denmark, Germany and Luxembourg, is reported to have helped prevent dependent persons with relatively high care needs from moving to even more expensive care settings. Maintaining flexibility to adjust benefit coverage to changing care needs is desirable on both adequacy and quality grounds".

1.3.3.1 Formalization of inclusiveness rates

As highlighted in the previous paragraphs, the degree of vulnerability and the minimum eligibility threshold for public LTC services are mainly defined as functions of a patient's health conditions (her medical-profile) in Austria, Belgium, Czech Republic, France, Friuli-Venezia-Giulia, Germany, Spain and Toscana. Age is the only additional socio-demographic criterion.[50]

A comprehensive list of the health conditions included (to various extents) in each assessment scale includes ADL, iADL, additional mobility limitations, cognitive limitations, behavioural/depression status, as summarized in Table 1-3.

We now state some preliminary definitions:

DEFINITION 1: Let us define $\mathbf{c}$ *as the vector of the aforementioned health-conditions, such that* $\mathbf{c} = \{c_1, \ldots, c_k, \ldots, c_H\}$ *where* $|\mathbf{c}| = H$ *is the total number of health-conditions for which we have information.*

DEFINITION 2: A generic vulnerability medical-profile i would be a vector $\boldsymbol{\pi}_i = \{\alpha_{i_1}, \ldots, \alpha_{i_k}, \ldots, \alpha_{i_H}\}$*, where each element is such that:*

[49] See footnote 134 and Table 1-4.

[50] The patient's income is often taken into account for redistributive purposes: it determines the monetary amount of the benefits, yet it does not have discriminatory power to define eligibility and non-eligibility.

$$\alpha_{i_k} = \begin{cases} 1 & \text{if limitation } c_k \text{ occurs} \\ 0 & \text{if limitation } c_k \text{ is absent} \end{cases}$$

As an example, $\boldsymbol{\pi}_i = \{1,1,0,0,0,\ldots,0,0,0,1\}$ is a vulnerability profile in which only three limitations are validated (namely the first, second and last) while the others are not present. Generalizing, we define:

DEFINITION 3: Let us define $\Pi = \{\pi_1,\ldots\pi_i,\ldots,\pi_P\}$ *as the set of all the theorical medical-profiles that can be built from the H elements of* $\boldsymbol{c}$.

Given that each profile $\boldsymbol{\pi}$ has H elements, the set Π will contain $P=2^H$ profiles, which correspond to all the possible combinations of the deficits related to ADL, iADL, cognitive and mental functioning, which are summarized in Table 1-3.

In the SHARE micro-data, respondents provide self-reported information about the occurrence of each of the H health-conditions included in the **c** vector. For a generic individual *i* living in country *J*, it would therefore be possible to build a medical-profile $\pi_{i,J}$.

Each country *J* defines its specific assessment-of-need and eligibility criteria for LTC benefits. As mentioned in the previous section, multiple programmes can be implemented in the same country. Let us suppose that a country *J* implements *R* programmes of care. We, then, make the following assumption:

ASSUMPTION 1: the health-conditions included in vector $\boldsymbol{c}$ *exhaust all the possible vulnerability outcomes that can be assessed by a LTC program's regulation.*

Assumption 1 guarantees that, once the limitations in **c** have been assessed, there are no other dimensions which need to be evaluated by a medical-team in order to provide a vulnerability assessment. This is a simplifying assumption since authorities operates with a potential degree of flexibility and there could be local subjectivity and variation in the need-assessment process; yet, we believe that choosing **c** as a *core-set* of outcomes is legitimate, given that, in principle, the regulations are explicated in the laws and are fixed nationwide (or region-wide).

DEFINITION 4: $\tilde{J}_r (\subset \Pi)$ *is a sub-set a subset of objectively vulnerable (eligible) medical-profiles, determined by the eligibility rules for a generic program "r" in country J, among all the possible medical-profiles (set Π).*

Alternatively stated: if an individual *i* living in country *J* would have her profile $\pi_{i,J}$ assessed by a medical-team following the regulations of LTC program *r*, this would determine whether $\pi_{i,J}$ belongs to the eligible-set $\tilde{J}_r$. That being the case, she would be entitled to receive the benefits from the *r-th* program of care.

We are interested in the extensive margin of eligibility at the *national-framework* level, i.e., whether an individual is eligible to any LTC program in her country. A simplified notation can therefore be adopted through

DEFINITION 5: let $\tilde{J}$ be the set of those medical-profiles which are eligible according to at least one of the LTC programmes implemented in country J.[51]

As long as $\tilde{J}$ is a set of medical-profiles, it is also a subset of Π, therefore $\tilde{J} \subset \Pi \neq \varnothing$.

We can now define the eligibility function *f*:

DEFINITION 6: define $f_{\tilde{J}} : \Pi \to \{0,1\}$,

where $f_{\tilde{J}}\left(\pi_{i,J}\right) = \begin{cases} 1 & \text{if } \pi_{i,J} \in \tilde{J} \\ 0 & \text{if } \pi_{i,J} \notin \tilde{J} \end{cases}$ *is the characteristic function of set* $\tilde{J}$.

The function $f_{\tilde{J}}$ determines the eligibility status of an individual *i* (living in country J), according to the rules of all country J LTC programmes (i.e., whether her medical profile belongs to $\tilde{J}$).[52]

By defining with N_J the population in J and summing up for each individual we obtain

$$\mathrm{E}_{J,\tilde{J}} = \sum_{i=1}^{N_J} f_{\tilde{J}}\left(\pi_{i,J}\right) \tag{1.1}$$

Where $\mathrm{E}_{J,\tilde{J}}$ is the number of eligible individuals living in country J, according to their own country regulations. Specifically, these individuals are eligible to *at least one* of the programmes implemented in country J.

The inclusiveness-rate $\omega_{J,\tilde{J}}$, which represents the share of eligible citizens of J over J's total population, is defined as

$$\omega_{J,\tilde{J}} = \frac{\mathrm{E}_{J,\tilde{J}}}{N_J} \tag{1.2}$$

This is an inclusiveness-rate at the *national-framework* level,[53] given that the numerator represents the number of individuals covered by *at least one* national LTC program. If the focus were to be kept at the *program level*, multiple inclusiveness-rates can be calculated, one for each of the *R* program implemented in country J. We will therefore have:

$$\omega_{J,\tilde{J}_1} = \frac{\mathrm{E}_{J,\tilde{J}_1}}{N_J}, \ldots, \omega_{J,\tilde{J}_r} = \frac{\mathrm{E}_{J,\tilde{J}_r}}{N_J}, \ldots, \omega_{J,\tilde{J}_R} = \frac{\mathrm{E}_{J,\tilde{J}_R}}{N_J} \tag{1.3}$$

---

[51] We do not investigate the intensive margin of eligibility, i.e., *how much* an individual scores in the eligibility scale and the amount of benefits that she is entitled to receive. Moreover, we do not distinguish between individuals who are eligible to multiple national programs of care and those that are eligible to just one.

[52] We are implicitly assuming that the laws and the guidelines are carefully followed by the medical evaluators and by the medical-board who takes the final decision on eligibility. This is, admittedly, a simplifying assumption and yet, we believe, a necessary step to take in order to perform a comparative analysis.

[53] See footnote 51.

Each $\omega_{J,\tilde{J}_r}$ represents the share of individuals living in J who are eligible to the specific *r-th* LTC programme, related to J's total population.

From the analysis performed in the previous paragraphs, and from the review in Section 1.5, the characteristic function *f* is a typical example of non-linear combinations of health-indicators included both in the assessment of need scales and in our dataset.[54] An example will help to clarify the nature of the *f* function.

> *The Austrian national LTC programme (Pflegegeld) assesses individuals' on fourteen dimensions (items), between ADL, iADL and cognitive limitations (paragraph 1.7.3). For each item, the legislation defines a nationwide amount of care-time (in hours per month), which is plausibly needed by individual who is limited in that item. When the assessment is complete, the sum of all the amounts of care-time corresponding to the respondent's limitations is taken. The regulation defines as eligible all the medical profiles that present a need-of-care of at least 50 hours per month (raised to 60h since 2011), and has at least one limitation in ADL and one in iADL. In order to build the eligibility status for Austrian citizens, we compute the overall need-of-care of each respondent in Austria, then apply the aforementioned eligibility rule: the minimum need-of-care should be 50h per month, and at least one ADL and one iADL limitations should be reported.*

1.3.3.2 Direct adjustment

By exploiting the information in the second wave of SHARE, we implement each country's LTC regulation on our selected sample (Section 1.3.2), thus being able to build an individual-specific dichotomous variable "eligibility status" for each individual: the variable will take value 1 when the individual is "eligible" according to his own country rules. Details on the adopted methodology for the implementation of LTC regulations on SHARE data are reported in the Appendix 1.7.3 .

Using (1.2), we compute the inclusiveness-rates for each country in our sample (our population is aged of 60 or older, (see Table 1-4). What we obtain is the share of individuals covered by *at least one* national LTC programme, in percentage of the country population. These estimates are reported in the following table.[55]

Table 1-5, crude inclusiveness rates

	Austria	Belgium		Czech Rep.	France	Germany	Spain
		Flanders*	Wallonia				
Inclusiveness rate (1.2) $\left(\omega_{J,\tilde{J}} = \frac{E_{J,\tilde{J}}}{N_J}\right)$	11.5%	8.2%	11.02%	8.3%	15.2%	8.2	12.8%

Data: SHARE wave 2. See section 3.2.

The share of eligible population varies significantly among countries: it goes from values higher than 12% in France and Spain, to values around 8% in Germany, Flanders and Czech Republic.

[54] Details on the correspondence between SHARE and the LTC legislations are reported in Appendix 1.7.3

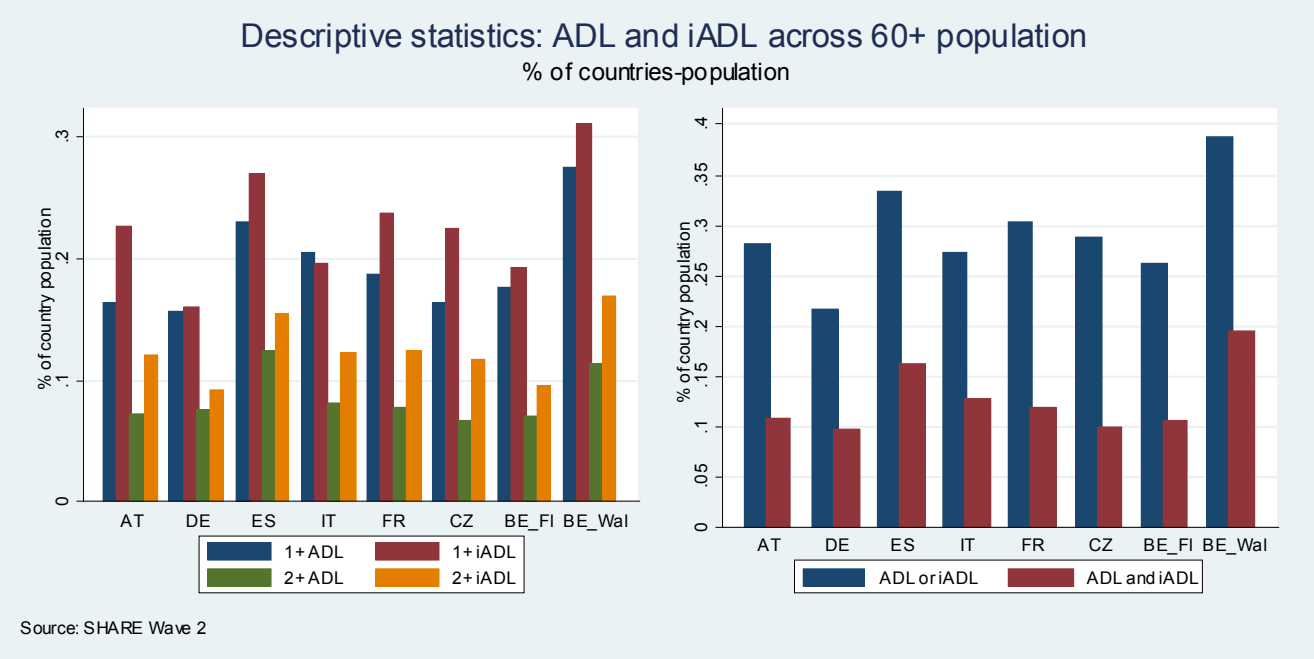
[55] The inclusiveness-rates computed for each LTC program (at the *program-level*) instead that for each country (the *national-framework level*) can be found in the Appendix.

By looking at the definition of the inclusiveness rate (1.2), it appears clear that comparing these coefficients could lead to misleading conclusions. Each share $\boldsymbol{\omega}_{J,\tilde{J}}$ is, indeed, a "crude rate" driven by two main factors: the eligibility rules adopted in J and the characteristics of the population N_J. Both of these elements are, by definition, country specific. As a result, when comparing rates for different J we are not able to disentangle a "regulation-effect" from a "population-effect": the former corresponds to differences in the LTC regulations, while the latter is due to health-related and demographic characteristics of each country's population. We are not comparing homogeneous coefficients: a country could report a higher share of eligible individuals either because its LTC system is on average more inclusive, or because its population has worse health-conditions (e.g., there is higher incidence of ADL or iADL limitations), or both. Statistics on within-country age and gender distribution (Table 1-3) do not seem to highlight significant demographic variations between countries; by contrast, as the next figure show, relevant heterogeneities exist on the incidence of vulnerability outcomes.

The graph on the left provides insights on the occurrence of ADL and iADL limitations in the set of countries considered in this paper. The first two bars from the left represent the share of population reporting to be limited in *at least one* ADL (first bar) or iADL (second bar). Notable differences emerge from the chart: Spain and Wallonia have a considerably higher ratio of ADL-limitations incidence, with France and Flanders also showing higher percentages than Austria, Germany and the Czech Republic. Although the share of iADL-dependent is generally higher than the ADL-dependent, this gradient is rather small in Germany and Flanders, whereas it is much larger in Austria, France and Czechia. Furthermore, having relatively higher iADL occurrences do not necessarily imply the same for ADLs: the Czech Republic and Austria have lower ADL ratios than Flanders, and very similar ones to Germany, yet they report much higher incidence for iADL.

As discussed in paragraph 1.3.1, many LTC regulations set their eligibility threshold in order to "exclude" from the care-benefits those individuals who are "lightly" vulnerable. Although this is not common to all the reviewed frameworks, the accumulation of limitations is often crucial to trigger eligibility. The third and the fourth bars in the left graph of Figure 1-1 show the shares of population who suffer from, respectively, two ADL or two iADL. It is worth noting that, contrary to the impression given by the first bar, the ADL-dependent population is now much more homogeneous between countries, with the exception of Spain and Wallonia: countries like the Czech Republic and Flanders, who had higher incidence of *at-least-one-ADL* occurrences, lie now in-line or below the German percentage. This goes to show how the intensity of vulnerability might differ from the simple realization of *one* outcome of dependency. As far as the iADL are concerned, the overall picture remains quite heterogeneous even when considering only the individuals who suffer from at least two of them; it appears, though, that Austria France and the Czech Republic have a higher share of *one-iADL-only* individuals with respect to Belgium and Germany.

Figure 1-1, incidence of ADL and iADL among SHARE countries



Another feature that is sometimes required for eligibility by LTC regulations (e.g., in Austria and Germany) is the concurrent existence of limitations in both ADL and iADL. The graph on the right-hand side of Figure 1-1 illustrates how heterogeneities remain evident when considering those individuals suffering from *at least one* ADL *and one* iADL. In particular, when comparing figures with the "1+ ADL or 1+ iADL" ratios, it appears that in France, the Czech Republic and Flanders there is a substantially higher share of population which is limited in a lighter way with respect to Germany: when considering individuals who have at least one ADL or iADL these countries show much higher incidences than Germany, yet these differences almost vanish when focusing on those for which the two kinds of dependency cumulate.

As it usually happens when studying health-events, geographical comparisons require that the influences of different population characteristics be controlled for, with some method of adjustment. This strategy is frequently applied in epidemiology and demography, e.g., in order to compare mortality rates across countries: since these rates are strongly age-dependent, "comparisons of crude age-specific rates over time and between populations may be very misleading if the underlying age composition differs in the populations being compared. Hence (…) a single age-independent index, representing a set of age-specific rates, may be more appropriate. This is achieved by a process of age standardization or age adjustment"[56].

As an example, let us suppose that we need to compare mortality rates for two countries A and B. Instead of simply comparing the two "crude" rates, the direct method of standardization would require to apply age-specific death rates from the two populations (which are supposed to have different age structures) to a "standard" population (e.g. the U.S. population). The age-specific death rates from A and B would then be multiplied by the number of individuals in the same age group for the standard population, to produce an expected number of death (in the standard population)

[56] Ahmad *et al.*

for each age group. These number should be summed up and divided by the total standard population to produce a summary age-adjusted mortality rate that would represent A and B if each had the same age structure as the standard population.[57] The directly-adjusted rates are to be intended as relative measures of mortality to be used for comparability purposes. They do not convey actual magnitude information about the issue at stake, nor an actual absolute measure of it, also given the – almost inevitable – arbitrary nature of the standard population chosen.

Following the same rationale, we aim at building an index of inclusiveness that would allow for comparability between different eligibility rules for LTC services. Let us set some new definitions:

DEFINITION 7: Y is a set of countries such that $Y = \{1,\ldots,J,\ldots,S\}$

DEFINITION 8: N_J *is the population of country J and* $N = \sum_{J=1}^{S} N_J$ *is the "standard" population.*

In particular, we include in Y all the countries for which we gathered institutional information in section 2, plus the other European countries included in the second wave of SHARE. The resulting standard population is therefore constituted by 17,442 individuals aged 60+ from Austria, Belgium, the Czech Republic, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden and Switzerland. Descriptive statistics for this population are reported in Table 1-4.

In order to obtain the directly-adjusted eligibility rate, we firstly implement each country eligibility rules on the standard population (see Appendix 1.7.3 for methodological details), thus obtaining the directly-adjusted eligible population, defined as:

$$\mathrm{E}_{\tilde{J}} = \sum_{J=1}^{S} \sum_{i=1}^{N_J} f_{\tilde{J}}\left(\pi_{i,J}\right) \tag{1.4}$$

Note the close relationship between (1.4) and (1.1)[58]: the latter computes the number of individuals living in J and eligible according to country J's rules, while the former "extends" the same rules to all of the other countries population – like they were, indeed, all part of a "standard" population.

By dividing (1.4) by the total number of individual N we get **the directly-adjusted inclusiveness rate** $\omega_{\tilde{J}}$ for the LTC regulations implemented by country J:

$$\omega_{\tilde{J}} = \frac{\mathrm{E}_{\tilde{J}}}{N} \tag{1.5}$$

Since (1.5) computes the eligibility ratio on the overall population N, it allows for comparisons with other ratios built by adopting other LTC regulations (on the same standard population).

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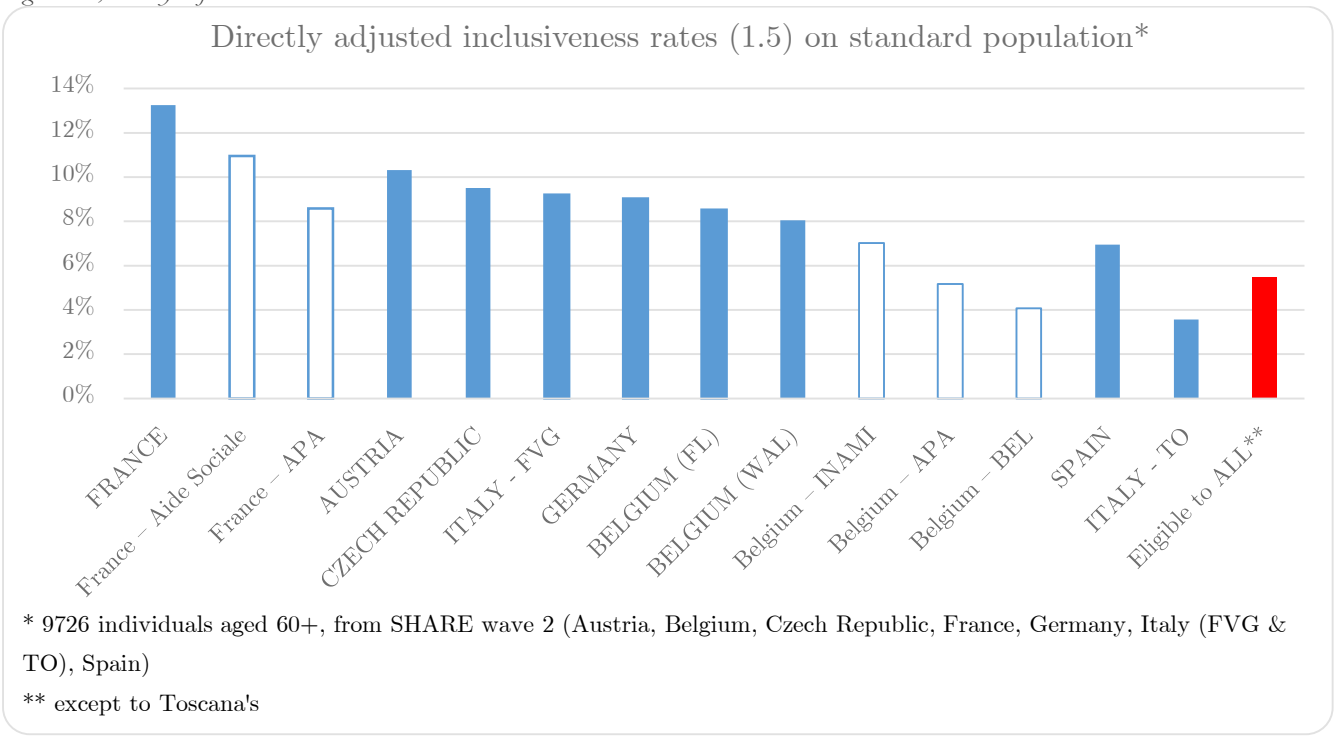
[57] Lilienfeld and Stolley (1994), Curtin *et al.* (1995), Boyle and Parkin

[58] $\mathrm{E}_{J,\tilde{J}} = \sum_{i=1}^{N_J} f_{\tilde{J}}\left(\pi_{i,J}\right)$

By repeating this procedure for each LTC regulation reviewed in section 1.5 (details in Appendix 1.7.3) and summarized in

Table 1-3, we obtain directly-adjusted (therefore: comparable) inclusiveness rates for 11 LTC programmes and 8 countries, which are summarized in Figure 1-2. Since for Belgium and France we collected information for more than one LTC programme, we report a *national-framework* inclusiveness rate, which represent the share of the standard population who is eligible to *at least one* programme of care, together with the *program-specific* rates, which represent the share of the standard population who is eligible to the specific programme of care. For all of the other countries, who implement a single national programme of care, the two approaches coincide. Moreover, since Flanders and Wallonia differ in terms of the LTC programmes offered, we report estimates separately. Numeric results are reported in Table 1-6.

Figure 1-2, directly-adjusted inclusiveness rates



* 9726 individuals aged 60+, from SHARE wave 2 (Austria, Belgium, Czech Republic, France, Germany, Italy (FVG & TO), Spain)

** except to Toscana's

The directly-adjusted coefficients of inclusiveness are considerably different from the "crude" rates reported in Table 1-5. France LTC, taken as a whole, is the one that has the highest percentage of coverage (above 13%) with respect to our standard population. When interpreting these coefficients and results it is worthwhile recalling that it is not this analysis's aim to compare countries' Welfare States, nor their Long-term care frameworks as a whole. The focus of this Chapter is to analyse the existing heterogeneities among different LTC programmes in how they define their target population. Specifically, we look at their vulnerability assessments (i.e., which are the limitations that can be accounted for as symptoms of vulnerability) as well as to their eligibility rules (i.e., the definition of the medical-profiles that are "objectively vulnerable" and therefore can be granted a public form of LTC assistance). Moreover, as already underlined, we are aware of the fact that, although they are in principle fixed nationwide, need-assessments can, in practice, be characterized by local subjectivity and variation and that minor supplementary programmes could be implemented at community levels.

By looking at the programme-specific inclusiveness-rates for **France**, the *Aide Sociale* (10.9%) has an inclusiveness degree higher than APA. This is not surprising, given that the former aims at delivering assistance to "light" conditions of vulnerability (mostly individuals with difficulties in shopping for groceries, in cooking or in washing activities), while APA (8.6%) targets more severe degrees of dependency and requires – roughly – the loss of two ADL or the presence of mental/cognitive disorders in order to be eligible to the programme. Considered as a whole, the French system tackles vulnerability conditions with a double-target design, and our estimates show that it can succeed in covering a relatively high (and heterogeneous) share of population, although the contributions supplied through the Aide Sociale are smaller than those related to APA (we do not deal with redistributional effects of the LTC programmes at this stage or our research). At country level, APA and Aide Sociale are not complementary, since in order the regulation does not allow individuals who are already benefiting from APA to get assistance through the Aide Sociale, and this is why the country inclusiveness rate is lower than the sum of its two programmes' rates.[59]

Belgium citizens have access to different kinds of programmes, depending on the region they live in. Two programmes of care are implemented nationwide: the home-assistance in-kind provided by the National Institute for Sickness and Disability Insurance (Institut National d'Assurance Maladie-Invalidité/Rijksinstituut voor Zieke – en Invaliditeitsverzekering - INAMI/RIZIV), and the APA (allocation pour l'Aide aux Personnes Âgées). The former has an inclusiveness of 7%. Such a rate is rather high compared to all the other programmes, when one considers that the INAMI is the only one (except for the French Aide Sociale) which targets specific limitations. Indeed, although basing its assessment-of-need on all of the ADLs and cognitive limitations, limitations in washing and dressing are sufficient per-se to trigger eligibility. Since these are exactly the ADL with the highest frequency of occurrence in our sample (Table 1-4), the INAMI programme reaches the 7% of individuals. Conversely, the APA programme has a more extensive assessment-of-need scale, yet its eligibility rules set a higher minimum vulnerability level for eligibility: indeed the adjusted inclusiveness rate is estimated at a lower percentage (5.2%). The overall inclusiveness rate for the public LTC system in Wallonia (8%) represents the share of individuals who are eligible to *at least one* of the aforementioned programmes of care. In the Flemish region (as well as in Bruxelles), citizens are offered a supplementary allowance (the assessment of need is performed through the so-called BEL scale), which targets individuals with a substantial vulnerability status defined by the accumulation of ADL, iADL and mental/cognitive limitations. This supplementary programme has a coverage degree of 4.1%; it is worth noticing that the 0.5% of the sample[60] is eligible to the Flemish programme while not being eligible to the INAMI or the APA. As a consequence, the adjusted coverage rate of the LTC system in Flanders is higher (8.5%) than the one in Wallonia (8%).[61]

LTC regulations in **Austria and Germany** result having different degrees of inclusiveness (10.3% vs 9%). As highlighted in sections 1.3.1 and 1.5, the two systems share several similarities in their assessments-of-need: evaluation of vulnerability is performed in both programmes through an analytic approach which includes a large number of daily activities and potential limitations. Moreover, they both characterize the need-of-care by assigning time-amounts (hours per month, minutes per day) to each limitation, where these measures represent the amount of time required by a caregiver to offer assistance in the specific tasks. Differences emerge in the eligibility rules defined by the two

[59] We hereby assume that vulnerable individuals eligible to APA do not choose to benefit from Aide Sociale instead.
[60] The difference between the inclusiveness rates for Flanders and Wallonia.
[61] From a resources-oriented perspective, receiving an additional allowance from the Flemish government can affect individuals behaviours and budget constraints. Our interest, though, is mainly coverage-oriented. We look at whether individuals are covered rather than uncovered, regardless of the intensity of the coverage itself.

programmes. The Austrian regulation requires individuals to be limited in at least one ADL and one iADL, and to need an amount of help corresponding to at least 50 hours per month. The German LTC Insurance sets a minimum eligibility threshold by setting two time-requirements: an individual should need at least 45 minutes per day (22.5 hours per month) for help with ADL, and an overall amount of 90 minutes per day (45 hours per month) when summing ADL and iADL. Although the overall requirements seem close, the German system puts more emphasis on ADL since it requires a specific minimum requirement of 45 minutes per day, not included in the Austrian regulation. The German regulation, with the latest reforms (see paragraph 1.5.7) grants eligibility to cognitively impaired individuals, while the Austrian regulation accounts for such impairments by adding 25 hours of need-of-care to the overall sum. Such different policies narrows down the distance in rates between the two national programmes.

The **Italian** LTC regional programmes included in this paper (for Friuli Venezia Giulia's CAF and Toscana's PAC) both base their vulnerability assessment on a (non identical) list of ADL as well as on cognitive and behavioural limitations (the latter, only for Toscana). Differences exist in their single-task evaluation (binary 0/1 in Friuli Venezia Giulia; on a scale from 1 to 4 in Toscana). Moreover, while the FVG programme grants eligibility to cognitively impaired individuals, the Toscana programme has a three-part evaluation that, broadly, requires the presence of both functional limitations and of cognitive and behavioural ones. Furthermore, Toscana gives slightly more weight to mobility limitations while excluding incontinence (which is, instead, part of the assessment-scale in FVG). Their directly-adjusted inclusiveness ratios are very different (9.2% vs 3.5%). It is worth noting that the classic *à la Katz* evaluation scale implemented in FVG shares some similarities with the French AGGIR scale adopted in the corresponding APA programme. As it was previously stated, they both require –roughly- the loss of two ADL or more to become eligible, and they both account for cognitive limitations. It is therefore not surprising that their respective inclusiveness rates are similar.

The **Czech** LTC regulation does not differ much from the Italian's FVG, since they both evaluate eligibility depending on the accumulation of limitations. The major feature of the Czech programme, which determines its relatively higher coverage-rate, is that iADL are included in the assessment while this is not the case for Friuli-Venezia Giulia.

Among the regulations that implement an analytic assessment-of-need for LTC services, the **Spanish** one has the lowest inclusiveness rate. In order to interpret this result, it is useful to compare descriptive information on eligibility rules (Table 1-2, Table 1-3) and on the standard population adopted in this analysis (Table 1-4). Although the Spanish assessment-of-need includes both ADLs and iADL, the weighting scheme adopted gives higher priority to limitations in nutrition, using the toilet (among ADLs) and preparing meals (among iADL): these do not occur in the population as frequently as those related to washing, dressing and doing housework, which are, instead, assigned a relatively lower weight.

Finally, the last bar on the right-hand side of the graph shows the percentage of individuals in our sample who are eligible to all the aforementioned national programmes, namely the Walloon, the Flemish, the German, the Austrian, the Spanish, the French and the Friuli-Venezia Giulia (excluding the low-inclusive Toscana's PAC). This share, 5.5%, hints at the high heterogeneity in the definition of vulnerability discussed in the previous Section. Even if many programmes have similar directly-adjusted inclusiveness rates, they are not covering the same individuals.

Table 1-6, directly-adjusted inclusiveness rates

	Directly-adjusted inclusiveness rate $\left(\omega_j = \frac{E_j}{N}\right)$	95% confidence interval
AUSTRIA	10.3%	[10.8% - 9.9%]
BE (FLANDERS)	8.5%	[8.9% - 8.1%]
BE (WALLONIA)	8 %	[8.4% - 7.6%]
Belgium – INAMI	*7%*	*[7.4% - 6.6%]*
Belgium – APA	*5.1%*	*[5.5% - 4.8%]*
Belgium - BEL	*4.1%*	*[4.4% - 3.8%]*
CZECH REPUBLIC	9.5 %	[9.9% - 9%]
FRANCE	13.2%	[13.7% - 12.7%]
France – Aide Sociale	*10.9%*	*[10.4% - 11.4%]*
France – APA	*8.6%*	*[9% - 8.1%]*
GERMANY	9%	[9.4% - 8.6%]
IT (FVG)	9.2%	[9.6% - 8.7%]
IT (TOSCANA)	3.6%	[3.8% - 3.3%]
SPAIN	6.9%	[7.3% - 6.6%]
eligible to ALL (except Toscana's PAC)	5.5%	[5.1% - 5.8%]

Data: 17,442 individuals aged 60+ from SHARE wave 2 (Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland)

1.3.3.3 Indirect adjustment

Alongside the direct-adjustment analysis performed in the previous paragraph, an alternative standardization strategy can be implemented, which is referred to as "indirect-adjustment".[62] This method is frequently adopted in order to compare two countries event-occurrences, and it is conveniently described by Boyle and Parkin (1991)as a comparison between an *observed* and an *expected* number of cases.

Let us suppose that our goal is to compare the *r-th* LTC programme available in country J with the *r-th* programme available in country Z. Let us also recall that our focus is on a programme's coverage-rate, i.e., the share of individuals who are labeled as "eligible" to LTC services according to a specific regulation.

Taking country J as the benchmark population, the indirect-adjustment method would compare the share of J-population eligible under the *r-th* programme in J (J_r) (i.e., the *observed* eligible population) with the share of J-population that would be eligible under the regulation of the *r-th* programme from country Z (Z_r). Formally, we define:

[62] Lilienfeld and Stolley (1994), Boyle and Parkin (1991)

(1.6) $$\mathrm{E}_{J,\tilde{J}_r} = \sum_{i=1}^{N_J} f_{\tilde{J}_r}\left(\pi_{i,J}\right)$$

where $\mathrm{E}_{J,\tilde{J}_r}$ is the *observed* number of eligible individuals living in country J, according to their own country *r-th* programme's regulation.[63]

Furthermore, we define:

(1.7) $$\mathrm{E}_{J,\tilde{Z}_r} = \sum_{i=1}^{N_J} f_{\tilde{Z}_r}\left(\pi_{i,J}\right)$$

Where $\mathrm{E}_{J,\tilde{Z}_r}$ is the *expected* number of eligible individuals living in country J, according to LTC regulations of the *r-th* programme from country Z.[64]

The **indirectly-adjusted inclusiveness-ratio** $\chi_{\tilde{J}_r,\tilde{Z}_r|J}$, is defined as the ratio between the *expected* eligible population in country J under the regulations of program Z_r (1.7) and the *observed* eligible population in country J under the regulations of programme J_r (1.6):

(1.8) $$\chi_{\tilde{J}_r,\tilde{Z}_r|J} = \frac{\mathrm{E}_{J,\tilde{Z}_r}}{\mathrm{E}_{J,\tilde{J}_r}}$$

The resulting coefficient $\chi_{\tilde{J}_r,\tilde{Z}_r|J}$ should be interpreted differently according to its value being greater or smaller than unity. Whenever $\chi_{\tilde{J}_r,\tilde{Z}_r|J} > 1$, the eligibility rules of Z_r are more inclusive than those of J_r, when both are applied to the same population in J. The opposite is true when $\chi_{\tilde{J}_r,\tilde{Z}_r|J} < 1$, while when the ratio equals unity the two regulations have the same coverage-rate with respect to the population in J.

Table 1-7 reports the indirectly-adjusted inclusiveness rates for each pair of LTC programmes reviewed in Section 1.2, using the same dataset as in Section 1.3.3.2, as well as the same methodology for simulating LTC regulations (Appendix 1.7.3).

[63] The adjective "*observed*" just indicates that the regulation J_r was actually designed for the population in J. In other words, it is not a counter-factual implementation.

[64] The "*expected*" eligible population is the result of a counter-factual implementation of legislation Z_r, which was originally designed for country Z, on the population in J.

Table 1-7, Indirectly-adjusted inclusiveness ratios, comparisons at the programme-levels

		Treatment $\tilde{Z}_r$										
		Austrian *Pflegegeld*	Belgium			Czech *Příspěvek na péči*	France		German *LTCI*	Italy		Spanish *Ley of Dependencia*
Population J	**Observed programme** $\tilde{J}_r$		*INAMI*	*APA*	*BEL*		*APA*	*Aide Sociale*		FVG	TO	
AT	Austrian *Pflegegeld*	1.00	0.64	0.49	0.32	0.92	0.77	1.10	0.80	0.79	0.29	0.76
BE	Belgian *INAMI*	1.75	1.00	0.73	0.59	1.52	1.27	1.94	1.50	1.37	0.47	1.02
BE	Belgian *APA*	2.41	1.38	1.00	0.82	2.09	1.74	2.67	2.07	1.88	0.64	1.41
BE (Fl)	Belgian *BEL-scale*	3.13	2.05	1.47	1.00	2.71	2.37	3.52	2.92	2.68	0.66	1.87
CZ	Czech *Příspěvek na péči*	1.03	0.54	0.46	0.36	1.00	0.84	1.13	0.85	0.86	0.32	0.65
FR	French *APA*	1.19	0.84	0.58	0.49	1.08	1.00	1.24	1.04	1.06	0.44	0.76
FR	French *Aide Sociale*	0.96	0.68	0.47	0.39	0.87	0.80	1.00	0.83	0.86	0.36	0.61
DE	German *LTCI*	1.16	0.76	0.62	0.39	1.02	0.96	1.22	1.00	1.04	0.50	0.89
ES	Spanish *Ley of Dependencia*	1.33	1.24	0.82	0.72	1.30	1.36	1.23	1.30	1.42	0.61	1.00

Data: 17,442 individuals aged 60+, from SHARE wave 2 (Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland). See Table 1-4 for country-specific descriptive statistics.

The first two columns describe the benchmark populations and regulations over which the indirect-adjustment analysis will be performed, e.g., the Austrian *Pflegegeld* applied on the Austrian population, the Spanish *Ley of Dependencia* applied to the Spanish population, etc.

The subsequent columns list the LTC regulations that are simulated on the benchmark populations indicated in each row. Each cell of the table reports an indirectly-adjusted inclusiveness ratio between the column-program and the row-program as in (1.8), that is, the ratio between the eligible population in country J when adopting the colum-regulation Z_r and the eligible population in country J when adopting the "original" row-regulation J_r. A coefficient greater than 1 means that the column-regulation exhibits a higher coverage-rate than the corresponding native one in the row-country (i.e., the eligible population in the row-country would be higher when applying the column-regulation, than when applying the original row-regulation).

> *As an example, the ratio corresponding to the comparison between the Austrian Pflegegeld and the Czech Příspěvek na péči, when both are applied to the Austrian population, is 0.92. This indicates that the Czech LTC regulation is less inclusive than the Austrian one, with respect to the same (Austrian) population: in particular, the number of*

Austrian citizens who would be eligible under the Czech regulations amounts to 92% of the number of Austrian citizens who are eligible under their own country's regulations.

Table 1-7 may be read row-wise as well as column-wise. A row-wise analysis allows to keep fixed a country population (e.g., Austrian population for the first-row) and to compare each LTC regulation reviewed in this paper with the native regulation for Austria (the Austrian *Pflegegeld*). A coefficient higher than 1 signals that the column regulation which is being counter-factually implemented on the Austrian population is able to cover a wider quota of individuals with respect to the native Austrian *Pflegegeld*. A column-wise review allows to keep fixed the "treatment" regulation and to verify which are the consequences of implementing it on various populations, comparing its inclusiveness with the native-regulation corresponding to each row-country.

The coefficients in Table 1-7 confirm the results of Section 1.3.3.2, and we refer to that paragraph for more exhaustive comments. Indeed, it is easy to see that the column corresponding to the French Aide Sociale contains only coefficients higher than unity, which highlights the programme's relative higher inclusiveness compared to every other regulation in this analysis. Also it is confirmed that the Austrian and the Czech cash-benefits have higher coverage power, while the Toscana's and the Flander's BEL regional-specific programmes are characterized by lower inclusiveness ratios.

Since some countries implement more than one nationwide LTC programme, it is again interesting to compare LTC frameworks (i.e., set of programmes) rather than the single programmes per-se. This implies that, instead of having two programmes for France and three programmes for Belgium we will now include one *framework* for France and *two* regional-frameworks for Belgium. An individual eligible under the French framework is *either* covered by APA *or* by Aide Sociale. An individual eligible under the Flemish LTC framework is covered by *at least one* among the INAMI/RIZIV, the APA or the Flemish additional allowance; a Belgian citizen from Wallonia is eligible if she is covered by *at least one* among the INAMI/RIZIV or the APA programme. Results of the *national-frameworks* comparisons are reported in Table 1-8, and confirm what was shown in the direct-adjustment analysis. The French framework is always the more inclusive one, no matter what the comparison is: we already know that this result is driven by the Aide Sociale programme which covers lighter forms of dependency, even if with lower contributions compared to the other national programme, the APA. Beside France, the Austrian and the Czech frameworks are those who show the highest inclusiveness ratios in the table (column "Austria" and "Czech-republic").

Table 1-8, indirectly-adjusted inclusiveness ratios, comparisons at the national-framework levels.

		Treatment $\tilde{Z}_r$								
		AUSTRIA	BELGIUM		CZECH REP.	FRANCE	GERMANY	ITALY		SPAIN
Population J	**Observed framework** $\tilde{J}$		FL	WAL				FVG	TO	
AT	Austria	1.00	0.76	0.72	0.92	1.24	0.80	0.79	0.29	0.76
BE-FL	Belgium (Fl)*	1.24	1.00	0.96	1.07	1.64	1.16	1.06	0.26	0.74
BE-Wal	Belgium (Wal)*	1.59	1.12	1.00	1.38	2.01	1.23	1.11	0.53	0.91
CZ	Czech Republic	1.03	0.81	0.73	1.00	1.40	0.85	0.86	0.32	0.65
FT	France*	0.77	0.67	0.63	0.70	1.00	0.67	0.69	0.29	0.49
DE	Germany	1.16	0.87	0.84	1.02	1.41	1.00	1.04	0.50	0.89
ES	Spain	1.33	1.38	1.33	1.30	1.60	1.30	1.42	0.61	1.00

** An individual eligible under the French framework is either covered by APA or by Aide Sociale. An individual eligible under the Flemish LTC framework is covered by at least one among the INAMI/RIZIV, the APA or the Flemish additional allowance; a Belgian citizen from Wallonia is eligible if she is covered by at least one among the INAMI/RIZIV or the APA programme.*
Simulation performed on individuals aged 60+, from SHARE wave 2. See Table 1-4 for country-specific descriptive statistics.

1.3.4 Discussion

This section aimed at offering an overview of the LTC programmes presented in Section 1.2 and reviewed in Section 1.5). We primarily focused on vulnerability assessments as well as on eligibility rules for LTC benefits. As highlighted in Section 1.3.1, relevant heterogeneities exist among countries (and even within countries, when multiple nationwide programmes are implemented) on the very issue of defining vulnerability. Even when restricting the perspective to a comprehensive set of functional (mostly ADL and iADL) and cognitive limitations[65], it appears that there is almost no regulation that includes them altogether in the assessment-process, to detect a vulnerable condition. Exempli gratia, "light" potential outcomes of frailty (mostly iADL) are often marginal in the evaluation, while cognitive impairment are always explicitly included as a relevant dimension (yet, to different extents). Moreover, the health-outcomes are often un-equally weighted within an assessment-scale: some limitations are given more importance than others in determining eligibility, and there are legislations that characterize some deficit as necessary and/or sufficient for eligibility (the Belgian's INAMI, the French APA, the German LTCI), thus constituting *veto* or *favor* criteria, respectively (Marichal, 2004). As a consequence, an individual with a given medical-profiles may well result to be eligible for LTC services under one legislation while being ineligible under others. This confirms the concerns that institutional LTC frameworks may constitute a source of heterogeneity that should not be neglected in economic analyses focused on the demand of health-care: besides individual characteristics, e.g., health- and socio economic status, differences in care-programmes' legislations may have a relevant impact on elders' decision in terms of formal-care utilization. This issue will be the main topic of the empirical analysis in Section 1.4 and will constitute an important identification tool in Chapter Two (see Section 2.2.2). In paragraph 1.3.3.2 we compared the LTC eligibility rules on a common sample

[65] Although medical literature describes it as determined by a larger set of symptoms, nearly all studies on frailty report deteriorations in ADL and iADL, that are therefore considered to be effective measures of the need-of-assistance (Pel-Littel *et al.* (2009)).

of individuals using micro-data from the second wave of SHARE (Section 1.3.3.2). Being able to implement different regulations on a standard population allows comparing different legislations while keeping the sample's health-conditions constant. IADL have higher incidence than ADL in Europe (they are often considered as early signals of the vulnerability process, see Table 1-3), therefore programmes who account for iADL in their eligibility conditions exhibit higher inclusiveness rates with respect to those who only evaluates ADL. At the same time, there are frameworks who consider only ADL limitations, but give high weight to those difficulties who are more frequent among European elderly (e.g., Belgian's INAMI, difficulties in washing and in dressing, see Table 1-4), and therefore reach coverage rates which are comparable with other systems. Conversely, there are programmes with a wide assessment-of-need but with strict eligibility rules (the Flemish Care Insurance) that cover lower shares of the population. Furthermore, when multiple nationwide programmes are implemented in the same country, with the aim of targeting different stages of vulnerability (France and, to a lower extent, Belgium), the national LTC framework – as a whole – exhibits higher inclusiveness rates even if the single programmes are not particularly inclusive per se. Indeed, there might exist complementarities between various branches of a nationwide LTC framework when, e.g., one programme provides generous benefits to a relatively low share of elderly who suffer from severe limitations, while another offers lower benefits to those who are in the early stages of vulnerability, in order to delay the frailty process, as it happens in France.

1.4 DETERMINANTS OF FORMAL-CARE ACCESSIBILITY: ELIGIBLE AND NON-ELIGIBLE POPULATION

In this Section, we exploit individual-specific information on the eligibility status to public LTC programmes in order to analyse the determinants of access to formal home-based care in different European countries.

In particular, we investigate potential "failures" of LTC programmes, which arise when vulnerable individuals who are legally-entitled to receive formal-service, do not make use of any of them, ending up in the so-called "no-care zone" (Wallace, 1990). Investigating the determinants of these conditions is a task of major economics and policy relevance. Although without considering the role of eligibility regulations, existing literature provided evidence for an important role played by education (health and bureaucracy literacy) on the lack of access (Cutler *et al.*, 2006; Cutler & Lleras-Muney, 2012; Nutbeam, D, 2008; Parker *et al.*, 2003; Peerson & Saunders, 2009; Sun *et al.*, 2013).

As mentioned in the Introduction as well as in Section 1.2, the process of Ageing is heterogeneous in both its pace and its levels among European countries (and beyond). Nevertheless, a common consequence of population ageing has been an increase in the incidence of age-related ill-health conditions and, consequently (but not entirely due to that), an increasing pressure on age-related public spending. Sustainability of LTC-systems is under intense debate. Expenditure-patterns in the medium-term will depend on the path of ageing in each country and, specifically, on the results that healthy-ageing policies will achieve. A key-element, in this regard, is the efficiency and effectiveness on the home-based programmes of LTC implemented by public (and private) institutions. Gaining insights on availability, accessibility, acceptability and utilization of these programmes is potentially crucial to improve both efficiency and effectiveness (Levesque *et al.*, 2013). Following the descriptive analysis performed in the previous Section, we now turn to an empirical investigation on the accessibility of formal elderly-care in Europe. Chapter Two will focus on care-

utilization patterns, introducing informal-care in the analysis and exploiting the insights on accessibility discussed in this Chapter.

Section 1.3 highlighted that countries, although facing similar challenges in terms of growing pressure from the ageing process, are highly heterogeneous with respect to the actual definition of the population in "need-of-care"[66]. Colombo and Mercier (2012), Eleftheriades and Wittenberg (2013) and Glendinning and Moran (2009) suggest that this variability is, at least partly, the outcome of different cultural approaches traditions of different countries. Indeed different choices reflect also different policy and expenditure target. Hence, differences in regulation context between countries should be accounted for in applied analyses on elderly-care utilization, in order to provide valuable insight for the development of policy and practice. Indeed, formal-care utilization should not be treated as a fully discretionary decision made by the elder adult. Arguably, access to care is, to a substantial extent, affected by programmes regulations, through the distinction between eligible and non-eligible individuals. Indeed, diversity in legislations directly echoes on LTC accessibility.

The contribution of our work relies on the novel use of LTC eligibility information in the empirical analysis of formal home-care utilization. Since eligible and non-eligible individuals are likely to differ in terms of access to LTC benefits (in-cash or in-kind), the observed formal care utilization for eligible individuals does not provide information on the preferences of the non-eligible population. From an empirical perspective, this points to the necessity of analysing formal care utilization differentiated by the eligibility status.

1.4.1 Data

We use data from the first two waves of SHARE, which were collected through personal interviews in 2004 and 2006, respectively. The survey and its variables are described in paragraph 1.3.2.

SHARE adopts a definition of home care that is in line with the OECD definition (Colombo *et al.*, 2011). Formal home care includes three specific categories: (i) professional or paid nursing care; (ii) professional or paid home help; (iii) meals on wheels. We do not consider the category "professional or paid domestic help" included in the SHARE question because this type of care, usually labelled as "unskilled" (not supplied by qualified caregivers), is not likely to fall within the public LTC schemes offered by different countries. Indeed, personal and nursing care are the types of assistance covered by the eligibility status we introduced in the previous paragraph.

SHARE includes the ISCED-97[67] classification to measure the education level of respondents. Isced is categorized into 7 levels: Isced 0 (pre-primary schooling); Isced 1 (primary education); Isced 2 (lower secondary); Isced 3 (upper secondary); Isced 4 (post high school); Isced 5 (university); Isced 6 (postgraduate). We build dummies for three levels of education (low, medium and high), grouping together levels 0, 1, 2; levels 3, 4; and levels 5, 6, respectively.

Our sample selection includes respondents with at least 60 years old and at least one child[68]. We choose to exclude from our analysis individuals living with their children since SHARE does not include quantitative information about the assistance provided by any caregivers (spouse, children) from *within* the household, while it reports details on the

[66] Section 1.5 will describe the different national/regional approaches adopted to provide dependent adults with suitable LTC services in Europe.
[67] International Standard Classification of Education.
[68]

source and the amount of informal care received from *outside* the household (from children, relatives, friends and neighbours). It is therefore hard to distinguish the way and the type of transfers that take place within a family in terms of informal care, e.g., by children, which represent a substantial share of the total informal care. Moreover, since our study focuses on the utilization of formal home-care services, we exclude institutionalized individuals because the kinds of care that these patients need substantially differ from those of the elderly living at home (Kalwij *et al.*, 2014). We focus our attention on a subset of European countries (Austria, Germany, Belgium, France), whose public LTC regulations clearly identify a minimum level of need corresponding to a condition of "objective dependency" that entitles individuals to receive a public home-care service[69]. Although the Czech Republic and Spain's systems meet the previous requirement, they are excluded from the analysis because LTC reforms have been introduced after the SHARE data collection took place. Our final sample, after deleting records with missing values, includes 8901 observations.

Table 1-9 contains some descriptive statistics of the overall sample. About 8.1% of the population receives home-care, 79.9% of the sample is retired while 42.6 percent has a low level of education (primary or first stage of secondary studies). The mean age of the respondents is 70.2 years, and 54.8 percent of the sample includes women. About 15.8% of the sample reports to have at least one ADL, while 18.4% percent declares to have at least one iADL. On average, the respondents have 2.1 children.

Following the approach described in paragraph 1.3.3.1 (see also Section 1.5 and Appendix 1.7.3), we are able to implement eligibility rules on the SHARE data for a subset of countries (Austria, Germany, Belgium, France), with the aim of identifying two peculiar population subsets. The first is composed of those individuals who are in a condition of "objective dependence" according to their own countries regulations, and are therefore "eligible" to at least one public programme of formal care. The second is made of those respondents that are not in a condition of "objective dependence", and are labelled by the public LTC system as "non-eligible".

[69] See sections 2.1 and 3.1

Table 1-9, descriptive statistics on SHARE sample, wave 1 and wave 2

	Whole sample	Austria	Germany	France	Belgium Flanders	Belgium Wallonia
observations	8,901	1,307	2,601	2,334	1,822	837
Receiving formal personal/nursing care	8.1%	3.2%	2.1%	15%	9%	14.0%
Annual hours formal personal/nursing home-care	10.8	22	10.7	7	9.9	5.9
Age	70.2	70	69.5	71	70.3	70.6
Aged 80+	12.4%	11.8%	10%	15.7%	11.8%	13.5%
Females	54.8%	58.6%	51.4%	57.9%	53.2%	54.7%
Retired	79.9%	82.1%	79.2%	84.5%	74.6%	77.6%
Homemaker	13.1%	14.5%	9.7%	10.2%	18.9%	16.6%
Years of education	9.7	7.8	13	7.6	9.1	9.6
Number of children	2.1	2.1	2	2.2	2.2	2.2
At least 1 ADL lost	15.8%	14%	13.9%	16.5%	15.3%	24.2%
At least 1 iADL lost	18.4%	18.9%	15.1%	19.5%	17.9%	26.1%
At least 1 ADL & 1 iADL lost	9.2%	8.5%	8%	9.5%	9%	14.4%
At least 2 ADL lost	6.3%	5.3%	6.1%	6.3%	6%	8.7%
2+ chronic conditions (out of 14)	1.76	1.54	1.75	1.81	1.73	2.12
2+ mobility deficits (out of 10)	1.7	1.72	1.7	1.72	1.42	2.16
Orientation impaired	2.1%	1%	2.3%	3%	1.9%	1.4%
EURO-D score	2.2	1.9	1.9	2.8	2	2.7
Bad subjective health	37.4%	31.3%	43.7%	41%	28.8%	35.9%

Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 60, with children (no co-residence), not institutionalized.

Table 1-10 presents some summary statistics for the eligible and non-eligible subgroup of individuals. The eligibility status is exogenously determined on the basis of the rules adopted by LTC regulations. The variable is dichotomous, and it takes value 1 if the individual fulfils the minimum requirements of at least one LTC programme implemented in her region/country of residency (i.e., she is *eligible* to LTC home-care services) and 0 otherwise.

We compare the eligible population to the whole sample, to the population of individuals with some functional limitations (*at least* one ADL, iADL) and to the sample of non-eligible elderly. A comparison between the second and the other columns shows how the eligibility status detects a peculiar subsample of the population and does not correspond to an arbitrary selection of "dependent" individuals. Indeed, the characteristics of the sample of eligible individuals, built according to country- or region- specific regulations, is notably different from the one that adopts an arbitrary (and fixed-for-all) definition of dependency based on the number of functional limitations (third column).

Table 1-10, summary Statistics, eligible population

	Eligible	Individuals with 1+ ADL, 1+ iADL	Whole sample	Non-eligible
Observations	658	2232	8901	8243
% individuals receiving:				
formal-care	37.3%	19.8%	8.1%	5.9%
informal care from any provider	38.5%	32.5%	17.6%	16.1%
informal care from children	32.7%	25.9%	13%	11.6%
Average annual hours of:				
formal care	120	40.1	10.9	2.9
informal care	409	206	81	57.4
informal care from children	322	160	60.3	41.4
formal care (among receivers)	314	202	134	49.3
informal care from any provider (among receivers)	1059	634	459	356
informal care from children (among receivers)	998	619	462	355
Age	76.8	74	70.2	69.7
Number of ADL lost	2.5	1.1	0.29	0.12
Number of iADL lost	2.8	1.5	0.38	0.20
EURO-D score	4.1	3.56	2.2	2.12
Orientation impaired	25.7%	5.02%	2.1%	0.46%

Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 64, with children (up to 4; no co-residence), not institutionalized.

About 38% percent of eligible individuals receives formal home-care services, and the 63% percent of the sample is female. The mean age is 76.8. Formal-care users are nearly 39% among eligible individuals, while their percentages were 8.1% in the whole sample and 19.8% in the sample of minimum functionally impaired (at least 1 ADL, 1 iADL). Moreover, in the eligible population, the incidence of informal-care provision (from outside the household by children, relatives, friends and neighbours) is substantially close than the formal-care's (38% vs 37%), while it is substantially higher in the other samples (e.g., 17.6% versus 8.1% in the whole sample). This highlights the increasing relative importance of professional (skilled) assistance services as long as the patient's conditions start to constitute an objective vulnerability-risk. When looking at the intensive margin of elderly-care utilization, the eligible sample receive considerably larger amounts of hours-of assistance, both informal and formal. Again, the ratio between the mean annual amounts of informal- and formal-care narrows down among objectively vulnerable elderlies (1059 hours vs 314 hours), with respect to the other benchmark samples. Indeed, this ratio is maximum among the non-eligible (356 hours of informal care, 49 hours of formal-care). Finally, the eligible population is characterized by a much higher incidence of cognitive impairments and depression symptoms.

1.4.2 Empirical model

Our empirical model is designed to analyse the determinants of formal care by splitting the sample into two different subpopulations: eligible and non-eligible individuals. In order to do that, we separately estimate two probit models conditioning on the eligibility status of the respondents. As mentioned in the previous paragraph, the dependent

variable predicting the probability of using formal home-care is a dichotomous variable that assumes value 1 if respondents receive (during the twelve months preceding the interview) professional or paid nursing/personal care.

In line with the prevailing literature, the demand for formal care is assumed to rely on various socio-demographic, health-related and economic factors (Balia & Brau, 2013; Bolin *et al.*, 2008; Bonsang, 2009; Kalwij *et al.*, 2014; Stabile *et al.*, 2006; Van Houtven & Norton, 2004). Specifically, we include a set of socio-demographic variables: gender, age, education, household composition (whether the parent lives with someone or not) and the three education categories previously described (excluding the *high* category). Education can play a crucial role not only in the health promotion and disease, but also in helping vulnerable individuals to access to specific health-care programmes. It is known in literature that more advanced literacy skills (along with cognitive and social skills) can help elderly to improve the management of health-related materials, to extract information and derive meaning from different forms of communication, and to apply these information to make health-related decisions and, consequently, to access to health-care services (Nutbeam, D, 2008; Parker *et al.*, 2003). In other words, more educated individuals are more likely to understand the complicated bureaucracy to navigate the intricate LTC settings, and could easily overcome structural barriers to access to health-care programmes.

We consider several measures of the health status of respondents. Specifically, we have included a set of dummies related to chronic diseases, functioning limitations (mobility), long-term illnesses, limitations with the Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) and cognitive ability of the respondents.

Among health variables we include dummies for chronic diseases (heart problems, high blood pressure, high cholesterol, stroke, diabetes, lung disease, asthma, arthritis, osteoporosis, cancer, ulcer, Parkinson disease, cataracts, hip or femoral fracture, psychological problems), a dummy for the presence of long-term illnesses (taking value 1 if the respondent reports to suffer from some long-term illness, including mental health problems), the presence of mobility limitations, the number of limitations in ADL as well as in iADL.[70] Cognitive impairments, which are often considered the assessments-of-need for LTC, and limitations in daily living activities (ADL and IADL) are likely to be correlated but involve separate domains of functioning (Wiener *et al.*, 1990). In other words, not all individuals with substantial cognitive impairment have ADL or IADL disabilities. Consistently with this, we include in our analysis two measures of cognitive ability: the first is a dummy variable assessing mathematical skills of elderly respondents (numeracy), and the second a binary indicator measuring the loss of orientation in space and time.

Then, we consider a binary variable that captures the self-perceived health of individuals. It assigns value 1 if the respondent reports a bad self-perceived health status ("fair", or "poor"), measured on a five-point scale from "excellent" (score 5) to "poor" (score 1). The use of self-perceived health status (SPHS) is supported by evidence that shows a strong predictive relationship between people's self-rating of health and morbidity (Idler and Benyamini, 1997; Kennedy et al., 1998). In order to account for behavioural and potential depression conditions, we introduce a continuous variable based on EURO-D scale.

In addition to the health-related variables, we introduce two variables as proxies of the degree of involvement in the public sphere of the elderly respondents. The first is "sociability", and indicates the number of social activities in which respondents had been involved during the month preceding the interview. Such activities include volunteer and charity

[70] Definitions of ADL and iADL are provided in Appendix 1.7.1.

work; active membership in a church, sports, or social club; or political environment (Kalwij *et al.*, 2014). The second is "seen the dentist", and refers to the number of contact with the dentist during the twelve months prior to the interview. Finally, our model also includes a set of dummies related to the country-specific wealth quintile (including housing wealth) and household income quintile.

Informal care

As previously highlighted, many factors might effectively contribute to the use (or foregone use) of formal care services. For instance, the role of informal care as a substitute for formal care could discourage dependent individuals from asking for institutional services. In order to investigate the determinants of formal care for both the two sub-populations (eligible and non-eligible), we have to take into account for the potential endogeneity of informal care. Following (Bonsang, 2009), we assume that informal care given by respondents' offspring is substantially determined by children characteristics that are independent of the probability to receive formal care. Therefore, we estimate a reduced form model for the demand of formal-care by introducing a variable (proportion of daughters) on the gender composition of children as proxy for informal care.

Probit Model specification

The specification of the two probit models builds on a reduced-form equation determining the receipt of formal home-care. Thus, we have

$$FH_{ij} = f_j(H_i, I_i, X_i, C_i, e_{ij})$$

Where FH_{ij} is a binary variable that indicates if respondent *i* in the sub-population j is receiving formal home-care; H_i is a vector of health-related characteristics, I_i includes a proxy for informal care (fraction of daughters), X_i is a vector of socio-demographics characteristics, C_i denotes the country and e_{ij} is the error term[71]. The country dummies are included in order to capture some of the unobserved factors at the country level that might affect the use of formal home-care services. The subscript *i* represents the individual and the *j*=1, 2 the two subgroups of individuals (eligible and non-eligible) analysed in the paper.

1.4.3 Results and discussion

Table 1-11 reports the estimates for formal home-care use by eligible, non-eligible and overall population.

[71] In both the regressions, standard errors are computing using a cluster structure at the individual level.

Table 1-11, determinants of formal home-care use, by eligible/non-eligible population

Dependent variable: formal personal care utilization (dummy)	(1) Eligible population			(2) Non-eligible population			(3) Whole population		
	marginal coefficient		st. error	marginal coefficient		st. error	marginal coefficient		st. error
Age	0.017	***	0.004	0.001	***	0.000	0.001	***	0.000
Retired	0.049		0.061	0.011	**	0.005	0.011	**	0.005
Female	0.063		0.054	0.003		0.005	0.005		0.004
Living with spouse/partner	-0.113	**	0.054	-0.011	**	0.005	-0.015	***	0.004
Education (w.r.to high)									
low education	-0.195	**	0.090	-0.003		0.006	-0.008		0.005
Medium education	-0.128		0.089	0.010	*	0.006	0.007		0.005
Fraction of daughters	-0.117		0.090	0.003		0.005	-0.002		0.005
Sociability	-0.042		0.043	-0.003		0.002	-0.004	*	0.002
Seen dentist	0.001		0.012	0.002	**	0.001	0.002	**	0.001
Long-term illness	0.060		0.074	0.010	**	0.004	0.010	**	0.004
EURO-D scale	0.002		0.009	0.003	***	0.001	0.003	***	0.001
Numeracy	-0.013		0.049	-0.001		0.004	0.000		0.004
Orientation	0.000		0.067	0.019		0.039	-0.002		0.011
Mobility	0.174	*	0.079	0.008	*	0.004	0.010	**	0.004
# ADL	0.052	***	0.016	0.014	***	0.004	0.014	***	0.002
# iADL	0.011		0.014	0.012	***	0.002	0.008	***	0.001
Self-perceived health	0.231	***	0.065	0.015	***	0.004	0.019	***	0.004
Chronic conditions									
Heart attack	0.082	*	0.049	0.004		0.005	0.007		0.004
Hypertension	-0.124	*	0.047	0.006		0.004	0.001		0.004
Cholesterol	-0.001		0.055	-0.007	*	0.004	-0.007	*	0.004
Stroke	-0.011		0.062	0.004		0.009	0.002		0.008
Diabetes	0.132	**	0.056	0.010	*	0.006	0.014	**	0.005
Lung disease	0.078		0.069	-0.002		0.007	0.002		0.006
Asthma	0.080		0.093	0.010		0.008	0.011		0.008
Arthritis	-0.071		0.048	0.006		0.004	0.003		0.004
Osteoporosis	-0.031		0.061	0.000		0.006	-0.001		0.006
Cancer	-0.029		0.073	0.028	***	0.007	0.025	***	0.006
Stomach ulcer	0.128		0.074	0.008		0.007	0.013	**	0.007
Parkinson disease	-0.037		0.099	-0.047		0.032	-0.016		0.015
Cataracts	0.038		0.060	-0.007		0.006	-0.003		0.006
Fracture	0.042		0.073	0.020	**	0.010	0.020	**	0.008
Location (w.r. to rural)									
Big City	0.010		0.085	-0.006		0.008	-0.007		0.007
Suburbs	-0.078		0.079	0.002		0.006	0.000		0.006
Large town	-0.055		0.070	-0.007		0.007	-0.010		0.006
Small town	-0.153		0.061	0.007		0.005	0.002		0.005
Observations	658			8243			8901		

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home.
Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.
Standard errors are robust to heteroskedasticity and clustered at the individual level.
Education levels are categorization of ISCED codes: low (ISCED 0,1,2), medium (ISCED 3,4), high (ISCED 5,6).

Let us start by summarizing findings from specification (3), which reports the estimated coefficients for the whole sample (eligible and non-eligible). Overall results follow economic intuition. A positive effect of age and of being retired is found on the probability of receiving home-care, while we do not observe any relevant effect for education, nor for income and wealth (not shown, available upon request). Single-living respondents are more likely to receive formal home-care services compared to married or cohabiting individuals. This finding confirms the importance of spousal support in the long-term care. With regards to health status variables, suffering from some functioning limitations or chronic diseases significantly increase the probability of using formal care, as do the limitations in ADL and iADL and the subjective perception of a bad health. Finally, our findings show that having regular contacts with the dentist (during the twelve months prior to the interview) increases the probability of receiving formal home-care, and we'll comment this effect in few lines.

The first two columns of Table 1-11 report the results for the eligible and non-eligible subgroups, respectively. Age and spousal support are significant positive predictors for both populations, while being retired positively affects the probability of receiving home care only for the non-eligible sample, due to the higher average age of the eligible individuals. As regards income and wealth quintiles, their coefficients are not significant in both models (not shown).

Among the socio-demographic variables, an important result is found on education. Among eligible individuals, having a low education significantly decrease the probability to receive home care, and the coefficient has one of the highest magnitudes among the significant predictors of care utilization in eligible population. Conversely, no clear pattern can be identified for non-eligible respondents (nor for the whole sample). The dummy for medium education has also a negative sign in specification (1), though its significance is slightly above the 10% level (the p-value is 0.15). These findings provide evidence for an accessibility issue that would be hard to identify without information on eligibility status. Higher levels of education significantly matter in navigating the intricate LTC settings, understanding the complicated bureaucracy and the associated technical jargon in order to access to formal home-care services.[72] This effect can be related to the health literacy concept, which refers to the degree of familiarity with health-related terminology and notions (Nutbeam, D, 2008; Weiss, 2007). According to the WHO definition (reported in Nutbeam, Don (1998)), "health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health". Education is one of the crucial determinants of health literacy (see, e.g., Sun *et al.* (2013)). Highly educated individuals are more likely to apply literacy skills to health tasks, improving decision making related to health issues in a highly bureaucratic and complicated health-care maze. Being in a condition of objective dependency is not sufficient for receiving assistance: the unavoidable (so far) hurdle of interacting with regulations and formal institutions appears to increase the inequality of access for the low educated. In terms of policy implications, this remarks the importance of accounting for elderly health- and bureaucratic literacy levels in order to enhance the access to formal home-care programmes. Otherwise, the risk would be to misinterpret low-educated eligible individuals who do not get care as "non-compliants" when they just do not have enough competences to interact with the regulations implemented in their own nation or region.

[72] Including a single continuous variable for years of education, in spite of the three binary variables, confirms this result: year of education have a positive and statistically significant effect on the probability of receiving formal home-care (**coefficient xx**) for the eligible population, while the significance vanishes for the other sub-group.

Objective and generic vulnerability outcomes like mobility and ADL are still significant (with a positive sign) for eligible individuals. This, again, shows that discretionality of access to care still holds even when individuals' conditions are "officially" labelled as at risk of vulnerability, as does the positive coefficient of the bad-perceived health. Indeed, the latter is by far one of the most important predictors of receiving formal care (together with education) when we focus on the eligible subsample. Health variables' coefficients for non-eligible adults contribute to explain why we observe that individuals who are not in an "officially" vulnerable condition (maybe even without any functional limitation) still receive some formal care. First, when objective limitations are present (e.g., ADL, iADL, mobility), the individual can look for minor community-level/regional programmes (whose regulations are not included in our eligibility variable) that can provide her with some LTC benefit, or she can just decide to buy formal care on the private market. Second, when specific pathologies are detected (depression symptoms; chronic diseases that require home-assistance like diabetes, cancer or fractures; long-term illnesses), some peculiar public health/social programmes could come into play, which do not fall within the category of LTC services and provide a sort of domiciliary assistance; alternatively, individuals could by specific professional assistance from private providers. Nevertheless, Table 1-10 highlighted how the observed formal-care utilization among non-eligible receivers is quite low (less than 50 hours per year).

Results also indicate that non-eligible individuals who had contact with the dentist during the twelve months before the interview are more likely to receive home care. On one hand, regular contact with the dentist could help the elderly to create social "health" networks (e.g. interaction with medical professionals) and to find out how to navigate the complicated LTC delivery systems (public and private), often characterized by numerous layers of bureaucracy. On the other hand, it might be that individuals who have regular contact with a health specialist (such as the dentist) might well be more concerned about their health, or better cared for by their family and therefore more careful about the decisions they make regarding health and access to home-care programmes.

1.5 NEED-ASSESSMENT AND ELIGIBILITY FRAMEWORKS FOR LTC IN EUROPE

This last section offers details on eleven major programmes of home-based care for the Elderly in Europe. The countries covered are Austria, Belgium, Czech Republic, France, Germany, Spain and Italian regions such as Friuli – Venezia Giulia and Toscana (see paragraph 1.2.1 for a preliminary classification and Section 1.3 for an overall comparison).

1.5.1 Austrian *Pflegegeld*

Austrian regulations over long-term-care programmes do not provide a direct medical definition of *vulnerability*. Yet, the profile of a person in need corresponds to "an individual who needs frequent help from others in tasks that primarily affect their personal lives, and who would be seriously exposed in everyday life without that support".[73]

Eligibility for the Austrian's major cash-benefit programme (*Pflegegeld*) is based on individual requirements of care and its assessment-of-need follows a uniform federal set of guidelines defined by the Regulations on the Classification of the need-of-care (*Einstufungsverordnung*[74]) related to the Federal Long-term-care Act (*Bundes-pflegegeld-gesetzes*[75]). Austrian

[73] BGBl. (Bundesgesetzblatt) Nr. 110/1993, BGBl. II Nr. 37/1999
[74] BGBl. (Bundesgesetzblatt) II Nr. 37/1999
[75] BGBl. (Bundesgesetzblatt) Nr. 110/1993

citizens can be granted the allowance upon a legal entitlement, a LTC insurance, regardless of their income or age and of what caused their limitations in the first place. They have also a high degree of freedom in the usage of the benefit, which is tax-free, for financing their long-term-care services, although the allowance can be converted into an in-kind benefit in case of improper use of the money.[76]

The assessment-of-need covers a wide number of potential functioning limitations (ADL and iADL), together with a specific formalization of a potential need-of-care for post-surgery conditions or complex auto-medication. What is peculiar to this vulnerability assessment is that each limitation is converted in a specific amount of time, measured in hours per month. Each benchmark is, indeed, the minimum amount of care that - the law assumes - should be needed by a patient suffering from that deficit. The following table lists the dimensions of vulnerability together with their respective minimum amount-of-care:

Table 1-12, Austrian Pflegegeld assessment-of-need

Limitation	*Need-of-care (hours/month)*
Daily Body Care	25
preparation of meals	30
taking meals	30
defecation	30
dressing and undressing	20
Cleaning for incontinence sufferers	20
colostomy care	7.5
Care cannula tube care	5
Catheter Care	5
Enemas	15
taking medication	3
Mobility aid in the narrow sense	15
Motivational talks	10
Emptying and cleaning the toilet chair	10
procuring of food and medicines	10
cleaning the home and personal effects	10
Care of underwear and towels	10
heating of the living space including procuring of fuel	10
mobility aid in a broader sense	10
mental disorders	25*

Gesamte Rechtsvorschrift für Einstufungsverordnung zum Bundespflegegeldgesetz, BGBl. II Nr. 37/1999, BGBl. II Nr. 453/2011
**Since January 1st, 2009* [77]

Few points are worth stressing, with respect to the *Pflegegeld* assessment-of-need.

- A first inspection of the table suggests that vulnerability is depicted in quite a number of tasks, which are mainly divided in two groups: *core* and *auxiliary* activities (*Betreuungs-Maßnahmen* and *Hilfs-Verrichtungen*).
- The first category coincides partially with the Katz's Activities of Daily Living, which are all individually assessed in the screening. The tasks related to *going to the toilet* and *eating* have a benchmark time of care of 30 hours per month each (1 hour per day), as it is for the *meals preparation* activity (which belongs to the iADL list by Lawton). *Daily body care* is supposed to take 25 hours per month (two times a day, 25 minutes each) while *dressing and undressing*'s time is estimated in 20 hours per month (two times a day, 20 minutes each). If an individual suffers from incontinence, additional time is allotted (20 hours a month,

[76] MISSOC (2014)
[77] BMASK (2013a)

four times a day with 10 minutes each) for performing hygiene tasks. As for the *mobility* task, the Austrian Regulation includes the assessment of the need for *in-house mobility* help, encompassing both the *Transferring* task from the Katz's ADL (moving in and out of bed or chair unassisted) and the broader activity of moving inside one's own house or apartment. *Taking medications* (one of Lawton's iADL) is included as a core activity and requires 3 hours per month (6 minutes per day). It refers to the ability to properly prepare and self-administer medications, injections and inhalations, including the task of remembering the intake schedule. The last four tasks included in the screening are much more specific than the ones listed before, and relates to specific medications or procedures, and to a population who had undergone specific medical surgery. These tasks involve activities such as self-administered enemas (15 hours per month, 30 minutes per day), care and maintenance of a tracheal cannula, a gastric tube (5 hours per month, 10 minutes per day), a catheter (5 hours per month, 10 minutes per day) or an artificial anus (7.5 hours per month, 15 minutes per day).

- Alongside the core activities the screening comprises seven *auxiliary* tasks, which mainly refer to the Lawton's Instrumental ADLs such as house-works (*cleaning the household*, *doing laundry* and *heating the living space*), *shopping for groceries or medicines* and *moving outside the house*. An additional dimension is comprised to account for the potential difficulties of those who use a toilet chair, and assigns 10 hours-of-care per month for those unable to empty and clean their chair. A last task, *motivational talks*, which targets those with mental or spiritual (sic) limitations who need help in planning their daily activities in order to live an active and independent living, can account for 10 hours per month.
- Since January 1st, 2009, people with mental illnesses, dementia or severe behavioural disorders are allocated a fixed supplementary amount of care-time in terms of 25 hours per month.[78]
- As a last note, the assessment-of-need described above builds a *weighted* measure of vulnerability, since each dimension that concurs in defining the dependency-status is weighted throughout the amount of hours-of-need requested for that specific limitation. This results, as an example, in a difficulty related to nutrition (*taking meals,* 30 hours per month) having a double weight with respect to *mobility limitations* (15 hours per month) in defining vulnerability. In this perspective, from the list of activities shown above it is easy to see how the *core-activities* are generally weighted more than the *auxiliary* ones, highlighting the conviction, by the geriatricians and policy makers who generated this assessment method, that ADLs play a much higher role than iADLs in making an individual vulnerable.

The care allowance is provided to individuals who present a decline in functional status that require at least 60 hours of need-of-care per month and is expected to last for at least 6 months due to a physical, mental or emotional disability or sensory impairment in *at least one* core activity and *at least one* auxiliary activity.[79]

The cash-benefit is paid monthly, for twelve months a year, and its amount depends on the patient's level of need. Nevertheless, the allowance is paid directly to the person in need, without any obligation to pay for care or to use care services (OECD Health Statistics 2014). Although the minimum amount of need is 60 hours per month (out of a maximum of 275.5), which allows for a monthly benefit of €154,20, vulnerable elderlies are offered higher benefits as long as their demand-of-care grows, up to a maximum of € 1.655,80. Indeed, seven levels of eligibility are defined by law, as summarized in the following table.

Table 1-13, Austrian Pflegegeld eligibility rules

Level	*Need-of-care per month for at least one core and one auxiliary task*	*Allowance € per month (2013)*
I	at least 60h (50h before 01/2011)	€ 154,20
II	at least 85 h (75h before 01/2011)	€ 284,30
III	at least 120 h	€ 442,90
IV	at least 160 h	€ 664,30
V	at least 180 h of care needed per month, if an unusual need for LTC is required.	€ 902,30

[78] BMASK (2013a)
[79] BMASK (2013a)

VI	at least 180 h of care needed per month, if (1) care measures are required, which cannot be coordinated in terms of time and these are provided on a regular basis during day and night or (2) the continuous presence of a care giver is required during day and night, because it is probable that there is a danger for the care recipient of for other persons.	€ 1.242,00
VII	at least 180 h of care needed per month, if (1) it is not possible for the four extremities to move intentionally or (2) a similar situation occurs.	€ 1.655,80

Updated from Riedel and Kraus (2010) and BMASK (2013b).

In order to be granted the cash benefit, an application must be submitted to the competent social insurance institution, i.e., the one that pays the pension or annuity to the patient (*Pensionsversicherungs-Anstalt, die Versicherungsanstalt öffentlich Bediensteter, die Sozialversicherungsanstalt der Bauern*). Those who get no pension should submit the application to the Pension Insurance Institute. After the application is filed, an appointment is scheduled for an in-house assessment-of-need[80], which is usually performed by a doctor and a nurse-specialist together with the elderly patient and a trusted third person, who might cooperate in giving information about the type of care needed. When needed, other professionals from different fields (Social Service, Psychology, Psychotherapy) can be involved in the evaluation. Basing on the medical examination a decision is taken, by the insurance institution, about the degree of vulnerability of the applicant and therefore his eligibility level. In case of positive decision, the allowance is paid retroactively starting from the month in which the application has been submitted. If the patient does not agree with the decision, either because he has been excluded from the care allowance or because he believes he belongs to a higher dependency level, he can appeal against it to the Labour and Social Court.

1.5.2 The Belgian home nursing-care (INAMI/RIZIV)

Home nursing care in Belgium is, to various extents, reimbursed by the National Institute for Sickness and Disability Insurance (*Institut National d'Assurance Maladie-Invalidité/Rijksinstituut voor Zieke en Invaliditeitsverzekering* - INAMI/RIZIV), who is responsible for the general organization and financial management of the federal compulsory public health insurance.[81] [82] As described in Sermeus *et al.* (2010), "its most important tasks are to prepare and implement legislation and regulation, to prepare the budget, to monitor the evolution of health care spending, to control whether legislation and regulation are correctly implemented by health care providers and sickness funds and to organise the consultation between the different actors involved in the compulsory health insurance".

Benefits in-kind, i.e., formal home nursing-care, are provided irrespectively of patients' age or income but accordingly to their vulnerability conditions. The degree of reimbursement and the method of payment (fee-for-service or lump-sum payment) depend indeed on the applicant's degree of dependency. As a tool for the assessment-of-need, NIHDI adopted an ADL scale[83], slightly adapted from Katz *et al.* (1970), which includes six items on functioning and two on mental coherence and orientation. Patient's dependency or need-of-care for each item is scored on a four-step scale

[80] See also the Formular 703-25 "Determination of care requirement in addition to the medical opinion" in "Gutachterfibel-Bundespflegegeld (2009), Pensionsversicherungsanstalt (Pension Insurance Fund), available on-line. See also the Formular 703-25 "Determination of care requirement in addition to the medical opinion" in the Pension Insurance Fund report Pensionsversicherungsanstalt (2009) available on-line (in German).

[81] (Compulsory Health Insurance Law, *Loi relative à l'assurance obligatoire soins de santé et indemnités*, 14 July 1994, M.B/B.S. 27/08/1994)

[82] A comprehensive review on the Institutions that regulate LTC in Belgium is Willemé (2010)

[83] This evaluation scale is labelled as BESADL (Belgian Evaluation scale for ADL) in Sermeus *et al.* (2010)

for each item (from 1 to 4), where 0 corresponds to full-autonomy and 4 corresponds to impossibility to perform the specific task. Dependency-status on a single item arises when the need-of-care is either severe (3) or full (4).

Table 1-14, Belgian assessment-of-need for home nursing-care

Criteria	*Score 1*	*Score 2*	*Score 3*	*Score 4*
Washing	Able to wash him/herself without help	Needs assistance in washing above or below the waist	Needs assistance in washing above and below waist	Must be fully supported in washing
Dressing	Able to dress and undress without help	Needs assistance to dress above or below the waist (excluding laces)	Needs assistance to dress above and below the waist	Must be fully supported in dressing above and below the waist
Moving and transferring	Autonomous in moving and transferring without help or appliances	Autonomous in moving and transferring, using appliances	Need help for at least one move or transfer	Bedridden or in wheelchair, fully dependent to move and transfer
Using the toilet	Able to use the toilet, including (un)dressing and cleaning, without help	Needs help for one among: going to the toilet, dressing, cleaning	Needs help for two among : going to the toilet, dressing, cleaning	Needs help in going to the toilet, dressing and cleaning
Continence	Able to retain urine and stool	Accidentally incontinent for urine or stool*	Incontinent for urine or stool	Incontinent for urine and stool
Eating	Able to eat and drink independently	Needs help before eating or drinking	Needs some assistance while eating or drinking	Totally dependent for eating or drinking
Orientation in time	No limitations	Seldom problems	Frequent problems	Completely disoriented
Orientation in space	No limitations	Seldom problems	Frequent problems	Completely disoriented

* (including patients with urinary catheter or artificial anus)

Three main categories of dependency are established by the NIHDI. The minimum level of vulnerability (category A) in order to be eligible corresponds to limitations in washing *and/or* dressing *or* to being disoriented in time and space (but physically independent) as summarized in the following table:[84]

Table 1-15, Belgian eligibility rules for home nursing-care

Category	*Physical dependence*		*Mental dependence*
O	No dependence	AND	No dependence
A	Dependent in washing and dressing	OR	Disoriented in time and space (but physically independent)
B	Dependent in washing and dressing, AND dependent for moving and/or going to the toilet	OR	Disoriented in time and space, AND dependent in washing and/or dressing
C	Dependent in washing and dressing, AND dependent for moving and going to the toilet AND dependent for incontinence and/or eating	AND	No dependence
Cdement	As in category C	AND	Disoriented in time and space

As detailed in Sermeus *et al.* (2010), low dependent patients (category A) are reimbursed through fee-for-service related payments. With exception of hygienic nursing care, a doctor's prescription is required for reimbursement of all nursing

[84] Sermeus *et al.* (2010), Van den Bosch *et al.* (2011)

interventions in the fee-for-service payment system. Patients with Category B or C/Cdement are reimbursed through per diem lump sums, a type of fee-for-service payment system based on the number of days of care. A doctor's prescription is not required for reimbursement of nursing care delivery under the lump sum system, except for technical interventions under fee-for-service such as injections, wound care, bladder care, gastro-intestinal care, specific technical nursing interventions). Additional per diem lump sums apply to palliative care and diabetic patient.

1.5.3 The Belgian APA

The **Belgian** main LTC cash benefit, the Assistance to Elderly People (APA: *Aide à la Personne âgée*), allows eligible dependent individuals to benefit from an allowance whose amount is primarily based on a vulnerability-evaluation[85]. Besides the applicant's health-status, eligibility is based on a series of socio-demographic criteria including age, marital status and family composition. Moreover, the programme is means-tested since household income is taken into account in determining the monetary amount of the benefit. Since July 1st 2014, as a result of the sixth State Reform in 2011, the competences related to the APA are transferred from the federal level to the regional level. The Federal Public Service of Belgian Social Security, however, still holds responsibilities for submitted applications until the end of 2015.[86]

The assessment process is performed through a scale (APA scale) which depicts vulnerability as determined by six items that are briefly described in the following table:

Table 1-16, Belgian's APA assessment-of-need

task	*Definition*	*Evaluation*
Moving	Moving and transferring around the house	0 points: no difficulties 1 point: light difficulties 2 points: important difficulties 3 points: impossibility without help from others
Nutrition	Preparing meals and ingesting food	
Bathing and dressing	Performing body-care and being able to dress	
House-holding	Taking care of own house and performing house-tasks	
Communication	Being able to have contacts with others	
Need of supervision	Being able to assess and avoid dangerous situations	

Each item is evaluated on a scale from 0 (no difficulties in performing the selected item) to 3 (impossibility in performing the selected item without help from others), and the overall profile of vulnerability is constructed by summing each item' scores. The highest level of dependency is therefore represented by a score of 18. The minimum level of vulnerability corresponds to a score of 7 in the APA scale: all the applicants who get an overall index of less than 7 are not eligible to the monetary allowance.

Additional socio-economic criteria must be fulfilled in order to be granted the benefit. As for the demographic characteristics, an individual must be at least 65 years old and being of Belgian nationality or a foreign resident to apply for the program. Furthermore, the allowance is differentiated in 5 categories which depend on the patient's health-status: scores 7 and 8 give entitlement to category allowance 1, scores 9 and 11 to category allowance 2, scores 12 and 14 to category 3, scores 15 - 16 to category 4, while a score higher than 16 corresponds to category allowance 5. The

[85] The Allocation pour l'aide aux personnes âgées (Tegemoetkoming voor hulp aan bejaarden) is regulated by the Royal Decree of 5 March 1990, M.B./B.S. 05/04/90

[86] See the webpage of the FPS Social Security (*Service public federal Sécurité sociale*), "L'allocation pour l'aide aux personnes âgées", available on-line at http://handicap.fgov.be/fr/allocations/allocation-pour-laide-aux-personnes-agees .

cash-benefits in Euro vary from € 981.68 per year (category 1) to € 6,589.77 per year (category 5), and are inflation-indexed.

After determining a patient's vulnerability category, a means-test is performed on her household's income in order to determine the actual monetary amount that will be granted by the APA programme. The income-test takes into account the household composition and the marital status of the applicant. No allowance-reduction is applied to those who live alone or with other family members and have zero income or anyway an annual income lower than € 12,672.36. Similarly, for those who live with a partner who is not part of the family, no reductions will be applied up to an overall yearly income ceiling (of the applicant and his/her partner) of € 15,835.19. The following table provides the maximum amounts (no reductions) corresponding to each category:[87]

Table 1-17, Belgian APA eligibility rules

Category	*Maximum allocation amount in € (2013) (inflation-indexed)*	
	Per year	Per month
Category 1 (7 - 8 points)	981,68	81,81
Category 2 (9 - 11 points)	3.747,30	312,28
Category 3 (12 - 14 points)	4.556,11	379,68
Category 4 (15 - 16 points)	5.364,69	447,06
Category 5 (17 - 18 points)	6.589,77	549,15
Age requirement: 65 or older		

The means-test takes into account the income of the applicant and her/his partner. The law specifies which sources of income are included in (or excluded from) the test. As an example, the means-test includes pensions, real estates, savings and financial assets.

The assessment process follows several steps. A preliminary application must be submitted in the city-hall, in order to start the bureaucratic procedures. A series of forms must then be filled in by the applicant and his/her family doctor, with personal data and a brief self-evaluation of applicant's own dependency status. After returning these files to the Federal Social Services Department, an appointment with a doctor will be scheduled (the appointed can be arranged at the patient's home, would he be unable to move outside) and the official evaluation of the vulnerability condition will take place. The assessment will formalize the extent to which patient's limitations affect his/her ability to conduct the usual daily activities of an independent life, and whether these limitations are permanent or are subjected to evolve (worsening or improving) in the future. Should the latter be true, a new assessment in the forthcoming months will be scheduled in order to keep track of the patient's conditions and, if needed, to make the necessary modifications to his/her eligible status with respect to the APA benefit. Basing on the medical evaluation, a final decision about the applicant's eligibility will be taken by the Service Department. Should the patient not agree with the outcome of the assessment, she/he can appeal to the Labour Court (*Arbeidsrechtbank / Tribunal du travail*) no more than three months after the decision has been notified.

The APA scale presents several peculiarities that are worth stressing:

[87] See the webpage of the FPS Social Security at http://handicap.fgov.be/fr/allocations/allocation-pour-laide-aux-personnes-agees

- It is a relatively short scale (6 items), and yet it encompasses much more than 6 functional limitations, since there are items which aggregate pairs of activities and even mixtures of ADLs and iADLs. The "moving" item comprises both the "moving around the house" and the "transferring" tasks, while there is a single domain "bathing and dressing" which considers together the ability of performing body-care and of dressing/undressing. The "nutrition" item evaluates both the patient's ability to prepare a meal (which is an iADL) and the ability to ingest and cutting up the food (which is an ADL).[88] Other iADL-related tasks are included in the assessment: ability to perform house-tasks and ability to entertain contacts with others.[89] The last component of the APA scale is quite wide and generically-defined, since it involves the "ability to recognize and avoid dangers". The latter is an ability that involves both cognitive and mental limitations (being able to recognize the presence or the potential occurrence of a danger) together with physical limitations (ability to recognize a danger, i.e., ability to see or hear the preliminary stages of a dangerous situation, or ability to avoid a danger, i.e., ability to move away from a location or ability to perform proper self-medications). Other ADL limitations, as incontinence or ability to use the toilet, are not explicitly considered, although the latter could be partially spotted in the "moving" and in the "bathing and dressing" items. Numerous other iADLs are not included in the APA evaluation of vulnerability, like shopping for groceries, performing self-medications, moving outside own house, handle finances.
- Each item is perfectly substitutable to the others in contributing to the vulnerability index, and each one has the same weight (i.e., no item-specific weights are specified, the overall score is just the sum of each item' score). It is much more difficult to derive the weights of the single ADL/iADL tasks considered in the APA scale, since they are often mixed together in a unique item.
- Finally, as already mentioned, the evaluation of the limitation-degree for a single item is multivariate, and spans from a minimum score of 0 (no limitation is present) to 3 (impossibility to perform the activities described in the item), and therefore allows the evaluator with higher precision with respect to those assessment-tools which just ask for a bivariate evaluation (0/1).

1.5.4 Belgian Flemish *Zorgverzekering*

The Belgian **Flemish** region provides its vulnerable elderly with a care-allowance that is part of a separate LTC insurance scheme (*Zorgverzekering* / Care Insurance)[90] with respect to the nationwide APA and the home-care programme, discussed in Sections 1.5.3 and 1.5.2. Vulnerability is assessed on a detailed evaluation scale (BEL scale BEL-profielschaal) that assigns a dependency-score to each patient. Eligibility is limited to Flemish and Brussels-Capital citizens, it is not age- or income-related but it requires that the minimum BEL-scale score be higher than a fixed threshold (35 points). The cash benefit has a fixed amount of €130, irrespective of the patient's need-of-care.

The BEL-scale (*BEL-foto*) identifies 27 vulnerability outcomes to be assessed, split in four domains, namely *household-related activities*, *physical activities*, *social-related activities* and *mental-health issues*. Each of the 27 tasks has to be evaluated on a four-step scale (from 0 to 3), where 0 corresponds to full-autonomy and 3 corresponds to impossibility to perform the specific activity. The sum of each task' score provides the patient's dependency index. The highest achievable overall value is 81 (i.e., a patient that has full need-of-care in each of the 27 tasks).

The following table summarizes the 4 dimensions of the BEL-scale and their related tasks:

Table 1-18, Belgian Flanders LTC assessment-of-need

Household ADL	*Physical ADL*	*Social ADL*	*Mental Health*
House-holding	Bathing and showering	Social loss	Orientation in time

[88] Further reference on the validity of APA scale can be found in Sermeus *et al.* (2010), p.35.
[89] The latter is only partially related to the iADL taxonomy by Lawton and Brody (1969), which included communication in the form of "being able to use the telephone" (see Appendix 1.7.1).
[90] Decree of 30 March 1999, B.S. (Belgisch Staatsblad) 28/05/1999

Laundry	Dressing	Commitment to therapy and medical rules	Orientation in space
Ironing	Functional mobility	Safety inside/outside the house	Orientation in persons
Shopping	Using the toilet	Administration	Purposeless behavior
Meal preparation	Incontinence	Financial operations	Disruptive behavior
Housework planning	Feeding	Children hygiene	Lack of initiative
		Children care	Depressed mood
			Anxious mood

Evaluation for each item: 0 - no need-of-care; 1 - small need-of-care; 2 - medium need-of-care; 3 - full need-of-care

Source: Second Annex to the Ministerial Decree of 6 January 2006 regulating the determination of the severity and duration of the reduced autonomy on the basis of the BEL-profielschaal under the Flemish care insurance.

In order to be eligible, a patient should score at least 35 on the BEL-scale. Eligibility gives access to a monthly cash-benefit of €130, irrespective of age, income or need-of-care of the applicant.

Table 1-19, Belgian Flanders LTC eligibility rules

Dependency level	*Details*	*Monthly allowance*
unique	BEL-score of 35 or higher	€ 130

The programme's regulation presents clear similarities with respect to the other two main dependency-assessment tools in Belgium (the BESADL and the APA scale):

- Evaluation for each task is multi-levelled (from 0 to 3), so that a more precise measure of dependency can be selected for a specific task with respect to those assessments where the evaluation is dichotomous (dependence vs independence).
- The regulation defines a specific threshold with respect to the evaluation scale, in order to discriminate between those individuals which are on a condition of "objective dependence" (above the threshold) and those who are not (below the threshold)

At the same time, the BEL-scale presents some peculiar features:

- It provides a more detailed characterization of vulnerability than the APA and the BESADL models. ADLs and iADLs are included following the original taxonomy by Katz *et al.* (1970) and Lawton and Brody (1969), while the APA scale does not include all of them - frequently mixing ADLs and iADLs - and the BESADL scale does not cover iADL limitations at all.
- It deeply covers two dimensions of vulnerability, Social ADL and Mental Health, which are almost absent from the APA and the BESADL scale. Including issues on social and mental aspects of frailty seems to put BEL-scale more in line with the WHO bio-psychosocial perspective (WHO, 2002), and with many geriatric assessments like the "Multi-dimensional geriatric assessment"

1.5.5 Czech Republic *Příspěvek na péči*

Formal programmes of long-term care in the **Czech Republic** offer both in-kind and in-cash benefits. There is no unique institutional body that regulates care services for the elderly: the health-care sector (the Ministry of Health) mainly covers nursing care at home, while Social Services (the Ministry of Labour and Social Affairs – MoLSA, Ministerstvo práce a sociálních věcí - MPSV) cover other forms of home-care and offer dependent individuals a cash

allowance[91]. As a consequence, legal regulations, eligibility criteria and quality assessment are defined separately by each institution[92]. The Ministry of Labour and Social Affairs refers to long-term care as to a "wide range of supportive health and social services provided to people who are no more self-sufficient – either because of their age, disability or for any other serious reason – and thus require constant assistance by another person in coping with their everyday life and daily needs"[93].

Although entitlement for Health-care and Social services in-kind is based, respectively, on health-care insurance coverage and citizenship, a unique formal definition of "vulnerability" does not exist and the degrees of eligibility depend on individual assessments-of-need performed either by doctors (for Health-care services) or by social workers (for Social Services). Conversely, the main Czech care-allowance for dependent people (*Příspěvek na péči*), firstly introduced with the 2006 Social Services Act,[94] is uniquely regulated throughout the country both for the assessment-of-need process and for the eligibility criteria.

The care allowance is granted to vulnerable individuals older than one year of age who are dependent on others for basic tasks of personal care and self-sufficiency, irrespective of their income and age, so that they can "elect the most effective manner of having their needs provided for" (MoLSA 2009). The monetary amount depends on the degree of dependence, and has nature of a care-allowance rather than a full reimbursement of the care costs. Vulnerability is defined as an adverse state of health, expected to last for at least one year since first appearance, characterized by limitations in basic life activities like moving, exercise cognitive functioning, communicating, eating, dressing, caring for own's hygiene, using the toilet, performing self-medications, being involved in activities, performing household tasks. The original 2006 legislation aimed at monitoring vulnerability through a list of 36 activities split in two main groups, personal care and self-sufficiency, as reported in the Appendix 1.7.2.

A comprehensive reform of dependency categorization took place in 2011 when the act of Parliament 366/2011 simplified the evaluation scale and narrowed it down to a list of 10 major areas of basic life necessities (each area is mostly a regrouping of the original 36 tasks)[95]. Each activity is evaluated on a binary basis (dependent vs independent).

Table 1-20, Czech Příspěvek na péči assessment-of-need

Activities	*description*
Mobility	Walking and transferring
Orientation	Ability to hear, see, and use mental functions
Communication	Communicating and understanding
Eating	Cutting up food, eating, drinking, following diet
Dressing	Dressing/undressing, putting on shoes
Personal hygiene	Washing the body, combing hair, oral hygiene
Performance physiological needs	Using toilet, defecating, urinating and cleaning
Self-medications	Following prescribed treatments
Personal activities	Engaging in daily routines, age-related activities
Household tasks	Taking care of household, groceries, finances

[91] A review of the programmes regulated by MPSV can be found on-line at https://portal.mpsv.cz/soc as well as in MPSV (2009).
[92] See the European Commission report (European Commission, 2013a), and Sowa (2010).
[93] MPSV (2005)
[94] Social Services Act No. 108/2006; Decree No. 505/2005, Implementing certain provisions of the Social Services Act
[95] Act No. 366/2011 (§9) amending the Social Services Act 108/2006. A brief review of the reform can be found on-line at a dedicated MPSV website http://socialnireforma.mpsv.cz/cs/23 .

Four levels of dependency are distinguished[96], according to the number of limitations, as the following table summarizes:

Table 1-21, Czech Příspěvek na péči eligibility rules

Dependency level	*Details (old criteria in parenthesis)*	*Monthly allowance*[97]
Light	Dependent in 3 activities (12)	€ 29 – Kč 800[98]
Medium	Dependent in 5 activities (18)	€ 146 – Kč 4000
Heavy	Dependent in 7 activities (24)	€ 292 – Kč 8000
Very Heavy	Dependent in 9 activities (30)	€ 438 – Kč 12000

In order to offer a benchmark to appreciate the magnitude of the benefits, we gather from OECD (2013d) that the value of the basic pension in Czech Republic was CZK 2,270 in 2012, while the average pension (single paid out) was CZK 10,929 in June 2013 (Holub & Háva, 2013).

Applications for the care allowance must be submitted to the regional branches of the MPSV but can be filed on-line through the ministerial portal. The assessment-of-need follows two steps: a social worker will firstly schedule a meeting to assess the degree of vulnerability of the patient in his natural environment, while a Ministerial doctor will perform a second evaluation. The final decision on the applicant's eligibility will be taken by the MPSV regional branch, and can be appealed by the patient. The cash benefit, which is tax-free, can be only spent on care-activities, regardless of who the provider of care is (Social Services worker, professional caregiver, informal caregiver). Ministerial authorities are in charge for monitoring the proper usage of the cash benefit, and can suspend the allowance in case of misuse.

A few observations on the Czech assessment method:

- The 2006 version of the assessment-of-need scale was perhaps the most detailed (36 tasks) among those adopted in the major LTC programmes in Europe with the potential exception of the SVaMA (Italy) which nevertheless is built for clinical usage and has no clear threshold to determine dependency.
- The 2012 version of the scale is much simpler, as it consists of 10 basic activities which somehow summarize the 36 of the previous legislation. The Katz et al. ADLs are all included in the list, except for the continence item, as well as most of Lawton's iADLs.
- Dependence in each activity is assessed on a binary yes/no scale, without intermediate steps. Moreover, each activity has equal weight in the computation of the final degree of vulnerability, and no complementarity occurs: what matters here is the overall number of limitations, while the single components do not play any role. In other words, there are no pre-existing profiles of vulnerability and every combination of deficits that reaches the minimum overall count of 3 gives access to the care-allowance.

[96] For children below 18 years of age dependency is defined as follows: light dependency (limitations in 3 activities), medium dependency (limitations in 5 activities); heavy dependency (limitations in 6-7 activities); very-heavy dependency (limitations in 9 activities)

[97] On-line source on ministerial website, https://portal.mpsv.cz/soc/ssl/prispevek. Currency exchange rate at June 2014.

[98] The allowance for the first dependency level (light) was reduced from Kč 2000 to Kč 800 since 2010. See also Colombo *et al.* (2011).

1.5.6 French APA and *Aide Sociale*

There is no single regulation for long-term care policies in **France**. Conversely, a multitude of legislations, actors and sources of financing characterize specific programmes which target various kinds of dependency and vulnerability[99]. A "supplement for assistance of a third party (*majoration pour aide d'une tierce personne*)" and a "supplementary benefit for recourse to a third party" (*prestation complémentaire pour recours à tierce personne*) are offered, respectively, to non-elderly individuals who already get an invalidity or a work-injury pension and additionally need help in performing basic activities of daily life. The "disability compensation allowance" (*prestation de compensation du handicap*) is instead designed for disabled persons who are younger than 60 years old and who suffer from a degree of disability which meets certain pre-defined criteria.

As long as the elderly population is concerned, there are three main public sources of long-term care services: the sickness insurance scheme which covers some expenditures for health care, the retirement insurance scheme which finances forms of domestic assistance (*Aide sociale aux personnes âgées : aide ménagère à domicile*) and the Personalised Allowance of Autonomy (APA, A*llocation Personnalisée d'Autonomie*). The latter constitutes the main national programme for tackling dependency among the 60+ population. These LTC programmes target different profiles of vulnerable individuals, yet adopting a unique evaluation-scale to assess their dependency condition: the AGGIR scale, which we now turn to describe.

The **AGGIR** scale (Autonomie Gérontologique – Groupes Iso-Ressources) is a national standardized assessment-of-need tool that helps to determine an individual's vulnerability status. The scale, introduced in 1997 and modified in 2001, 2004 and 2008[100], evaluates limitations in ADL and iADL and generates an index-measure from 1 to 6 that represents a patient's vulnerability classification. Each category, or Group Iso-Resources (GIR), gathers individuals with similar loss of autonomy and equivalent need-of-care. GIR 1 represents the hardship case (0 percent of autonomy), while GIR 6 corresponds to the non-vulnerable level (93% of autonomy, or higher)[101]. The AGGIR assessment is a compound of two groups of variables:

- Ten "discriminatory" variables, eight of which are actually concurring at determining the final vulnerability score: six variables related to physical limitations and difficulties in ADL, two variables on psychical deficits (coherence and orientation) and two variables related to iADL (outdoor movement, distant communication), which do not concur in determining the AGGIR score.

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[99] See Courbage and Roudaut (2010) and European Commission (2013b)

[100] Decree n°97-427 du 28 avril 1997, Law n° 97-60 (January 24th 1997), Décret no 2001-1084 du 20 novembre 2001, Décret no 2008-821 du 21 août 2008

[101] Further details can be found in the User Guide to the AGGIR scale 2008 by the CNAMTS (*Caisse nationale de l'assurance maladie des travailleurs salaries* - The French National Health Insurance Fund for Salaried Worker) at www.cnsa.fr/IMG/pdf/Guide_AGGIR_2008-2.pdf; in the documentation on the website of the Ministry of Health and Social Affairs (*Ministère des Affaires sociales et de la Santé*) at http://www.social-sante.gouv.fr/IMG/pdf/fiche_1_grille_aggir_et_gir.pdf, as well as in Dupourqué *et al.* (2012).

- Seven "illustrative" variables, mainly related to iADL tasks, allow for a measure of contextual factors and are used to evaluate how much assistance a person needs to lead a normal social life, while not entering the algorithm of the AGGIR score.[102]

Each variable (item) is evaluated on a three-step scale (A, B, C), depending on the degree of limitation experienced by the patient in the specific task. The following table lists the ten discriminatory variables, together with a brief description[103]:

Table 1-22, France's AGGIR assessment-of-need

Discriminatory variables	*description*	*evaluation*
coherence	converse or behave in a logical and sensible manner	A: The individual performs the task spontaneously, habitually, completely and correctly alone.
orientation	locates oneself in time and space	
toileting	upper and lower body hygiene	
dressing	upper, middle and lower body dressing	B: The individual can perform the task alone, yet not spontaneously, and/or correctly and/or habitually and/or completely.
alimentation	serving and eating	
elimination	using the toilet for urine/faecal eliminations	
transfers	lying down, sitting down, getting up	
indoor movement	with or without technical assistance	
outdoor movement	same as above, but outdoors	C: The individual cannot perform, requires assistance or must have someone else do the activity.
distant communication	using the phone and tele-alarm	

The illustrative variables (each to be evaluated on the A,B,C scale), are: managing money, preparing meals, performing housekeeping tasks, using transportation modes while outdoor, shopping, follow medical prescriptions, doing leisure activities.

Through a rather complex algorithm[104], AGGIR splits the population into 6 iso-groups[105] depending on how they perform in the first 8 discriminatory tasks[106]. Belonging to one group rather than another will determine which LTC benefit an individual can claim for (if any). The following table briefly describes the six vulnerability categories.

Table 1-23, France AGGIR vulnerability categorization

GIR group	*Description*
GIR 1	Bedridden or confined to an armchair, with seriously impaired mental functions
GIR 2	Those confined to bed, needing assistance for most ADL (typically toileting, dressing, elimination, alimentation), with mental functions not entirely compromised. Those with severe mental deficits but with no serious limitations in mobility and personal care functions.
GIR 3	Those with no serious mental and mobility limitations, who need help several times a day for ADL (typically for hygiene and elimination tasks) while not requiring constant monitoring.
GIR 4	Those who have transferring limitation, but once up can move around indoors. They sometimes need help with washing and dressing, and most of them can eat without assistance. Alternatively, those with no mobility or transferring limitations, but who need help to perform other ADL, including eating.

[102] The AGGIR scale could, in principle, be included among the "analytic" assessment methods, since it comprises seventeen daily tasks above and beyond the ADL and the IADL taxonomies. As it has just been highlighted, though, only 8 of these tasks (the two items on mental deficits and the six ADL) actually contribute to determine an individual's vulnerability status.
[103] Adapted from Dupourqué *et al.* (2012).
[104] Details are available in Dupourqué *et al.* (2012). A free AGGIR simulator is available at http://www.ibou.fr/aggir/
[105] Syndicat National de Gérontologie Clinique (1994)
[106] As mentioned before, only the first eight tasks determine an individual's eligibility status to LTC, while the remaining help to determine the amount and type of care that best suits each individual condition.

GIR 5	Those who can move around inside their home without assistance, and can eat and dress themselves alone. They require occasional help with washing, preparing meals and doing housework.
GIR 6	Those who have not lost their autonomy for daily living activities.

- From the previous table it appears clear how mental and physical limitations play almost independent roles in defining a vulnerability condition. Regardless to other functional deficits in ADL, those who have mental limitations are assigned to, at least, GIR 2. Conversely, those with difficulties in - roughly - at least two ADL are categorized in GIR 4 regardless of their mental health. This holds whenever the limitations are reported with at least a B intensity-score. It should be highlighted that being limited in "moving inside the house" is not a sufficient limitation for GIR 4 if the only other loss-of autonomy concerns the "transferring" task. When the "moving" limitation is selected, there should be at least one further difficulty among "using the toilet", "dressing", "eating" or "washing" in order to determine GIR 4. Finally, as stated before, iADLs do not play any role in defining the GIR score.

The outcome of the AGGIR evaluation defines eligibility the APA programme in France, but it is also included in the eligibility rules for the Social Assistance to seniors (see below).

The **APA**[107] (A*llocation Personnalisée d'Autonomie*, Personalised Allowance of Autonomy) has been introduced in 2001, in place of the previous LTC program "*Prestation Spécifique Dépendance*" (PSD). It is managed at the *départmental* level[108] and provides vulnerable elderliy residing in France with an in-kind benefit whose intent is to finance a personalized assistance-scheme, both for institutional- and for home-care. The benefit's amount varies according to the recipient's health status and disposable income level, although means-test do not play any role in defining eligibility.

The total number of beneficiaries from APA was 1,191,897 in 2012, 702195 of which were domiciliary recipients. The total expenditure was 5.2 millions in the same year, 60% of which was allocated to non-institutionalized elderly.[109] Regulations are slightly different between the APA for home-care elderly and for nursing-care residents. Given that this dissertation focuses on the home-based LTC, we will discuss the rules intended to this kind of care. The APA "à domicile" represents the implementation of a plan of long-term assistance, personalized on individual needs. Three conditions are necessary in order for the allowance to be granted: an individual must be French resident, at least 60 years old and with a vulnerability level of at least GIR4. The following table summarizes these three criteria.

Table 1-24, French APA eligibility rules

APA eligibility criteria	*description*
Residency	Being resident in France
Age	At least 60 years old
Vulnerability	At least GIR4

The vulnerability status is assessed through the AGGIR scale. In order to be eligible for the APA, an individual must belong to a group between GIR 1 and GIR 4. The assessment is performed by medical professionals, paramedicals or social workers, usually at the patient's place, after a proper demand has been submitted to the local Social Community Centre. If the assessed vulnerability iso-group is at least GIR 4, the evaluators develop a personalized care scheme which comprises all the tasks that should be performed in order to help the patient to live a comfortable life in his/her own home. Such tasks include nursing home-care, meals-on-wheels, social assistance, housework, technical assistance

[107] Articles L. 232-3 / 232-7, R. 232-7 / 232-14 of Code de l'action sociale et des familles (CFAS).
[108] The *department* is a level of government which lies between the region and the arrondissement.
[109] Data from the Ministry of Health, http://www.drees.sante.gouv.fr/ , last updated on 26 October 2014.

with aids. The APA is designed to (partially) finance this care-plan, with no time limitations. The maximum monthly APA contributions are summarized in the following table, by GIR group:

Table 1-25, French Apa benefits' amount

GIR group	*Maximum APA allowance (monthly amount in euro)*[110]	*individual contribution-share to care-scheme*
GIR 1	1.312,67	0% up to €739,06 monthly income from 0% to 90% up to € 2.945,23 monthly income 90% if above € 2.945,23
GIR 2	1.125,14	
GIR 3	843,86	
GIR 4	562,57	
GIR 5	non-eligible	-
GIR 6	non-eligible	-

The actual monetary amount, and therefore the extent to which APA will contribute to the care-plan, depends not only on the GIR classification but also on the applicant's income (together with the partner's income if they are a couple)[111]. If an applicant's monthly income lies below € 739,06, all the care-plan is financed by the APA. For higher incomes, the individual's contribution to the care-plan increases linearly from 0% up to a ceiling of 90% of the total cost, which is paid by those who have a monthly income equal or higher than € 2.945,23. Having ascertained the patient's costs share, the APA benefit is determined as the difference between the total care-plan amount and the patient contribution.

The allowance is usually paid directly to the professional care-givers, or to the care-receiver who must then provide proofs of expenditures. APA can be suspended if this documentation is not provided, or if random audits and controls verify the presence of misuse of the allowance.

While APA is designed to target vulnerability profiles with numerous limitations in ADL, the **Social Assistance to seniors** (***Aide sociale*** *aux personnes âgées*) is an in-kind benefit aimed at providing home-help (A*ide ménagère à domicile*) to elderly who report lower degrees of dependency and are therefore not necessarily eligible for the APA allowance[112]. The program is intended to support elderly people with cooking, washing and bathing, shopping for groceries and for the small and common tasks of daily living. It also provides moral assistance to individuals living alone, involving them in meaningful and supportive talks.

In order to be eligible to the Social Assistance to seniors, three conditions must be met by the applicant, as the next table highlights: a minimum age-requirement of 65 years old; the presence of limitations in activities related to personal hygiene, meals preparation, shopping for groceries and some domestic housework (GIR 5 or GIR 6 classification); not being beneficiary of the Personalized Autonomy Allowance (APA) program. The programme is not means-tested but, as for APA, the amount of service-costs covered by the Action Sociale will depend on applicants' resources.

Table 1-26, French Aide Sociale eligibility rules

Aide sociale eligibility criteria	*description*
Age	At least 65 years old
Vulnerability	Needing assistance with personal hygiene / meals preparation / shopping for groceries / domestic tasks

[110] Monetary amounts at 01/04/2014. Governmental source: http://vosdroits.service-public.fr/particuliers/F1802.xhtml
[111] Official details on income screening can be found at http://vosdroits.service-public.fr/particuliers/F1802.xhtml
[112] Code de l'Action Sociale et des familles (CFAS), L 113-1 / 113-3, L. 231-1 / 231-6, R. 231 / 231-6, L. 313-1. CNAV Circular n° 2007-16 02/02/2007, CNAV Circular n° 2013-52 21/11/2013. Other references are available on-line at http://sante.lefigaro.fr/social/personnes-agees/aide-menagere-personnes-agees/references-legales

- As detailed in the previous paragraphs, the GIR5 is the only degree of vulnerability (except for GIR 6, who covers low dependency levels) which does not give eligibility to the APA program. It mainly includes individuals with limitations in doing housework and iADLs, or those with difficulties in washing or bathing. This eligibility rule stresses the complementary nature of the *Aide Sociale* programme, which is able to offer a minimum coverage to those elderly who still face difficulties in everyday activities, but to a lower extent with respect to the APA recipients. Limitations in instrumental activities of daily livings (iADL) like those included in GIR5 or GIR6 are known to be the first signals of an ongoing process of vulnerability. While they cannot trigger eligibility to the APA on their own, they are the main target of the *Aide Sociale* programme.

Depending on applicants' resources, the home-care services will be financed by the *Deparment* (through Social Assistance) or by the applicants' retirement insurance (a major example is the *Caisse Nationale d'Assurance Vieillesse* - CNAV). As for the year 2014, the *Département*'s intervention is limited to those cases in which applicant's monthly income is lower than €791.99 (€ 1,229.61 if he/she lives with a partner). For those earning more than € 791.99 per month, the retirement insurances will finance a share of the total expenditure needed for the home-care services, depending on the applicant's income level. To make few examples, those living alone with an income lower than € 1.140 will not contribute more than 36% of overall costs, while they will pay 73% when earning more than € 1.423. Those living in couple will contribute just 10% when they have an income lower than € 1.451, while their contribution will be maximum (73%) after they exceed the earning threshold of € 2,134[113].

1.5.7 German *Pflegeversicherung*

The **German** long-term care framework is shaped by the 1994 Long-term care Act which became effective in 1995 (the Law on social protection for the Long-term-care risk, *Gesetz zur sozialen Absicherung des Risikos der Pflegebedürftigkeit*), introducing a mandatory Long-term care Insurance[114] (*Pflegeversicherung*) for German citizens as an additional pillar of the national Welfare State[115]. The long-term care Insurance specifically targets vulnerable individuals who suffer from physical or mental limitations that prevent them from performing basic and regular tasks of daily living[116]. It provides them with benefits in cash and/or in kind, in order to ease the costs of home-care assistance. From a financial point of view, the LTC Insurance is not a full insurance, since it still requires the individuals to contribute to the care-expenditure, depending on their level of vulnerability. In addition, other services such as nursing courses for caregivers or nursing aids are provided. It is also worth noting that home-care, alongside with policies of prevention and rehabilitation, is stressed in the law (SGB XI, §3, §5) as a crucial component of the Long-term care in Germany: its

[113] Monetary thresholds and contributions are valid throughout all the 2014. Further details on contributions and on means-test are available on the French civil service website, at http://vosdroits.service-public.fr/particuliers/F245.xhtml

[114] The Long-term care Insurance is regulated in the 11th Book of the Social Code (*Buch des Sozialgesetzbuches* - SGB), available at http://www.gesetze-im-internet.de/sgb_11/index.html . Major recent modifications took place in 2008 (Long-term Care Further Development Act / Pflege-Weiterentwicklungsgesetz), 2012 (Law on Realignment of Care / Pflege-Neuausrichtungs-Gesetz) and 2014 (Amendment to the 11th Book of Social Code / *Änderung des Elften Buches Sozialgesetzbuch, 5. SGB XI-ÄndG, Änderungsgesetz*)

[115] Those German citizens under the Social Health Insurance (*Gesetzliche Krankenversicherung*) automatically have the Long-term care Insurance. Those with a private Health Insurance will have to apply to a private LTC insurance-fund.

[116] The Statutory Health Insurance Funds Association, the central representation of the statutory health and nursing care insurance funds in Germany, estimates that in 2013 over 2 million people were dependent on care or support because of their inability to independently cope with daily living tasks due to a physical or mental illness or disability.

major goal is to keep the vulnerable individual in his/her own home environment, delaying institutionalization and in-patient care[117].

There are four main forms of LTC benefits available to an eligible insured individual: cash-benefits for home-care (*Pflegegeld*), benefits in kind for home-care (*Pflegesachleistung*), day and night home-care (T*agespflege und Nachtpflege*) and institutional care in nursing-homes (*Vollstationäre Pflege*).[118] Among home-care services, individuals can choose between an exclusive cash benefit, an exclusive domestic-care programme in kind or a proportionate combination of the two (*Kombinationsleistung*)[119]. Cash benefits are paid directly from the insurance-fund to the dependent person who can use them at his/her discretion to compensate a self-procured caregiver; the benefits are not treated as income and thus are tax-free. Benefits in kind (community care) consist in personal-care and domestic-help service provided by professional carers, usually a licensed home care service which can be both for-profit or non-profit. Professional help is considerably more expensive than private aid, therefore the budget of in-kind benefits is considerably higher than for the cash-programmes (Table 1-29). It is important to notice that the LTCI funds will contribute to the expenditures up to a maximum amount (SGB XI §§36-45; see also Table 1-29). Should the total care-cost exceed this amount, the remaining part will be paid by the patient. Should they not be able to, the social welfare office can intervene. Conversely, when the in-kind allowance is not fully utilized, the applicant can claim for a partial in-cash benefit for the remaining share, thus realizing the *Kombinationsleistung* scheme. As Rothgang (2010) clarifies, "if only x per cent of claims for in-kind benefits are realized, 100 – x per cent of the cash benefits claims are still available" and can be paid as care allowance.

For all of the aforementioned benefits, eligibility depends on the level of vulnerability of the insured person (need of assistance, *Hilfebedürftigkeit*), while other characteristics like economic resources, age or availability of informal caregivers are not taken into account. Vulnerability is assessed by the medical service of the health insurance companies. The assessment focuses on those limitations which are likely to last in the long-term, i.e., for a minimum of six months, because of a physical or mental illness or disability.

The medical evaluation covers 4 main areas of daily activities: personal care, nutrition, moving, household activities, which all refer to ADL and iADL tasks. The §14 of SGB XI lists the main areas of activities that should be evaluated to assess patient's vulnerability, with their respective tasks. For each task the nurses and/or the physicians have to evaluate the amount of care that would take to a non-professional caregiver to provide assistance, in terms of minutes per task. To ensure the same standards for all patients, nationwide guidelines have been specified for most (but not all) tasks. The time measures, reported in the following table, refer to a single task-occurrence and serve as a guideline to the operator in order to calculate the daily demand of care.

Table 1-27, German Pflegeversicherung assessment-of-need

AREA of DAILY ACTIVITIES	*Tasks to evaluate*	*Standard amount of time for care (minutes per task)*
PERSONAL CARE	Washing body (upper- lower- body, hands)	*20-25*
	Dental care	*5*
	Combing	*1-3*

[117] Long-term care insured are entitled to in-patient care services when home-care or day-care is not feasible or not suitable to the individual case. The care fund will contribute to the in-patient-assistance expenditure, accordingly to the level of vulnerability of the applicant. See the SGB XI, § 42, 43.
[118] SGB XI, §36-43
[119] SBG XI, §38

	Shaving	*5-10*
	Taking a shower	*15-20*
	Bathing	*20-25*
	Defecation and urination	*8*
	Maintenance of urinary drainage bag / ostomy bag	*2-4 each*
	Incontinence	*11*
NUTRITION	Bite sized food preparation	*2-3*
	Food in-take	*15-20*
MOVING	Moving in and out of bed / changing positions	*1-3 each*
	Dressing-undressing (upper- lower body)	*12-16*
	Moving inside house, Standing (transferring), Climbing stairs, Leaving and returning to house, Shopping	*to be individually defined*
HOUSEHOLD ACTIVITIES	Cleaning dwelling, Cooking, Washing dishes, Washing and ironing clothes, managing the heating	*to be individually defined*

- Similarly to the Austrian system, the German vulnerability-assessment is particularly detailed with respect to tasks of personal care: even small activities like combing, shaving or dental care are assigned a specific guideline-amount of time, and specific attention is paid to those individuals who have to deal with urinary drainage or ostomy bags. Furthermore, tasks regarding nutrition are split in a preparatory phase (preparing bite-sized food) and an eating phase; the movement-related activities are also analytically separated, even though only few of them have specific time-requirement guidelines while the remaining must be evaluated on an individual basis. Household activities are characterized by a number of tasks, though time-requirements are not specified a-priori. It is worth noting that two of the Lawton's iADLs (managing money and communication-using the telephone) are excluded from the list. An important difference with the Austrian framework relies on the role of the time-requirements guidelines, which are defined *per-task* rather than *per-day*. This allows for a greater flexibility in designing a personalized programme of care: for instance, even though the time-requirements for bathing are fixed at 20-25 minutes, not every person uses to take a bath every day. The daily amount of time for bathing could therefore be just a fraction of the bathing occurrences during a week: if an individual takes a bath twice a week, he/she will require 40 minutes of care every seven days, which results in a daily requirement of circa six minutes. As a further example, this flexibility (and lower degree of standardization between individuals) will apply as well to the number of daily occurrences of defecation/urination and nutrition.
- Some critiques have been cast on the peculiarity of this assessment tool that mainly focus on physical limitation and does not take sufficiently into account the specific needs of people with mental deficits. Rothgang (2010) highlights that such a "tight definition of dependency has meant that people with dementia are entitled to LTCI benefits only insofar as they need help with the activities of daily living, as the assessment does not evaluate or take into account their general need for supervision". This shortfall has been partially addressed with the 2012 reform, when a stronger attention has been devoted to those individuals who are limited in their activities of daily living because of mental illnesses and cognitive limitations. These individuals, considered at risk of being a danger to themselves or to others, are included in the taxonomy of vulnerability under the label PEA (*Personen mit eingeschränkter Alltagskompetenz*, People impaired in activities of daily living).[120]

As a result of the evaluation process, each patient is categorized one among three levels of need (Pflegestufen I, II, III; see the next table), defined by the original legislation, which differ with respect to the number of limitations, the estimated amount of care-time requested, the balance between limitations in ADL and iADL.[121]

[120] See details in MDS (2013), pag.73 - section E "Feststellung von Personen mit erheblich eingeschränkter Alltagskompetenz", as well as in SGB XI (§ 45a).

[121] Following an ongoing debate, there are proposal of re-designing the levels of care on a five-steps scale from 2016/2017. A higher number of levels would allow for a more efficient classification of patients, specifically taking into account those individuals with dementia. http://www.pflege-deutschland.de/pflegeversicherung/pflegegrade.html

Table 1-28, German Pflegeversicherung eligibility rules

	assistance for basic care (personal care, feeding, mobility)	*assistance for household activities*	*Minimum requirements of care-needs per day*
Level 1	At least once a day for at least 2 tasks from one or more areas	Several times a week	overall: 90' (45' for basic care)
Level 2	At least thrice a day for at least 2 tasks from one or more areas	Several times a week	overall: 180' (120' for basic care)
Level 3	Help needed around the clock	Several times a week	overall: 300' (240' for basic care)
hardship level	Those in level 3 who need assistance for at least 420 minutes a day with at least 120 minutes during the night, or who need simultaneous help from multiple caregivers		
Cognitive impairment	Following the 2012 reform, individuals affected by cognitive impairment are given access to an additional allowance, irrespective of their functional disability status (even if they are classified as Level 0 (*Pflegestufe 0*).		

The minimum requirements of daily care-needs in order to be eligible (*Pflegestufe I*) are an overall need for 90' of help, with at least 45' attributable to basic care tasks. The 2012 reform introduced new rules to account for the relatively under-dimensionality of mental illness in the original assessment evaluation scheme.[122] The 2012 reform introduced new rules to account for the relatively under-dimensionality of mental illness in the original assessment evaluation scheme.[123] For the same vulnerability level, being affected by cognitive/mental limitations (PEA) gives access to an additional allowance; moreover, those patients who do not qualify for level 1 benefits (patients with "level 0" / "Pflegestufe 0") can still receive an allowance if they suffer from mental disturbances. The following table provides details on how the vulnerability levels relate to amount of LTC benefit an insured individual can claim for. The monetary amounts reflect the latest reform (June 2014).[124] For those who do not suffer from mental illnesses, level 1 is the minimum vulnerability level that entitles to LTC services.

Table 1-29, German Pflegeversicherung benefits' amount

LEVEL	*Home care*		*Day & Night*	*Nursing Home Care*[125]
	€ in-cash §37	€ in-kind §36	€ in-kind §41	€ in-kind §43
Level 0 (PEA)	120 from 1/2012	225 from 1/2012		
	123 from 1/2015	231 from 1/2015		
Level 1	235 from 1/2012	450 from 1/2012	450 from 1/2012	1023
	244 from 1/2015	468 from 1/2015	468 from 1/2015	1064 from 1/2015
Level 1 (PEA)	305 from 1/2012	665 from 1/2012		
	316 from 1/2015	689 from 1/2015		
Level 2	440 from 1/2012	1100 from 1/2012	1100 from 1/2012	1279
	458 from 1/2015	1444 from 1/2015	1144 from 1/2015	1330 from 1/2015
Level 2 (PEA)	525 from 1/2012	1250 from 1/2012		
	545 from 1/2015	1298 from 1/2015		
Level 3	700 from 1/2012	1550 from 1/2012	1550 from 1/2012	1550 from 1/2012
	728 from 1/2015	1612 from 1/2015	1612 from 1/2015	1612 from 1/2015

PEA (Personen mit eingeschränkter Alltagskompetenz, Individuals impaired in activities of daily living) are individuals with limited or compromised cognitive ability.

[122] Paaßen (2012)
[123] Paaßen (2012)
[124] Kabinettsentwurf des 5. SGB XI ÄndG. On-line resources at: http://www.pflege-deutschland.de/pflegeversicherung/gesetz/ and http://www.pflegestufe.info/
[125] For the hardship level (higher than level-3), the monthly benefits amounted at € 1918 in 2012 and will increase to € 1995 starting from January 2015.

1.5.8 The Italian Regional LTC programmes (Friuli – Venezia Giulia and Toscana)[126]

Friuli – Venezia Giulia established a Long-term Care Fund (*Fondo per l'autonomia possibile e per l'assistenza a lungo termine*), through a regional law in 2006 (L.R. 6/2006), with the aim of helping elderly adults who, due to a substantial loss of autonomy, are not able to independently care about themselves and to live an independent and decent life. The main programme for domiciliary-assistance to the elderly is the CAF cash-benefit (*Contributo per l'aiuto famliare,* Family help contribution) which aims at (partially) financing the home-care services received by the elderly from private nurses or social assistants, with an employment contract of at least 20 hours of assistance per month. An additional, yet alternative, cash-benefit is the APA (*Assegno per l'Autonomia Possibile*, Autonomy Allowance): a monetary contribution, lower than the CAF, for those vulnerable elderly who receive help from informal-caregivers (mainly family members). Both programmes are means-tested and have age-requirements for eligibility. The Fund also finances the *Sostegno alla vita indipendente* (Allowance for an Independent Life), and the *Sostegno per persone con problemi di salute mentale* (Allowance for cognitive impaired individuals), who provide benefits to non-elderly individuals suffering from specific mental illnesses or (temporary) severe disabilities. The Fund's resources are allocated to the Municipalities Social Services Offices (*Servizi Sociali del Comune*).[127]

The assessment-of-need for the programmes financed by the Long-Term Care Fund is performed by the Multi-professional Assessment District Unit (*Unità di Valutazione Multiprofessionale, UVM*), which is part of the National Health System (NHS) and is composed by at least one municipality Social Assistant and one trained medical professional from the NHS. Functional vulnerability is evaluated on a list of activities (Table 1-30) corresponding to the ADL taxonomy from Katz *et al.* (1970).[128] Cognitive impairment is assessed through the Clinical Dementia Rating scale (Morris, JC, 1993).

Table 1-30, Assessment-of-need for Friuli – Venezia Giulia's CAF and APA

Limitations		evaluation
Washing	Needs help with bathing more than one part of the body, getting in or out of the tub or shower.	**yes/no**
Dressing	Needs help with dressing self or needs to be completely dressed	**yes/no**
Use of WC	Needs help transferring to the toilet, cleaning self or uses bedpan or commode	**yes/no**
Transferring	Needs help in moving from bed to chair or requires a complete transfer	**yes/no**
Continence	Is partially or totally incontinent of bowel or bladder	**yes/no**
Nutrition	Needs partial or total help with feeding or requires parenteral feeding	**yes/no**

Eligibility conditions for CAF and APA encompass both demographic, economic and health conditions: individuals should be aged 65 or more, should have a yearly household income lower than € 35000, and should suffer from at least 2 limitations in the ADL scale. Moreover, individuals with severe mental impairment (defined as having a score of 3 on the Clinical Dementia Rating scale) are also eligible to the benefit.

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[126] The eligibility criteria in Italy for regional and local LTC benefits in-kind or in-cash are not harmonized. For a review of the highly heterogeneous Italian LTC framework, see Gori (2013), Da Roit and Le Bihan (2010) Ranci and Pavolini (2012), Rebba (2010), Tediosi and Gabriele (2010), Visca *et al.* (2012).

[127] CR-FVG (2013) AGENAS (2014)

[128] An ongoing reform-project aims at replacing the Katz-ADL scale with a new assessment-method, the ValGraf scale, in the forthcoming years.

Table 1-31, Friuli-Venezia Giulia's CAF and APA eligibility rules

individual characteristics	*eligibility requirements*
Age	at least 65 years old
Economic resources	Yearly household income lower than € 35000
Health	Loss of autonomy in at least 2 ADL *or* cognitive impaired condition (level 3 on CDR)

The monetary amount of the allowance depends on the degree of vulnerability assessed by the UVM as well as on the household income. As far as the functional vulnerability is concerned, the legislation set two intensity levels: having two limitations in ADL, *versus* having three or more limitations. Furthermore, the CAF allowance depends on the amount of hours-of-care indicated in the employment contract (at least 20 hours per month). As for the household economic resources, the allowance is maximum when the yearly income is lower than € 7500; it reaches its minimum value for an income level of € 35000.

Table 1-32, Friuli Venezia Giulia's CAF and APA allowances

	ADL-loss	*Yearly income*	*Allowance per year*
Maximum allowance CAF	3+ ADL (39+ hours of care per month)	€ 0 - 7000	€ 10920
Minimum allowance CAF	2 ADL (20-25 hours of care per month)	€ 35000	€ 262
Maximum allowance APA	3+ ADL	€ 0 - 7000	€ 6548
Minimum allowance APA	2 ADL	€ 25000-35000	€ 1550

Toscana's main regional Long-term Care programme PAC (*Progetto per l'assistenza continua alla persona non autosufficiente,* Long-term care for non autonomous individuals) was introduced in 2010 with the regional law D.G.R. n.370 (March 22, 2010). The PAC is financed by the *Fondo per la non autosufficienza* (regional law L.R. n.66, December 18, 2008) and encompasses both benefits in-cash and in-kind for adults older than 64, with the aim of keeping vulnerable elderly in their home-environment, allowing them to live a decent life and ultimately delaying institutionalization. The program is means-tested, since the household income is taken into account when defining the amount-of-care to be supplied/reimbursed or the cash-benefit to be allocated (AGENAS (2014), Profili *et al.* (2009))

Several home-care services are included in the PAC, ranging from nursing-care by public medical professionals *(Interventi domiciliary sociali e sanitari)*, to cash-benefits aimed at sharing the costs of hiring a private professional caregiver *(buoni servizio o titoli per l'acquisto di servizio)*, to cash-benefits or respite-care services for informal caregivers *(interventi di sostegno alle funzioni assistenziali della famiglia / Sostegno alla persona e alla famiglia e la qualificazione del lavoro dell'assistente familiare).* The PAC is managed at the district level *(distretti sanitari)*. Each district set up a Multi-disciplinary Evaluation Unit *(Unità di Valutazione Multidisciplinare,* UVM*)*, composed of a doctor, a nurse and a social assistant, who is responsible for the assessment-of-need of the elderly applicants and for the definition of a Personalized Plan of Assistance (*Progetto Assistenziale Personalizzato,* PAP), which regulates the care-services to be supplied. In order to facilitate the access to the PAC, an information service has been put in place, the *Punti Insieme* offices, who should help the elders or their families in following the proper steps to file an application to the program.

Vulnerability is assessed by the UVM through a multi-dimensional approach that gather individuals in 5 iso-groups, representing five homogeneous levels of need-of-care. This is, to some extent, similar to the rationale of the French AGGIR scale (Section 1.5.6), whose categorizations, the Groups Iso-Resources (GIR), identify individuals with similar loss of autonomy and equivalent need-of-care. The Toscana's PAC assesses individuals' limitations in three main

dimensions: Basic Activities of Daily Living (BADL), Cognitive Impairment, Mood and Behavior. The BADL is a Katz-adapted list of activities-of-daily-living included in the Minimum Data Set for Home Care (MDS-HC) assessment method (Morris, JN *et al.*, 1997). It has seven items, unlike Katz's six, since the "movement" task is split into a "transferring" activity (as in the Katz ADL scale), a "moving when in bed" and a "moving around house" activity. Each activity is evaluated on a five-step scale, from 0 (independence) to 4 (full assistance required) according to the need of care required by the applicant in the last seven days, as the following table illustrates:[129]

Table 1-33, Assessment-of-need for BADL, Toscana's PAC

Limitations	*description*	Evaluation
Washing	Needs help with bathing more than one part of the body, getting in or out of the tub or shower.	From 0 to 4
Dressing	Needs help with dressing self or needs to be completely dressed	From 0 to 4
Use of WC	Needs help transferring to the toilet, cleaning self or uses bedpan or commode	From 0 to 4
Moving	Needs help in moving around the house, even when using mobility aids	From 0 to 4
Transferring	Needs help in moving from bed to chair or requires a complete transfer	From 0 to 4
Moving in bed	Needs help in changing position when in bed	From 0 to 4
Nutrition	Needs partial or total help with feeding or requires parenteral feeding	From 0 to 4

Evaluation: 0 - independence; 1 - supervision only: 2 - light dependency; 3 - heavy dependency; 4 - full dependency

Three degrees of dependency in BADL are then identified, according to the number and the intensity of the BADL limitations experienced by the individual.

Table 1-34, Definition of dependency in BADL, Toscana's PAC

Dependency in BADL	*description*	*MDS-HC BADL scale*
Light	Full dependency in 2 BADL *or* light/heavy dependency in 3 BADL	At least 8
Moderate	Full dependency in 3 BADL *or* light/heavy dependency in 4+ BADL	At least 15
Heavy	Full dependency in 2+ BADL *or* light/heavy dependency in 3+ BADL	At least 22

Cognitive impairment is measured through the application of Eric Pfeiffer's Short Portable Mental Status Questionnaire (Pfeiffer, 1975), which classifies patients as "non impaired or lightly impaired", "moderately impaired" and "severely impaired", according to a short- and long-term memory test, an orientation test and a verbal fluency test (Profili *et al.*, 2009).

Mood- and Behavior-assessment follow the guidelines from MDS-HC. Mood assessment consists in a list of questions about whether the patient exhibits: (i) a feeling of sadness depression or death-wishes; (ii) persistent anger with self or others; (iii) expressions of what appears to be unrealistic fears; (iv) repetitive health complaints (obsessive concerns); (v) repetitive anxious complaints; (vi) sad, pained, worried facial expressions; (vii) recurrent crying, tearfulness; (viii) withdrawal from activities of interest; (ix) reduced social interaction; Instances when client exhibited behavioral symptoms. Behavior-assessment deals with the occurrence of: (i) wandering; (ii) verbally abusive behavioral symptoms; (iii) physically abusive behavioral symptoms; (iv) other behavioral symptoms; (v) resisting care/taking medications/injections/ADL assistance/eating/changes in position. Depending on the number of mood and

[129] Adapted from Profili *et al.* (2009). *Supervision* refers to a need of supervision for three or more times a week; *light dependency* refers to a need of light physical-help for three or more times; *heavy dependency* refers to a need of heavy physical-help for three or more times; *full dependency* refers to constant need for help.

behavioral disturbances, an individual is categorized as "lightly disturbed", "moderately disturbed", "severely disturbed".

Five iso-groups of vulnerability are built by combining the BADL status, the cognitive status and the mood/behavioral status. Group 5 corresponds to those who have a bad BADL status, are severely cognitive impaired and severely disturbed, while group 1 gather those who have –roughly– a light deficit in one of the three dimensions. The following table explains in details how the iso-groups are defined (see Profili *et al.* (2009) and Visca *et al.* (2012)):

Table 1-35, ISO-vulnerability groups, Toscana's PAC

ISO-GROUP	BADL limitations								
	light			*moderate*			*severe*		
	mood/behav. impairment			mood/behav. impairment			mood/behav. impairment		
cognitive impairment	*light*	*moderate*	*severe*	*light*	*moderate*	*severe*	*light*	*moderate*	*severe*
light	1	2	3	2	3	4	4	4	5
moderate	2	2	3	3	3	4	4	4	5
severe	3	3	4	3	4	5	4	5	5

Eligibility for PAC depends on age, income and on the ISO-vulnerability group assessed by the UVM, as shown in Table 1-36.

Table 1-36, Toscana's PAC eligibility rules

individual characteristics	*eligibility requirements*
Age	at least 65 years old
Economic resources	Yearly household income lower than € 25000
Health	ISO-GROUP 3 or higher*

The minimum age is 65 years old. The minimum ISO-category is 3, even though the UVM can, in principle, decide to allow some benefit for individuals in groups 1 and 2.[130] The amount of the in-kind or the in-cash allowance is means-tested: individuals with yearly household income above € 25000 will not receive any benefit.[131] Moreover, they depend on the ISO-vulnerability categorization, as shown in Table 1-37.

Table 1-37, Monetary allowances, Toscana's PAC

ISO-GROUP	*Minimum – maximum allowance*
3	[€80 – €120]
4	[€170 – €310]
5	[€260 – €450]

[130] Regional law D.G.R. n.370, Attachment A.
[131] See, e.g., the regulation of the Casentino district, at http://www.uc.casentino.toscana.it/regolamenti/disposizioni-attuative-anno-2013.pdf .

1.5.9 Spanish Ley de Dependencia

Formal long-term care programmes in **Spain** include in-kind services and cash benefits. To analyse the Spanish system, we have to refer to two separate periods: before 2006, year of the introduction of the *Ley de Dependencia*, and after 2006, subsequently to the implementation of the reform[132].

The Spanish system, prior to the Law 36/2006 (*Ley de Dependencia*), was highly decentralized and characterized as a "system of regional long-term care services". The access to publicly funded long-term assistance was based on an assessment of needs and resources, which varies by region. The social security system provided assistance in the form of benefits for those with a high degree of dependency, cash-allowances within the non-contributory disability pension and family benefits for those with disabled children. The supply of social services has been inadequate to the needs of dependent population, and characterized by a high level of heterogeneity among regions. Due to the scarcity of publicly funded LTC services, there has been a large expansion of privately provided programmes since the 1980s (OECD, 2011).

To harmonize this complex legislative setting, in 2006, the Spanish government enacted a new *Ley de Dependencia* (Dependency Law - Act 39/2006, of 14th December, on the Promotion of Personal Autonomy and Care for Dependent persons) which aim was to "*configure a network for public use that integrated on a coordinated basis, both public and private centres and services*" (Jiménez-Martín & Prieto, 2010). The law defines the concept of *dependency as the permanent state in which persons that for reasons derived from age, illness or disability and linked to the lack or loss of physical, mental, intellectual or sensorial autonomy require the care of another person/other people or significant help in order to perform basic activities of daily living,* and introduces a standardized procedure of assessment-of- needs at the national level. Assessment-of-need process is conducted by the autonomous administration operating in the applicant's residence and it is valid throughout the whole country, to guarantee equality at the national level. Degree and level of dependency are established by using an assessment scale (Table 1-38) approved by the Territorial Council of the System for Autonomy and Care for Dependency.

Table 1-38, Assessment of need in the Spanish Ley de Dependencia

	Age			
	3-6	7-10	11-17	18 and older
Eating and drinking	**22.4**	**18.3**	**18.3**	**16.8 (10)**
Recognize e/o reach the food served	0.35	0.25	0.25	0.25
Cutting up food	NA	0.2	0.2	0.2
Using cutlery	0.3	0.3	0.3	0.3
Putting a glass to mouth	0.35	0.25	0.25	0.25
Control of physical needs	**20.3**	**16.1**	**16.1**	**14.8 (7)**
Go to the appropriate place	0.31	0.2	0.2	0.2
Dressing and undressing	0.23	0.15	0.15	0.15
Adopting the right posture	0.46	0.3	0.3	0.3
Cleaning oneself	NA	0.35	0.35	0.35
Washing	**12.1**	**9.6**	**9.6**	**8.8 (8)**
Turning on and turning off taps	0.43	0.15	0.15	0.15
Washing hands	0.57	0.2	0.2	0.2
Using shower or bath tub	NA	0.15	0.15	0.15

[132] The reform will be gradually implemented from January 2007 to 2015, year in which the system will be completely operational (even though, due to the economic crisis, funds devoted to long-term care suffered a dramatic cut in July 2012, producing delays in the implementation process) (Jimenez et al., 2014).

Washing lower part of the body	NA	0.25	0.25	0.25
Washing upper part of the body	NA	0.25	0.25	0.25
Other personal tasks	**NA**	**3.2**	**3.2**	**2.9 (2)**
Combing hair	NA	0.35	0.3	0.3
Cutting nails	NA	NA	0.15	0.15
Washing hair	NA	0.3	0.25	0.25
Brushing teeth	NA	0.35	0.3	0.3
Dressing	**16.3**	**12.9**	**12.9**	**11.9 (11.6)**
Recognize e/o reach clothes and shoes	0.15	0.15	0.15	0.15
Putting on shoes	0.1	0.1	0.1	0.1
Doing up buttons	0.15	0.15	0.15	0.15
Dreesing upper part of the body	0.3	0.3	0.3	0.3
Dressing lower part of the body	0.3	0.3	0.3	0.3
Maintaining health	**NA**	**3.2**	**3.2**	**2.9 (11)**
Request therapeutic assistance	NA	0.3	0.15	0.15
Applying therapeutic measures	NA	0.2	0.1	0.1
Avoiding indoor risks	NA	0.5	0.25	0.25
Avoiding outdoor risks	NA	NA	0.25	0.25
Distress call	NA	NA	0.25	0.25
Mantenimiento de la salud	**12.1**	**11**	**11**	**9.4 (2)**
Changing position from lying to sitting on the bed	0.1	0.1	0.1	0.1
Sitting	0.15	0.15	0.15	0.15
Getting up from a chair	0.1	0.1	0.1	0.1
Standing up	0.15	0.15	0.15	0.15
Sitting down on a chair	0.1	0.1	0.1	0.1
Changing posture from a sitting position	0.1	0.1	0.1	0.1
Changing posture from bed	0.1	0.1	0.1	0.1
Changing centre of gravity of body in the bed	0.2	0.2	0.2	0.2
Moving inside home	**16.8**	**13.4**	**13.4**	**12.3 (12.1)**
Movements related dressing	0.25	0.25	0.25	0.25
Movements related eating	0.15	0.15	0.15	0.15
Movements related washing	0.1	0.1	0.1	0.1
Movements not related to self-care	0.25	0.25	0.25	0.25
Access to all settings of the rooms	0.1	0.1	0.1	0.1
Access to all rooms	0.15	0.15	0.15	0.15
Desplazarse fuera del hogar	**NA**	**12.3**	**12.3**	**12.2 (12.9)**
Going out	NA	0.29	0.25	0.25
Walking around the house/buiding	NA	0.29	0.25	0.25
Walking short distances in known places	NA	0.24	0.2	0.2
Walking short distances in unknown places	NA	0.18	0.15	0.15
Walking long distances in known places	NA	NA	0.1	0.1
Walking long distances in unknown places	NA	NA	0.05	0.05
Housekeeping	**NA**	**NA**	**NA**	**8 (8)**
Cooking	NA	NA	NA	0.45
Shopping (for food)	NA	NA	NA	0.25
Cleaning the house	NA	NA	NA	0.2
Washing clothes	NA	NA	NA	0.1
Only for patients with a mental illness or cognitive impairment:				
Making decisions	**23.4**	**16.6**	**16.6**	**15.4**
Decisions about food	0.4	0.21	0.2	0.2
Self-care activities	0.2	0.11	0.1	0.1
Mobility activities	NA	0.11	0.1	0.1
Personal relationships with friends or relatives	0.4	0.21	0.2	0.2
Personal relationships with strangers	NA	0.1	0.1	0.1
Use of money	NA	0.1	0.1	0.1
Time management	NA	0.16	0.15	0.15
Use of public services	NA	NA	0.005	0.005

Source: Real Decreto 174/2011, Ministerio de Sanidad, Politica Social e Igualdad "BOE", num.42, 18/02/2011

Similarly to the Czech Republic, the Spanish ranking scale consists of 10 distinct activities and, in turn, each activity includes a set of specific tasks. An additional activity (**making decisions**) is included only for individuals who suffer from mental disorders or cognitive impairment. Moreover, for this specific group of vulnerable persons the ranking scale assigns different weights to each activity (they are reported in parenthesis).

The degree of support required for performing each task is also taken into account (see next table).

Support coefficient	**0.9**	**0.9**	**0.95**	**1**
	Supervision	*Partial Physical Assistance*	*Maximum Physical Assistance*	*Special Assistance*
	If the dependent only needs a third person to prepare the necessary elements to perform the activity	When a third person has to participate actively	If the third person has to substitute the dependent individual in the execution of the activity	The dependent individual suffers behavioural disorders that hinder the provision of the task by the third person

The final score is the sum of the weights of the tasks for which the individual has difficulty, multiplied by the degree of supervision required and the weight assigned to that activity:

Score = ∑ (Weight of the task performed with difficulty * Degree of supervision required in the specific task * Weight of the corresponding activity)

The ranking scale identifies three degrees of dependency:

- *Moderate dependency* when the person needs help to perform various basic daily living activities at least once a day
- *Severe dependency* when the person needs help in order to perform various basic daily living activities two or three times a day
- *High dependency* when the person needs help to perform various basic daily living activities several times a day and due to the total loss of physical, mental, intellectual or sensorial autonomy, he needs permanent support of another person.

Within each of the three degrees, the ranking scale distinguishes two levels of dependency on the basis of the person's autonomy and on the intensity of care that is required. The first level corresponds to those individuals who can perform the activity without the direct support of a third person, whereas the second level refers to those situations in which the dependent individual needs some type of specific support. Table 1-39 shows the ranking scale used for the determination of the degree of dependency (Fernanda Gutierrez *et al.*, 2010; Jiménez-Martín & Prieto, 2010).

Table 1-39, Degrees and Levels of Dependency (score) in the Spanish system

Degree	**Level**	**Score**
High dependence	Level 2	90-100
High dependence	Level 1	75-89
Severe dependence	Level 2	65-74

Severe dependence	Level 1	50-64
Moderate dependence	Level 2	40-49
Moderate dependence	Level 1	25-39
Not dependent		0-24

Source: Gutierrez et al., 2010.

After the assessment-of-need procedure, the dependent persons are entitled to receive formal care by means of services and benefits that are matched to their degree and level of dependency (Individual Care Programme) (Fernanda Gutierrez *et al.*, 2010). The assessment of needs, the prescription of assistance and the management of the care-allowances are carried out directly by the public administrations, and might not be object of delegation. Different types of in-kind services are offered by the Spanish system:

Regarding the "Home help service", which includes housework and other services related to home needs (cleaning, washing, cooking, etc.), personal care and related services in performing daily activities, the *Ley de Dependecia* has been introduced a specific regulation in terms of home-care hours received by month, according to the level and the grade of dependency of vulnerable individuals (see Table 1-40).

Table 1-40, Home-care hours, Spanish Ley of Dependencia

	Home Care (Hours/month)
Intensive Home Care	
High dependence. Level 2	70-90 hours/month
High dependence. Level 1	77-70 hours/month
Severe dependence. Level 2	40-55 hours/month
Severe dependence. Level 1	30-40 hours/month
Moderate dependence. Level 2	21-30 hours/month
Moderate dependence. Level 1	12-20 hours/month
Non-intensive Home Care	
High dependence. Level 2	Up to 45 hours/month
High dependence. Level 1	Up to 35 hours/month
Severe dependence. Level 2	Up to 28 hours/month
Severe dependence. Level 1	Up to 20 hours/month

Source: Gutierrez et al., 2010.

Concerning the cash benefits, three types of allowances are available:

1. Allowance for the care recipient to hire services. This benefit is meant for the care recipient to hire services through private centers (with accreditation), when public services are not available.

2. Allowance for the care recipient receiving informal care. To receive the benefit, the informal carer needs to be a relative of the dependent person, except in the case service are unavailable in the area (in this situation, the informal carer must be a neighbor residing in the same municipalities, or nearby).

3. Allowance for personal assistance. This benefit is meant for individuals having a high degree of disability (Degree III) to hire personal help in order to provide them with access to work and education and help in daily activities.

All cash allowances are means-tested and depend on cost, or on hours of care for the allowance towards informal carers (OECD (2011); Fernanda Gutierrez *et al.* (2010)).

Levels of dependence	*Allowance for the care recipient to hire services*	*Allowance for the care recipient receiving informal care*	*Allowance for personal assistance*
High - Level 2	833.96	520.69	833.96
High - Level 1	625.47	416.08	625.47
Severe - Level 2	426.18	337.25	Not available
Severe - Level 1	401.20	300.90	Not available
Moderate - Level 2	300	180	Not available
Moderate - Level 1	Not implemented yet	Not implemented yet	Not implemented yet

Source: Fernanda Gutierrez et al. (2010)

Some observations on the Spanish assessment method:

- The Spanish system puts a lot of emphasis on the intensity of support needed and the tasks for which care is required. The vulnerability assessment is highly detailed with respect to all activities included in the scale, and a special attention is paid to those individuals who have limitations in eating/drinking tasks or in performing daily living tasks such as dressing and undressing and cleaning oneself.
- In contrast with the Czech Republic method, dependency in each activity is evaluated by using a weighted scale, in which different weights have been assigned to each specific task. Interestingly, the Spanish ranking scale assigns different activity coefficients (and an additional activity: **making decisions**) to those individuals who have a difficulty in performing tasks due to some cognitive or intellectual challenges. Its focus on mental aspects of frailty is in line with the WHO bio-psychological perspective (WHO, 2002).

1.6 CONCLUSIONS

This paper focused on assessment of vulnerability and eligibility frameworks of main public Long-Term Care programmes in Europe. These topics, not specifically covered in the recent literature, represent a compulsory gateway for elderly adults in order to be able to receive benefits in-kind or in-cash for home-based care. LTC frameworks may constitute a source of heterogeneity that should not be neglected in economic analyses focused on the demand of health-care: besides individual characteristics, e.g., health- and socio economic status, differences in care-programmes' legislations may have a relevant impact on elders' decision in terms of formal-care utilization. The European framework appears highly heterogeneous in terms of the operational definition of vulnerability, thereby determining substantial differences in the coverage of each LTC system. The most frequent measures of vulnerability are limitations in ADL, iADL as well as cognitive impairments, but these dimensions are weighted differently and not always included in the assessments-of-need scales. The eligibility conditions (i.e., the rules determining whether an individual is in need of care or not) are most often non-linear functions of health-limitations, with many regulations setting *veto* criteria (i.e., some limitations are necessary for being eligible) or *favor* criteria (some limitations are sufficient for eligibility). By implementing the set of rules on the SHARE data, we are able to identify a sub-population of eligible individuals. We are thus able to address potential "failures" of LTC programmes (the so called "no-care zone" occurrences), that happen when older adults that are in a condition of objective dependency according to their own country regulation, do not make use of any formal home-care although being entitled to. By the use of a probit analysis, we show that educational attainment (which is a main determinant of health-literacy) are significant and important predictor of the

lack of access to formal personal/nursing home-care among the eligible population. Lower educated eligible individuals might appear as non-compliants, while they might just be, in fact, unable to interact properly with the LTC regulations.

1.7 APPENDICES

1.7.1 ADL and iADL[133]

The ADL taxonomy assesses how an individual performs, without assistance, in six main functioning domains: bathing, dressing, toileting, transferring, continence, and feeding. The iADL scale comprises eight tasks: ability to use the telephone, shopping, food preparation, housekeeping, doing laundry, mode of transportation, responsibility for own medications and ability to handle finances. The activities included in the iADL list require, to be performed, a more complex of neuropsychological organization than ADL, and therefore measure less severe levels of vulnerability.[134] Brief definitions for ADL and iADL tasks are reported in the following table:

Table 1-41, ADL and iADL

ADL: Activities of Daily Living	*iADL: instrumental Activities of Daily Living*
Washing: dependency means "needing help with bathing in more than one part of the body", "getting in or out of the tub or shower", or "requiring total bathing".	**Ability to use the telephone**: dependency means "not using the telephone at all on own initiative". Lighter levels are: "dialing only a few well-know numbers" and "answering but not dialing".
Dressing: dependency means "needing help with self-dressing" or "needing to be completely dressed".	**Shopping**: Dependency means "shopping independently only for small purchases", "needing to be accompanied on any shopping trip" or "being completely unable to shop".
Use of WC: dependency means "needing help in transferring to the toilet, self-cleaning or using bedpan or commode".	**Food preparation**: dependency means "preparing adequate meals only if supplied with ingredients", "heating and serving prepared meals", "preparing meals but being unable to maintain adequate diet" or "needing to have meals prepared and served".
Transferring: dependency means "needing help in moving from bed to chair" or "requiring a complete physical transfer".	**Housekeeping:** dependency means "not participating in any housekeeping tasks". Lighter levels include "performing only light daily tasks while being unable to maintain acceptable level of cleanliness" and "needing help with all home maintenance tasks".
Continence: dependency means "being partially or totally incontinent of bowel or bladder"	**Doing laundry:** dependency means "being unable to do laundry". Lighter levels include "laundering only small items and rinsing stocks and stockings".
Nutrition: dependency means "needing partial or total help with feeding" or "requiring parenteral feeding".	**Mode of transportation**: dependency means "travelling only with taxi or automobile, with assistance of another" or "not travelling at all". Lighter levels include: "travelling independently with taxi-only" and "travelling on public transportation when accompanied by another".

[133] Further details of ADL and iADL can be found in seminal works by Katz *et al.* (1970) and Lawton and Brody (1969) as well as in Shelkey and Wallace (1998) (for ADL) and Graf (2009) (for iADL).

[134] On the hierarchical structure of ADL and iADL see Wiener *et al.* (1990), Kempen *et al.* (1995), Thomas *et al.* (1998), LaPlante (2010). As LaPlante (2010) highlights, the paediatric development model implicit in the ADL scale implies that "as a child matures, the simplest activity, eating, is mastered first, then continence, transferring, toileting, dressing, and bathing, in order of increasing complexity. As a person ages, or experiences certain chronic illnesses, performance is lost in the reverse order, from bathing to eating".

Responsibility for own medications: dependency means "being incapable of dispensing own mediation, except maybe for those already prepared in advanced and in separate dosages".
Ability to handle finances: dependency means "being incapable of handling money". Lighter levels include "being able to manage day-to-day purchases while needing help with banking, major purchases etc".

In the original paper by Katz *et al.* (1970), the ADL tasks were to be evaluated on a zero-one scale, i.e., a person could either be having a deficit or not, and no intermediate degrees of dependency could be selected. Yet, many assessment tools for long-term-care programmes in Europe now include an evaluation of ADL using a multivariate scale with several degrees of dependency for each task (e.g. complete dependency, partial dependency, light dependency).

The Lawton iADL taxonomy is binary as-well (Lawton & Brody, 1969), with patients being classifiable as "dependent" or "not dependent" with respect to each task, without intermediate values. The original scale includes a specific definition for "dependency" together with a list of *lighter* levels of dependency, which are anyway included into the "not dependent" category. As an example, consider the housekeeping dimension: there is one specific definition for "dependency", which is "not participating in any housekeeping task", alongside a list of lighter degrees of limitation (e.g. "performing only light daily tasks" or "needing help with all home tasks") which are anyway included in the "non-dependency" category.

1.7.2 Czech Republic old assessment scale

Table 1-42, the old assessment-of-need for the Czech Příspěvek na péči

Self-Care tasks	*Self-Sufficiency tasks*
Food preparation	Verbal, written and non-verbal communication
Food serving and portioning	Orientation with respect to people and time, also outside one's own natural environment
Nutrition; compliance with drinking regime	Disposing of money and other valuables
Body washing	Arranging for personal matters
Bathing or showering	Time planning, life planning
Care for mouth, hair and nails, shaving	Inclusion in social activities
Exercising physiological need including hygiene	Ensuring food and common articles (shopping)
Transferring in/out of bed, changing positions	Cooking, heating up simple meals
Sitting, ability to remain in the sitting position	Dish washing
Standing, ability to remain standing	Common household cleaning
Moving articles of everyday use	Caring for linen/underwear
Walking on a flat surface	Washing up small linens
Walking on stairs, up and down	Caring for bed
Selecting clothes, recognizing proper overlays	Operating common household appliances
(Un)dressing, putting on/taking off shoes	Manipulating with taps and switches
Orientation in the natural environment	Manipulating with locks, windows and doors
Exercising simple self-medical treatments	Cleaning the household, disposing of refuse
Complying with medical regime	Other simple acts of household maintenance

1.7.3 Implementing LTC eligibility regulation on SHARE data

This appendix compare each assessment-of-need scale reviewed in Section 1.5 with the information from the SHARE survey, which is described in Section 1.3.2. Nearly all of the tasks included in the LTC regulations have a close correspondent in SHARE, yet some adjustments had to be made, as it will be described hereafter. The aim of this

correspondence-exercise is not to replace or mimic the work and the expertise of the trained professionals who actually conduct the assessments. Our goal is to implement legal benchmarks into our micro-data in a prudent and robust fashion, in order to identify a sub-population of "eligible individuals" out of the total sample; indeed, this sub-population is at the core of the analyses conducted in Sections 1.3, Section 1.4 and Chapter Two.

Three major issues must be acknowledged when comparing actual legislations with micro-data information. *First*, as already mentioned, the correspondence between *each* assessment-of-need and the SHARE survey is not perfect: some information are not available in our data, and some medical definitions may slightly differ. *Secondly*, most of the evaluation of functional limitations in SHARE are scored dichotomously (0 or 1), i.e., a limitation can either occur or fail to occur, but no intensity is measured. Although this is consistent with Katz's ADL and Lawton-Brody's iADL original design, some comparability issue arise with respect to those LTC assessment-of-need adopting a multi-step scale evaluation, i.e., requiring information about the *degree* of the potential loss-of-autonomy. Nevertheless, it should be highlighted that, regarding ADL iADL and mobility limitations, SHARE respondents are asked not to report difficulties that are expected to last less than three months. *Lastly*, the information collected in SHARE are self-reported, even though the interviewer is able to signal unreliable answers. Respondent' subjectivity is, therefore, a potential issue that affect also the information on the health-status, e.g., the occurrence of ADL or iADL limitations.[135]

AUSTRIA – *Pflegegeld* (Section 1.5.1)

What follows is a summary of the assessment-of-need for the Austrian *Pflegegeld*, together with the corresponding information from SHARE.

Table 1-43, Austrian Pflegegeld and SHARE

Core / Auxiliary	*Limitation*	*Fixed need-of-care (hours/month)*	*SHARE tasks (binary: yes / no)*
c	*Daily body care*	25	Bathing or showering
c	*Preparation of meals*	30	Preparing a hot meal
c	*Taking meals*	30	Eating (+cutting up your food)
c	*Defecation*	30	Using the toilet (+ getting up or down)
c	*Dressing and undressing*	20	Dressing (+ putting on shoes and socks)
c	*Cleaning for incontinence sufferers*	20	Incontinence or involuntary loss of urine
c	*Colostomy care*	7.5	-
c	*Care cannula tube care*	5	-
c	*Catheter care*	5	-
c	*Enemas*	15	-
c	*Taking medication*	3	Taking medications
c	*Mobility aid in the narrow sense*	15	Walking across a room *or* Getting in or out of bed
a	*Motivational talks*	10	EURO-D scale
a	*Emptying and cleaning the toilet chair*	10	-
a	*Procuring of food and medicines*	10	Shopping for groceries
a	*Cleaning the home and personal effects*	10	Doing work around the house
a	*Care of underwear and towels*	10	Doing work around the house
a	*Heating the living space (+procuring of fuel)*	10	Doing work around the house

[135] Similar concerns are expressed by Bonsang (2009) and Balia and Brau (2013). Reliability of self-reported health-conditions is investigated in Bound (1991), Baker *et al.* (2004), Dwyer and Mitchell (1999), LaPlante (2010). A cross-survey comparison between HRS, SHARE and ELSA is performed in Chan *et al.* (2012).

a	*Mobility aid in a broader sense*	10	Using a map to figure out how to get around in a strange place
	*Cognitive impairment**	25*	Orientation in time (day, week, month, year): cannot answer three or more

*Source: Gesamte Rechtsvorschrift für Einstufungsverordnung zum Bundespflegegeldgesetz, BGBl. II Nr. 37/1999, BGBl. II Nr. 453/2011 *Since January 1st, 2009.*[136]

The care allowance is provided to individuals who present a decline in functional status that require at least 60 hours of need-of-care per month (it was 50 hours before 2011). The decline is expected to last for at least 6 months due to a physical, mental or emotional disability or sensory impairment in at least one core activity *and* at least one auxiliary activity.[137] Since January 1st 2009, people with mental illnesses, dementia or severe behavioural disorders are given a fixed supplementary amount of care-time in terms of 25 hours per month.[138]

Disclaimer for empirical analyses in Section 1.4 and in Chapter Two:

Since our data have been collected from 2004 to 2006, we cannot compute the additional 25-hours for cognitive impaired individuals; furthermore, we adopt the minimum threshold of 50-hours threshold when simulating the eligibility rules.

BELGIUM – Flanders supplementary LTC programme *Zorgverzekering* (Section 1.5.2)

The *BEL-foto* assessment-of-need adopts a four-step scale for each item (from 0 to 3), where 0 corresponds to full-autonomy and 3 corresponds to impossibility to perform the specific task. Since most of the health-conditions in SHARE are reported on a binary scale (yes/no) [139], we prudently chose to assign a score of 2 in the BEL-scale to each activity that respondents report to be limited in, instead of assigning the full score of 3.

Table 1-44, Belgium (Flanders) Zorgverzekering and SHARE

Limitation	*Value*	*SHARE tasks (binary: yes / no)*
Household ADL		
House-holding	2 out of 3	Doing work around the house
Laundry	2 out of 3	Doing work around the house
Ironing	2 out of 3	Doing work around the house
Shopping	2 out of 3	Shopping for groceries
Meal preparation	2 out of 3	Preparing a hot meal
Housework planning	2 out of 3	Doing work around the house
Physical ADL		
Bathing and showering	2 out of 3	Bathing or showering
Dressing	2 out of 3	Dressing (+ putting on shoes and socks)
Functional mobility	2 out of 3	Getting in or out of bed
Using the toilet	2 out of 3	Using the toilet (+ getting up or down)
Incontinence	2 out of 3	Incontinence or involuntary loss of urine
Feeding	2 out of 3	Eating (+cutting up your food)

[136] BMASK (2013a)
[137] BMASK (2013a)
[138] BMASK (2013a)
[139] SHARE respondents are asked not to report difficulties that are expected to last less than three months.

Social ADL		
Social loss	2 out of 3	EURO-D scale = 4 or higher
Commitment to therapy and medical rules	2 out of 3	Taking medications
Safety inside/outside the house	2 out of 3	Doing work around the house or garden
Administration	2 out of 3	Managing money, such as paying bills and keeping track of expenses
Financial operations	2 out of 3	Managing money, such as paying bills and keeping track of expenses
Mental Health		
Orientation in time	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more
Orientation in space	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more
Orientation in persons		-
Purposeless behavior	2 out of 3	EURO-D scale = 4 or higher
Disruptive behavior	2 out of 3	EURO-D scale = 4 or higher
Lack of initiative	2 out of 3	EURO-D scale = 4 or higher
Depressed mood	2 out of 3	EURO-D scale = 4 or higher
Anxious mood	2 out of 3	EURO-D scale = 4 or higher

Source: Second Annex to the Ministerial Decree of 6 January 2006 regulating the determination of the severity and duration of the reduced autonomy on the basis of the BEL-profielschaal under the Flemish care insurance.

We followed a strict approach in defining the Mental Health conditions related to purposeless/disruptive behaviors, lack of initiative, depressed/anxious mood. In principle, a direct correspondence could be established between the items in the BEL-scale and the questions in SHARE ("In the last month, have you been sad or depressed", "Have you been irritable recently?", etc.). Nevertheless, given the potential inherent subjective interpretation of the questions by the respondents, we felt more comfortable with adopting the EURO-D measure and threshold proposed by Dewey and Prince (2005) (having at least 4 disturbances among a set of 12[140]) as a more objective signal of latent psychological issues.

In order to be eligible, a patient should score at least 35 on the BEL-scale.

BELGIUM – *APA* (Section 1.5.3)

The assessment process is performed through a scale (APA scale) which depicts vulnerability as determined by six items that are evaluated on a scale from 0 (no difficulties in performing the selected item) to 3 (impossibility in performing the selected item without help from others), and the overall profile of vulnerability is constructed by summing each item' scores. We chose to assign the score of 2 whenever a respondent reports to suffer from a limitation in the corresponding SHARE task:[141]

Table 1-45, Belgian APA and SHARE

Limitations	*Value*	*SHARE tasks*
Moving and transferring around the house	2 out of 3	Walking across a room *or* Getting in or out of bed
Preparing meals and ingesting food	2 out of 3	Preparing a hot meal *or* Eating (+cutting up your food)

[140] The 12 disturbances are pessimism, depressed mood, suicidal thoughts, guilt, trouble sleeping, loss of interest, irritability, fatigue, inability to concentrate, lack of appetite, incapacity of enjoyment, tearfulness.
[141] SHARE respondents are asked not to report difficulties that are expected to last less than three months.

Performing body-care and being able to dress	2 out of 3	Bathing/showering *or* Dressing (+ putting on shoes and socks)
Taking care of own house and performing house-tasks	2 out of 3	Doing work around the house *or* Managing money, such as paying bills and keeping track of expenses
Communication: being able to have contacts with others	2 out of 3	Making telephone calls
Need of supervision. Being able to assess and avoid dangerous situations	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more

The minimum level of vulnerability corresponds to a score of 7 in the APA scale: all the applicants who get an overall index of less than 7 are not eligible to the monetary allowance. The minimum age requirement is 65 years old.

BELGIUM – *nursing home-care by INAMI/RIZIV* (Section 1.5.2)

The assessment-of-need for public home-help adopts a four-step scale for each item (from 1 to 4), where 0 corresponds to full-autonomy and 4 corresponds to impossibility to perform the specific task. Dependency-status on a single task arises when the need-of-care is either severe (3) or full (4). We chose to assign the score of 3 whenever a respondent reports to suffer from a limitation in the specific task.[142]

Table 1-46, Belgian nursing home-care programme and SHARE

Criteria	*Value*	*SHARE tasks (binary: yes / no)*
Washing	3 out of 4	Bathing or showering
Dressing	3 out of 4	Dressing (+ putting on shoes and socks)
Moving and transferring	3 out of 4	Walking across a room *or* Getting in or out of bed
Using the toilet	3 out of 4	Using the toilet (+ getting up or down)
Continence	3 out of 4	Incontinence or involuntary loss of urine
Eating	3 out of 4	Eating (+cutting up your food)
Orientation in time	3 out of 4	Orientation in time (day, week, month, year): cannot answer three or more
Orientation in space	3 out of 4	Orientation in time (day, week, month, year): cannot answer three or more

The minimum level of vulnerability (category A) in order to be eligible corresponds to limitations in washing and dressing *or* to being disoriented in time and space (but physically independent).

CZECH REPUBLIC - *Příspěvek na péči* (Section 1.5.5)

Table 1-47, Czech Příspěvek na péči and SHARE

Limitation	*Fixed binary value (0/1)*	*SHARE tasks (binary: yes / no)*
Mobility: walking and transferring	1	Walking across a room *or* Getting in or out of bed
Orientation, ability to hear, see, and use mental functions	1	Orientation in time (day, week, month, year): cannot answer three or more
Communicating and understanding	1	Making telephone calls
Cutting up food, eating, drinking, following diet	1	Eating (+cutting up your food)

[142] SHARE respondents are asked not to report difficulties that are expected to last less than three months.

Dressing/undressing, putting on shoes	1	Dressing (+ putting on shoes and socks)
Washing the body, combing hair, oral hygiene	1	Bathing or showering
Using toilet, defecating, urinating and cleaning	1	Using the toilet (+ getting up or down)
Self-medications: following prescribed treatments	1	Taking medications
Engaging in daily routines, age-related activities	1	Doing work around the house *or* Preparing a hot meal

In order to be eligible an individual must report at least 3 limitations from the Czech scale (*light dependency*

FRANCE: *APA and Aide Sociale* (Section 1.5.6)

Each variable (item) in the French AGGIR scale is evaluated on a three-step scale (A, B, C or 1, 2, 3), depending on the degree of limitation experienced by the patient in the specific task.[143] Since we do not have information on the intensity of the limitations reported by the SHARE respondent, we chose to prudently assign the label B (the intermediate level) whenever a respondent reports a limitation in a specific task.[144]

Table 1-48, French AGGIR scale and SHARE

Discriminatory variables	*description*	*assigned value*	*SHARE tasks*
coherence	converse or behave in a logical and sensible manner	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more
orientation	locates oneself in time and space		
toileting	upper and lower body hygiene	2 out of 3	Bathing or showering
dressing	upper, middle and lower body dressing	2 out of 3	Dressing (+ putting on shoes and socks)
alimentation	serving and eating	2 out of 3	Eating (+cutting up your food)
elimination	using the toilet for urine/faecal eliminations	2 out of 3	Using the toilet (+ getting up or down)
transfers	lying down, sitting down, getting up	2 out of 3	Getting in or out of bed
indoor movement	with or without technical assistance	2 out of 3	Walking across a room
outdoor movement	same as above, but outdoors	2 out of 3	Walking across a room *or* Using a map to figure out how to get around in a strange place
distant communication	using the phone and tele-alarm	2 out of 3	Making telephone calls

The **APA** regulation requires individual to be at least 60 years old in order to make an application for the allowance. Moreover, the AGGIR categorization of dependency must correspond to, at least, GIR 4. We went through a rather complex algorithm[145] to population into 6 ISO-groups (Table 1-23). Individuals with difficulties in - roughly - at least two ADL are categorized in GIR 4 regardless of their mental health status. This holds whenever the limitations are reported with at least a B (or, 2) intensity-score. It should be highlighted that being limited in "moving inside the house" is not a sufficient limitation for eligibility when the only other loss-of autonomy concerns the "transferring" task. When the "moving" limitation is selected, there should be at least one further difficulty among "using the toilet", "dressing",

[143] A: The individual performs the task spontaneously, habitually, completely and correctly alone. B: The individual can perform the task alone, yet not spontaneously, and/or correctly and/or habitually and/or completely. C: The individual cannot perform, requires assistance or must have someone else's help to do the activity.
[144] SHARE respondents are asked not to report difficulties that are expected to last less than three months.
[145] Details are available in Dupourqué *et al.* (2012). A free AGGIR simulator is available at http://www.ibou.fr/aggir/

"eating" or "washing" in order to determine GIR 4. Regardless to other functional deficits in ADL, those who have cognitive impairment are assigned to, at least, GIR 2.

In order to be eligible to the **Social Assistance to seniors** (*Aide Sociale*), three conditions must be met by the applicant, as the next table highlights: a minimum age-requirement of 65 years old; the presence of limitations in activities related to personal hygiene and to small acts of daily livings as meals preparation and shopping for groceries (GIR 5 or GIR 6 classification); not being beneficiary of the Personalized Autonomy Allowance (APA) program. In order to simulate eligibility for Aide Sociale, we exploit the following SHARE information: "Bathing or showering", "Preparing a hot meal" and "shopping for groceries". In order to perform a prudent implementation of the regulation, we exclude the SHARE task "doing work around the house or garden", as it seems too generic with respect to the Aide Sociale rationale.

Table 1-49, French Aide Sociale eligibility rules

Aide sociale eligibility criteria	*description*	*SHARE information*
Age	At least 65 years old	Age
Vulnerability	Needing assistance with personal hygiene / meals preparation / shopping for groceries	Bathing or Showing / Preparing a hot meal / Shopping for groceries
Non-cumulation	Not receiving APA allowance	-

GERMANY – *Pflegeversicherung* (Section 1.5.7)

The assessment-of-need for the German LTC Insurance programme shares some similarities with the Austrian one, to the extent to which they are both detailed and they both assign to each task a measure of need-of-care expressed in units of time. The time guidelines are not significantly different between Germany and Austria, although the former programme adopts a measure in minutes/day while the latter's measurement unit is in hours/month. Nevertheless, the German regulation does not fix time-guidelines for the iADL limitations (which mostly correspond to the so-called "non basic activities" in the scale): indeed, Table 1-50 shows how some limitations have an "unspecified" time-requirement in the "need-of-care" column. The term "unspecified" refers to the fact that the need-of-care should be assessed on an individual basis by the evaluation-team. In order to be able to implement the whole German legislation on SHARE data, we chose to fill the limitations having "unspecified" requirements with the corresponding guidelines coming from the Austrian *Pflegegeld* regulation (moving inside the house, leaving and returning to house, shopping, cooking, doing housework). As an example, the "cooking" task has a time-requirement of 30 hours/month (1 hour per day) in Austria, which translates in 60 minutes per day in Germany.

Table 1-50, German Pflegeversicherung and SHARE

Basic care	*Limitations*	*Need-of-care (minutes per task)*	*Assumed daily need*	*SHARE tasks (binary: yes / no)*
✓	Washing body (upper- lower- body, hands)	20-25	40'	Bathing or showering
✓	Dental care	5	10'	Bathing or showering
✓	Combing	1-3	-	Bathing or showering
✓	Shaving	5-10	-	Bathing or showering
✓	Taking a shower	15-20	6'	Bathing or showering
✓	Bathing	20-25		
✓	Defecation and urination	8	32'	Using the toilet (+ getting up or down)
	If also dependent for: mobility inside the house	*8+2*	*40'*	

✓	Maintenance of urinary drainage bag / ostomy bag	2-4 each	-	-
✓	Incontinence	11	44’	Incontinence or involuntary loss of urine
✓	Bite sized food preparation	2-3	51’	Eating (+cutting up your food)
✓	Food in-take	15-20		
✓	Moving in and out of bed / changing positions	1-3 each	4’	Getting in or out of bed
✓	Dressing-undressing (upper- lower body)	Unspecified	12’	Dressing (+ putting on shoes and socks)
✓	Moving inside house	Unspecified	(30’)	Walking across a room
✓	Standing (transferring)	Unspecified	-	Getting in or out of bed
✓	Climbing stairs	Unspecified	-	Climbing one flight of stairs without resting
✓	Leaving and returning to house	Unspecified	(20’)	Walking across a room
✗	Shopping	Unspecified	(20’)	Shopping for groceries
✗	Cooking	Unspecified	(60’)	Preparing a hot meal
✗	Cleaning dwelling	Unspecified	(60’)	Doing work around the house
✗	Washing dishes,	Unspecified		
✗	Washing and ironing clothes,	Unspecified		
✗	Managing the heating	Unspecified		

Guidelines in brackets are taken from the Austrian legislation

The minimum requirements of daily care-needs in order to be eligible (*Pflegestufe I*) are an overall need for 90’ of help, with at least 45’ attributable to basic care tasks. Following the 2012 reform, individuals affected by cognitive impairment are given access to an additional allowance, irrespective of their functional disability status (even if they are classified as *Pflegestufe 0*, see that entitles to LTC services.

Table 1-29).[146] The SHARE survey contains information that allow to identify cognitive-impaired individuals, with the generated variable “Orientation in time (day, week, month, year)”. In particular, cognitive deterioration is defined as not being able to answer correctly to three (or more) out of the four questions (see Section 1.3.2 for details on SHARE data).

Disclaimer for empirical analyses in Section 1.4 and in Chapter Two:

Since our data have been collected from 2004 to 2006, we do consider the 2012 reform and therefore we do not account for cognitive impairment in defining eligibility in Germany.

ITALY – (Section 1.5.8)

The regulation for the CAF and the APA in Friuli – Venezia Giulia determines eligibility on the basis of the presence of limitations in ADL or cognitive impairment. The following table explicates the relationship with the SHARE survey, which is highly precise.

Table 1-51, Italian Friuli-Venezia-Giulia's CAF/APA and SHARE

Limitations	*evaluation*	*SHARE tasks (yes/no)*
Washing	yes/no	Bathing or showering

[146] Paaßen (2012)

Dressing	yes/no	Dressing (including putting on shoes)
Use of WC	yes/no	Going to the toilet
Transferring	yes/no	Getting in or out of bed
Continence	yes/no	Being urinary incontinent
Nutrition	yes/no	Eating
Cognitive impairment	-	Orientation in time (day, week, month, year): cannot answer three or more

The minimum eligibility level corresponds to having at least two losses in ADL *or* being cognitively impaired. The age requirement is 65 years old.

Toscana's PAC determines vulnerability through functional, emotional and cognitive assessments. As shown in Table 1-33, five ISO-groups of vulnerability are built by combining the BADL status, the cognitive status and the mood/behavioral status. Group 5 corresponds to those who have a bad BADL status, are severely cognitive impaired and severely disturbed, while group 1 gather those who have –roughly– a light deficit in one of the three dimensions.

The minimum requirement in order to be eligible is an ISO-group of 3 as well as an age of 65 or higher. As Table 1-33 illustrates, an ISO-level of 3 can originate from a light BADL status, if either the cognitive status or the emotional status are troublesome, or from a moderate BADL status with no behavioural or cognitive impairments. A "light" BADL limitation arises with a score of at least 8 points in the assessment of need described in Table 1-52, while a "moderate" level corresponds to a minimum score of 15.

Table 1-52, Assessment-of-need for BADL, Toscana's PAC

Limitations	*description*	Original Evaluation	*assigned value*	*SHARE tasks (yes/no)*
Washing	Needs help with bathing more than one part of the body, getting in or out of the tub or shower.	From 0 to 4	3 out of 4	Bathing or showering
Dressing	Needs help with dressing self or needs to be completely dressed	From 0 to 4	3 out of 4	Dressing
Use of WC	Needs help transferring to the toilet, cleaning self or uses bedpan or commode	From 0 to 4	3 out of 4	Using the toilet
Moving	Needs help in moving around the house, even when using mobility aids	From 0 to 4	3 out of 4	Walking across a room
Transferring	Needs help in moving from bed to chair or requires a complete transfer	From 0 to 4	3 out of 4	Transferring: getting in or out of bed
Moving in bed	Needs help in changing position when in bed	From 0 to 4	3 out of 4	Transferring: getting in or out of bed
Nutrition	Needs partial or total help with feeding or requires parenteral feeding	From 0 to 4	3 out of 4	Eating

Evaluation: 0 - independence; 1 - supervision only: 2 - light dependency; 3 - heavy dependency; 4 - full dependency

As already explained, we classify an individual as cognitive impaired when she is not able to provide three or more correct answers to questions regarding the current day, week, month and year. We label as "having behavioral issues" those respondents with an EURO-D value of 4 (or higher), which has been demonstrated to be associated with a clinically significant level of depression[147] (see paragraph 1.3.2 for detailed information on these SHARE data).

[147] Colombo *et al.* (2011). Primary reference: Dewey and Prince (2005).

SPAIN – (Section 1.5.9)

The assessment-of-need for the Spanish national LTC programme (Real Decreto 174/2011, Ministerio de Sanidad, Politica Social e Igualdad "BOE", num.42, 18/02/2011) is valid throughout the whole country, to guarantee equality at the national level. Degree and level of dependency are established by using an assessment scale approved by the Territorial Council of the System for Autonomy and Care for Dependency.

As it is detailed in the next Table, some of the tasks included in the Spanish assessment do not have a perfect match in the SHARE dataset. We always opted for the most coherent and prudent choice. As an example, with regards to the task of moving *outdoor* (which is an iADL), for which we lack a specific information in SHARE, we looked at the respondents' ability to move *indoor* (which is an ADL). We want to avoid the risk of labeling someone as non-autonomous in a task when he is in-fact able to do it. In this case, moving *indoor* clearly represents a prudent choice, since it is arguable that an individual who cannot move inside her house will not able to walk *outdoor*, while the vice-versa is not necessarily true.

The Spanish assessment-scale involves 10 *Activities* (plus one for mentally impaired individuals). Each activity comprises several *tasks*. Each Activity carries a weight (in bold, e.g., 16.8 for Eating and drinking). Each task has a coefficient (bounded between 0 and 1), representing the share of the Activity's weight carried by that task (e.g., Cutting up food has the 20% of the Eating and drinking weight). When an individual is mentally impaired, a further eleventh Activity is considered, while the remaining ten are assigned a new weight (in parenthesis). E.g., for a mentally impaired individual the weight of the Activity Eating and drinking is 10.

Table 1-53, Assessment of need in the Spanish Ley de Dependencia

Activities *– tasks*	*Weight*	*SHARE tasks*
Eating and drinking	**16.8 (10)**	Eating (+cutting up your food)
Recognize e/o reach the food served	0.25	|
Cutting up food	0.2	|
Using cutlery	0.3	|
Putting a glass to mouth	0.25	|
Control of physical needs	**14.8 (7)**	Using the toilet (+ getting up or down)
Go to the appropriate place	0.2	|
Dressing and undressing	0.15	|
Adopting the right posture	0.3	|
Cleaning oneself	0.35	|
Washing	**8.8 (8)**	Bathing or showering
Turning on and turning off taps	0.15	|
Washing hands	0.2	|
Using shower or bath tub	0.15	|
Washing lower part of the body	0.25	|
Washing upper part of the body	0.25	|
Other personal tasks	**2.9 (2)**	Bathing or showering
Combing hair	0.3	|
Cutting nails	0.15	|
Washing hair	0.25	|
Brushing teeth	0.3	|
Dressing	**11.9 (11.6)**	Dressing (+ putting on shoes and socks)
Recognize e/o reach clothes and shoes	0.15	|
Putting on shoes	0.1	|
Doing up buttons	0.15	|
Dreesing upper part of the body	0.3	|

Dressing lower part of the body	0.3	|
Maintaining health	**2.9 (11)**	
Request therapeutic assistance	0.15	Taking medications
Applying therapeutic measures	0.1	Taking medications
Avoiding indoor risks	0.25	Walking across a room
Avoiding outdoor risks	0.25	Walking across a room
Distress call	0.25	Making telephone calls
Mantenimiento de la salud	**9.4 (2)**	**-**
Changing position from lying to sitting on the bed	0.1	Getting in or out of bed
Sitting	0.15	Sitting for about two hours
Getting up from a chair	0.1	Getting up from a chair after sitting for long periods
Standing up	0.15	Walking across a room
Sitting down on a chair	0.1	Getting in or out of bed
Changing posture from a sitting position	0.1	Getting in or out of bed
Changing posture from bed	0.1	Getting in or out of bed
Changing centre of gravity of body in the bed	0.2	Getting in or out of bed
Moving inside home	**12.3 (12.1)**	**-**
Movements related dressing	0.25	Dressing (+ putting on shoes and socks)
Movements related eating	0.15	Eating (+cutting up your food)
Movements related washing	0.1	Bathing or showering
Movements not related to self-care	0.25	Walking across a room
Access to all settings of the rooms	0.1	Walking across a room
Access to all rooms	0.15	Walking across a room
Desplazarse fuera del hogar	**12.2 (12.9)**	**-**
Going out	0.25	Walking across a room
Walking around the house/buiding	0.25	Walking across a room
Walking short distances in known places	0.2	Walking across a room
Walking short distances in unknown places	0.15	Walking across a room *or* Using a map to figure out how to get around in a strange place
Walking long distances in known places	0.1	Walking across a room
Walking long distances in unknown places	0.05	Walking across a room *or* Using a map to figure out how to get around in a strange place
Housekeeping	**8 (8)**	
Cooking	0.45	Preparing a hot meal
Shopping (for food)	0.25	Shopping for groceries
Cleaning the house	0.2	Doing work around the house or garden
Washing clothes	0.1	Doing work around the house or garden
Only for patients with a mental illness or cognitive impairment:		
Making decisions	**(15.4)**	Orientation in time (day, week, month, year): cannot answer three or more

As explained in the paper, the Spanish legislation allows for different degrees of *loss-of-autonomy* for each of the aforementioned tasks. The need-of-support can be *special*, *full* or *partial*, to which is assigned a coefficient of 1, 0.95 or 0.9 respectively. These support coefficients must be multiplied to the coefficient of the task in which the limitations is experienced. E.g., if an individual has *full* limitations in cooking, she will be assigned a score of 0.45*0.95 within the dimension *Housekeeping*. Since in SHARE we do not have information about the intensity of occurring limitations, we prudently chose to always assign a need-of-support of 0.9. To sum up, the total score in the Spanish scale is constituted by the sum of the coefficient assigned to each task (in which the respondents reports a loss-of-autonomy), each being multiplied by the support-coefficient 0.9 and furthermore by the weight assigned to the corresponding Activity. An individual who reports only a limitation in cooking will have a total score of 0.45*0.9*8.

The law defines as vulnerable all the individuals with a total score higher or equal than 25.

CHAPTER TWO

Demand of Long-Term Care and benefit eligibility across European countries[148]

ABSTRACT

In the context of an unprecedented aging process, the role of domiciliary care for older adults is becoming increasingly essential. Designing effective and proactive policies of formal elderly-care is a major priority for the sustainability of the Long-term programmes in Europe. In this context, it is crucial to understand how vulnerable elderly individuals would adjust their informal long-term care utilization to changes in the formal-care provision. Although theoretical frameworks have been proposed, showing that a complementary relationship could arise when the Elderly exhibit an excess demand of care, empirical evidence is scarce, due to the endogenous nature of formal-care decisions. We propose an instrumental variable approach with a novel instrument: a variable that capture individuals' eligibility status to the LTC domiciliary programmes implemented in their own nation or region. That is, a dummy variable - being eligible or not - which has individual variation and which is grounded on the LTC regulation context at national or regional level. We are able to estimate an instrumented two-part model using waves 1 and 2 from SHARE, for non-institutionalised individuals in Austria, Germany, France and Belgium. Our results point at the lack of crowding-out of the informal- by the formal-care, thus suggesting the existence of a substantial unmet demand of LTC among the Elderly, which is supplemented with a combination of both formal and informal assistance.

2.1 INTRODUCTION

Due to an unprecedented process of population ageing, the demand of care by elderly Europeans with age-related vulnerability conditions is rapidly growing. With tightening public expenditure budgets, declining number of people in working age and socioeconomic changes in family contexts, substantial challenges on the supply of formal and informal Long-Term Care (LTC) need to be faced and are the subject of current policy debate. Indeed, the risk that the demand of care would fail to be met by effective, responsive and good-quality forms of social protection is high and worrisome (European Commission, d. o. E., Social Protection Committee, 2014). Proactive programmes of formal-care, especially home-based, are being designed (and slowly introduced), to promote health-literacy, prevention, rehabilitation, re-enablement, as well as age-friendly environments, ultimately fostering financial sustainability, effectiveness and adequacy of the systems. This would help elderly individuals to better adapt to the ageing process, thus delaying the occurrence of frailty and disability. Demand of LTC would grow slower, while investments in the "Silver Economy"

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would increase the supply of LTC from healthy-aged informal and formal caregivers (Rechel *et al.*, 2013; van Leeuwen *et al.*, 2014).

In order for these Healthy-Ageing Agendas to be successfully implemented, it is crucial to understand how would elderly vulnerable individuals adjust their informal long-term care utilization to changes in the formal-care provision, which is the research question of this paper. Empirical studies rarely tried to predict whether an increase in formal-assistance (hopefully with the aforementioned characteristics) would result in a crowding-out, rather than in a subsequent increase of informal-care. In the former case, there would be a reduction in the burden of care on informal caregivers) and the overall care-utilization would remain almost constant, although the formal-care provision could be more efficient in performing the tasks that were previously done through the informal source. In the latter, the net aggregate protection for the elderly adult would increase. From a theoretical perspective, what discriminates between the two effects is: (1) whether there exists a residual need of care that was previously unmet; and (2) whether the formal- and the informal-care provide similar or different services (Bonsang, 2009; Stabile *et al.*, 2006). This research question deals with a highly relevant matter, since it can offer valuable insights on the care-utilization mechanisms, and help policy maker and geriatricians design more effective programmes. Applied analysis on this topic struggle with the theoretical cautioning on the endogenous nature of the formal-care utilization choice with respect to the informal-care. In empirical terms, this implies the need of relevant and exogenous instrumental variables that could correct for this potential bias. So far, this task has been proven to be problematic and demanding, and most of the economic studies focused on the opposite direction of causality, i.e., the effect that a modification in the informal-care provision (usually, by children only) reflects in formal-care utilization. In order to concentrate on the most policy-relevant control variable (formal-care), we investigate the regulation frameworks that characterize public domiciliary LTC programmes in Europe. Besides being different in financing models, degree of universalism and centralization, LTC systems differ in how they assess elderlies' vulnerability conditions, and in the eligibility rules that determine accessibility to a program, either in-kind or in-cash. Indeed, assessment and eligibility rules are compulsory gateways to publicly funded long-term care, and yet they have not been extensively documented. There is an increase need to account for context variations in comparative and applied work, in order to go beyond the common inclusion of country dummies to account for cross-country differences (Bakx *et al.*, 2014; Eleftheriades & Wittenberg, 2013). After reviewing main national and regional LTC regulations in Europe, we implement this information on SHARE microdata, thus building a dichotomous individual-specific variable that identifies elderly individuals who are eligible to public programmes (in-kind or in-cash) of formal home-care. Eligibility is exogenously determined according to respondents' own country and/or region regulations. We, therefore, use this instrument, which is shown to be strongly relevant under many specifications, in an instrumental-variable two-part model (Dow & Norton, 2003; Duan *et al.*, 1983). We show that changes in the formal home-based care utilization by elderly adults positively and significantly affect informal home-care provision from family and friends. This positive effect, that ultimately increases the individual's overall care-utilization, suggests the existence of a substantial unmet demand of LTC among the Elderly, which is supplemented with a combination of both formal and informal assistance. According to Stabile *et al.* (2006), indeed, such a result hints at the existence of an insufficient supply of *public* LTC, which forces individuals to buy additional care from private providers. Furthermore, the positive and significant relationship could, at least partially, derive from the different intrinsic nature of the formal- and the informal-care services, which are likely to be imperfect substitutes. Overall, this result shows that further social-protection is needed to address the LTC risk, both with public and private forms, enhancing accessibility, affordability and accessibility of care. Moreover, endogeneity of the formal-care decision

is detected with respect to the aggregate supply of assistance by respondents' children, relatives, friends and neighbours; when the informal-care is narrowed to the assistance supplied by children only, as in most of the recent literature on the topic, the exogeneity cannot be rejected. This confirms the relevance of accounting for the interplays between all the informal care providers, as recently stressed by (Kalwij *et al.*, 2014).

The growing economic relevance of formal LTC can be retrieved by recent data. (OECD, 2013b) highlights that, on average across OECD countries, over 12% of the elderly population receive some long-term care services at home or in institutions in 2011. Indeed, in response to most people's preference to receive LTC services at home, together with the undergoing policies for promoting Healthy Ageing through proactive formal-care, an important trend in many OECD countries over the past decade has been the rebalancing of care-programmes and benefits from institution- to home-based care. In most countries for which trend data are available, the share of people receiving long-term care at home in the total number of LTC recipients has increased over the past ten years. On the expenditure sides, data underline a substantial heterogeneity in how European countries have implemented their LTC services. The OECD Health Statistics data for 2012 show that expenditure on LTC (home-based plus institutional/residential care) lies above 3.5% of GDP in the Netherlands and in Sweden, while being around 2% in Belgium and in Italy, and around 1% in France, Austria and Germany. Although definitions of LTC, and therefore expenditure data, are still not fully consistent across countries, e.g., with respect to the boundaries between health and social LTC (OECD, 2013b), projections stress that spending (as a share of GDP) will double by 2060 in Europe (de la Maisonneuve & Martins, 2013). Meanwhile, home-care spending is expected to increase more than for residential care (a review of policies for home-based care in Europe can be found in Genet *et al.* (2011)). On the determinants of LTC spending, as well as on the connected role played by Healthy Ageing policies, see, e.g., de Meijer *et al.* (2011) and Rechel *et al.* (2013). Although the stated preferences of individuals are mixed[149], the family pillar is still the backbone of LTC systems in all OECD countries where, on average, over 15% of people aged 50 and over provided care for a dependent relative or friend in 2010. This proportion reaches about 20% in Belgium and Italy. Statistics show that women informal carers are frequently women (over 60% across countries), and that, to a large extent, people providing regular informal care have a family relationship with the care recipient. Indeed, informal caregivers are typically spouses, middle-aged daughters or daughters-in-law (European Commission, d. o. E., Social Protection Committee, 2014; OECD, 2013b).

The paper is organised as follows. We first discuss the relationship between the formal and the informal provision of care (2.2.1) and the identification strategy grounded on a novel instrumental variable based on a review of LTC eligibility frameworks in Europe (2.2.2). We then present the SHARE dataset and the variables which will be used in the empirical analysis (2.2.3), as well as some descripted statistics on our instrument and on the population eligible to LTC (2.2.4). Section 2.3 describes the two-part model adopted as main specification. Next, we test the instrument's goodness-of-fit (2.4.1) and present our results (2.4.2, 2.4.3). Several robustness test are performed in Section 2.5, while Section 2.6 includes a discussion of the main results as well as an additional analysis on the other direction of causality.

[149] E.g., a recent national survey in US reports that 40% of respondents prefer professional care while 31% prefer care from family (Brown, Goda, McGarry, Health Affairs, 2012)

2.2 CONCEPTUAL FRAMEWORK

2.2.1 Relationship between formal and informal care

Long-Term-Care policies aim at covering the higher vulnerability risk that specifically affect the elderly population, characterized by declining functional and cognitive abilities, and a higher propensity to suffer from multiple and concurrent deficits than younger individuals. These deficits can, in turn, quickly deteriorate their autonomy and independence in carrying out basic activities and therefore affect elderly adults' ability to maintain an acceptable level of well-being. Among the characteristics of ageing there are cellular and physiologic deterioration, increased mortality with age, increased vulnerability to disease and decreased ability to adapt to stress.[150] Indeed, the OECD acknowledge that protecting the right to a life in dignity of frail older people is becoming a major policy challenge (OECD (2013a), Foreword), and defines the Long-Term Care (LTC) as a range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent for an extended period of time on help with basic activities of daily living (ADL). This personal care component is frequently provided in combination with help with basic medical services such as nursing care (help with wound dressing, pain management, medication, health monitoring), as well as prevention, rehabilitation or services of palliative care. Long-term care services can also be combined with lower-level care related to domestic help or less demanding tasks.[151] LTC can be provided at the recipient's own dwelling (*home-based care* / *domiciliary care*) rather than in nursing-homes or residential care-facilities (*residential-* / *institutional care*).

It is common to differentiate LTC providers according to their (lack of) formalization, i.e., a contract or an official agreement between the care receiver and the caregiver. Indeed, the *formal-care* includes all care services that are provided in the context of formal regulations, such as (but not necessarily) through contracted services, mostly (but not necessarily) by trained care workers, that can be paid out of pocket or through reimbursement by public (or, less often, by private) institutions. What characterizes formal care-provision is its acknowledgment by the Social or Health departments at the proper governmental level. Examples of formal-care would span from nursing interventions by professional public medical trained operators (reimbursed by the national health-system), assistance by social workers from NGOs affiliated to the public LTC programmes (reimbursed by the care recipient through a public voucher) or by private professional-caregivers paid out-of-pocket by the care-recipient (possibly using a publicly provided cash-allowance). *Informal-care* is, conversely, a term that refers to the unpaid (and untraceable) assistance provided by partners, relatives (especially children), friends or neighbours who hold a significant personal relationship with the care recipient.[152]

This paper's research question relies on the consequences that an increase (or a decrease) in the utilization of formal home-care can have on the informal-care provision, and therefore on the overall amount of home-care (for a review of home-based assistance in Europe see, e.g., Genet *et al.* (2011)). Our contribution to the existing literature relies on

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[150] Determinants of vulnerability such as conditions of frailty, dependency/disability or comorbidity were illustrated in the first Chapter of this thesis, section 2.

[151] The ADL taxonomy (as well as the iADL) is discussed in Chapter 1, paragraph 1.2 as well as in the Appendix 1.7.1

[152] Although these definitions are widely accepted and adopted in the literature, potential misspecifications still exist, since there exist paid caregivers that are un-declared to social security, e.g., the illegal nursing auxiliary staff (relevant phenomenon in Austria and Italy, see, e.g., Simonazzi (2009)) or the un-declared use of publicly provided cash-allowances to pay informal caregivers or to buy services unrelated to the LTC).

a novel instrumental variable approach (paragraph 2.2.2) which allows us to estimate a rarely studied (due to identification issues) but highly relevant direction of causality, on a population of 9,000 individuals aged 60+ and living in Austria, Belgium, France and Germany.

The relevance of our economic question is detailed, to various extents, in Christianson (1988) Pezzin *et al.* (1996), Stabile *et al.* (2006), Motel-Klingebiel *et al.* (2005), Viitanen (2007), Golberstein *et al.* (2009), Kaye *et al.* (2010), Fontaine (2012), Goltz and Arnault (2014) and European Commission, d. o. E., Social Protection Committee (2014). Policy intervention on formal-care can, broadly speaking, intervene on LTC availability, by implementing new programmes or terminating existing ones. It can intervene on LTC accessibility, i.e., on programmes' coverage, typically by changing eligibility rules as it was discussed in Chapter One. Lastly, a policy can intervene on the intensity of the utilization offered to eligible individuals, through changes in the amounts of cash-allowances/reimbursements or in the amount of care provided in-kind through nurses, social workers or affiliated NGOs.[153] Anyway, after institutional changes have taken place, elderly individuals will be faced with either a reduced or an increased supply of formal-care. Our main question relates to how this potential change would affect the overall long-term care received by the dependent adult, that is wondering whether a, say, increase in the formal-care provision would: (1) substitute for the existing informal-care already being provided by family members, friends and neighbours, or; (2) be complemented by the family pillar of social protection, therefore raising the overall amount of care and fulfilling what we would call a previously unmet demand of care. This issue is particularly important in the context, mentioned in the introduction, of a changing LTC framework where higher priority is given to home-based services for elderly adults, rather than on residential-care. Indeed, formal home-care is not conceived to just provide help for limitations experienced by the dependent individual but, rather, to be a vehicle for realizing countries' Healthy (Active) Ageing agendas, through effective information, prevention and befriending services that would ultimately improve elderlies' quality of life and delay their vulnerability process (Rechel *et al.*, 2013; van Leeuwen *et al.*, 2014).

Several contributions in the health-economics literature have helped to formalized the economic relationship between the formal and the informal sources of elderly care, a recent and influential one being Van Houtven and Norton (2004). Courtney Van Houtven and Edward Norton modeled a family decision-making process where altruistic children choose the optimal provision of informal care to provide to their parents who, in turn, decide the optimal quantity of care to receive from formal-providers[154]. Adriaan Kalwij, Giacomo Pasini and Mingqin Wu (Kalwij *et al.*, 2014) adapted the model to allow for multiple caregiving sources (relatives, friends and neighbours, besides children), thus designing a theoretical framework which is suitable for our analysis. In the framework of the family decision-making process, the health status of the elderly adult is modeled as a "production function" with input factors being the amount of care received by formal and informal providers.

Mark Stabile, Audrey Laporte and Peter Coyte (Stabile *et al.* (2006)) developed a choice-theoretic model of household decision-making where care receivers and care givers select the amount of formal and informal care in order to achieve the optimal level of health for the care receiver. Formal and informal Health is measured in terms of the ability in

[153] Paying higher benefits to low-income dependent adults as in France and Austria is a possible way of ensuring access to care for those who need it without excessive public expenditures (see Colombo and Mercier (2012))

[154] As pointed out in the literature, the provision of informal-care could be also the result of a strategic game involving future bequests. Although this motivation is excluded in the models hereby mentioned, the hypothesis of pure altruism is hardly believable (Alessie *et al.* (2014)). Nevertheless, no evidence has been provided for pure exchange-driven behavior, either.

performing activities of daily living. Formal care can be bought by private providers (M2, at a price P) rather than by public sources (M1, that would cost P-S where S is subsidy, but that can be consumed up to a maximum amount *m*, which represents the publicly financed allocation of care). The household's optimization problem has three elements: the choice of the optimal A* (such that the marginal benefit of ability equal the marginal cost of its production); the optimal selection of public-, private- and informal-care to achieve A*, given their prices; and the choice of leisure time L (such that a marginal benefit from increasing leisure would equal the marginal cost of forgone market goods and services). The budget constraint involves time allocation between leisure, work and caregiving activities (with an opportunity cost W), besides expenditure for consumption and formal care. Private and public formal care are perfect substitutes (i.e., they are assumed to be equally productive in care-provision). If a subsidy S is implemented, then, given that individuals' choice is cost-efficient, they will arguably exhaust the available public care before buying it on the market. That is, if we observe that if the household consumes less than its allowable limit of publicly subsidized service then it must be that no private service is additionally purchased. We are interested in the effects that an increase in the maximum publicly provided care *m,* has on the allocation of informal care. The theoretical model predicts that, if the household were already exhausting all the publicly provided care *m* (M1 = *m*) and were additionally buying private care M2>0 (M = *m* + M2), the increase in *m* would increase the household non-wage income (since a part of the previously purchased-care can be obtained at a lower cost P-S) that would translate in an increase in the total formal-care M and in an increase of informal care-giving. Ultimately, this would lead to a higher level of production of ability A. If, conversely, a household were consuming public-care at its limit (M1 = *m*), while not purchasing private-care (M2 = 0), an increase in the generosity of the public home care program (higher *m*) would yield a substitution effect that lowers informal care-giving activities.

The results from Stabile *et al.* (2006) can be re-interpreted in those cases where, like in most health-survey data, we observe the amount of formal and informal-care received by elderly individuals, while we do not have information on the prices of formal-care or on the specific subsidies connected with it, nor on the source of formal-care between public and private providers.

For simplicity, let us assume that, in equilibrium, an individual is able to obtain all the care he needs, depending on her preferences and medical status, i.e., we assume that her observed care-utilization matches his latent demand of care. Suppose that an increase in the formal-care observed provision occurs, holding constant the medical conditions and preferences: this can happen, e.g., because of public interventions that increase the intensity (e.g., a reform that increases the allocation of in-kind services) or reduce the cost of care (e.g.. higher public reimbursements, either to the care-recipient or to the formal provider, or richer public vouchers). In this situation, we would expect a reduction in the informal-care utilization, i.e., a substitution effect. The individual would, again, entirely fulfil her need-of-care, but under a different allocation. The reduction in informal-care will be proportionally higher than the increase in formal-care if the latter is more efficient than the former in performing the same help-activities.

Suppose that, conversely, the latent demand of care is not fully satisfied at the equilibrium point, i.e. the observed care-utilization is lower than what the individual would need. A constrained utilization can result from several reasons, including budget constraints (e.g., prices of formal-care are too high because public reimbursements are low or zero) or limited-supply (e.g., because formal-care is not available or not accessible). When formal-care provision increases, because of lower prices or higher supply, the previously unmet demand-of-care is now satisfied, at least partially. In this case, no substitution with informal-care is predicted, (a different effect could occur if the increase in formal-care

would be so strong to exceed the unmet demand). Indeed, a positive effect on informal-care could be observed, since higher utilization of formal-provision could raise the awareness of both care-recipient and informal providers on the existing occurrence of unmet need-of-care, and therefore stimulate a further provision of informal assistance.

So far we implicitly assumed that formal and informal-care are intrinsically perfect substitutes from an operational point of view, i.e., they address the same kind of loss-of-autonomy. We already mentioned that formal-care can be divided in a skilled part (personal/nursing care) and a relatively unskilled part (domestic-help). Conversely, a distinction of informal-care types is more difficult, due to its multidimensional nature (Bonsang, 2009). If the relationship under study is between skilled formal-care and informal-care, it is possible that these two sources of care are not perfect substitutes, i.e., the informal-caregiver cannot perform exactly all the tasks as a formal-operator. In this case, the two care-provisions are like two separate goods, and an increase in the utilization of formal-assistance could result in an increase in the informal-assistance because of a spillover effect that raises awareness on the elderly vulnerability status, similarly to the previous example.

Our analysis focus on the hours of long-term home-based care for the elderlies (HC), which is constituted by formal (FHC) and/or by informal (IHC) care. In particular, we limit our analysis to the skilled formal-care (personal/nursing care), which is the most demanding type of help and which is commonly regulated, through reimbursements or direct provision, by public Health-care or Social Policy departments.

The aforementioned theoretical approaches lead to the estimation of a reduced-form equation for the demand of informal (rather than formal) care, having the utilization of formal (rather than informal) care as main regressor:

$$TIHC_i = \gamma_0 + \gamma_1' HS_i + \gamma_2' CV + \gamma_3 FHC + \varepsilon_i \tag{2.1}$$

where *TIHC* is the total amount (e.g., yearly hours) of informal home-care, *FHC* is the total amount (e.g., yearly hours) of formal home-care, *HS* is a set of health-variables and *CV* is a set of socio-economic control variables (a detailed description of the variables will be presented in Section 2.3). We are interested in estimating an equation of the total informal-care provision, where an additional covariate is the formal personal/nursing care utilization. Our research question relies on the identification of the effect of a variation in the provision of formal-care on the care-provision of the other sources of care (informal help from children, relatives, friends and neighbours).

In order to offer comparable results with recent literature that mostly focused on informal-care from children[155], we will also estimate a modified version of (1) with just hours of children informal home-care (*CIHC*) as dependent variable (see Sections 2.3 and 2.4).

The relationship between formal and informal care can vary with the type of formal care considered. This issue is addressed by Bonsang (2009), investigates the opposite direction of causality, i.e., the effect of informal-care on formal care, and argues that "informal care is likely to be a substitute for formal care that requires low level skills such as grocery shopping or cleaning the house. However, this substitution effect may not apply to formal care demanding

[155] This is also due to the fact that most literature treats informal-care as endogenous determinant of formal-care (the opposite direction of causality with respect to ours). Characteristics of respondents' offspring, usually included in health-surveys, have been found to be good instruments for the part of informal-care coming from children. Conversely, it is difficult to adopt plausible strong instruments for help by relatives, friends and neighbours, whose contributions as caregivers are, therefore, not included in the "informal-care" variable.

higher level skills such as personal or nursing care". While disentangling informal-care in skilled and unskilled tasks constitutes a hard empirical issue, due to its inherent lack of specialization, a distinction is usually done for the formal-care, between skilled (nursing/personal care) and unskilled (domestic help), as mentioned at the beginning of this Section. Given that our paper focus on the consequences of changing policy rules for the formal LTC programmes, and given that these policies mainly affect *skilled* care-provision, we limit our attention on the nursing/personal formal-care, not accounting for the formal provision of domestic tasks (which is, also, relatively more likely to be provided through the black market, see note 152). Furthermore, decision about the hours of formal- and informal care to receive are likely to be affected by omitted variable bias, when there is a latent effect (unobservable to the researcher) that can influence both choices (e.g., unobserved health-characteristics or the care recipient's preferences toward receiving help by well-known friends or relatives rather than by strangers). It is also plausible that these choices occur simultaneously, thus determining a reverse causality issue in empirical estimation: the observed provision of informal-care can be driven by the choices regarding the formal-care, and vice versa.

Potential endogeneity of formal-care in the informal-care equation raise important difficulties in the empirical strategy to identify the parameter of interest (γ_3). Indeed, health-economics literature rarely addressed this research question, due to the difficulty of finding a plausible identification strategy (e.g., an exclusion restriction) to correct of the endogeneity bias. Stabile *et al.* (2006) and Goltz and Arnault (2014) are recent examples of instrumental variable approaches on this topic. The former study, previously mentioned for its theoretical model, empirically investigates how the generosity of public home-care programmes in Canada affect care-giving activities. Their results suggest that an increase in the generosity of public home care programs (at provincial level) will increase care-giving activities among households who were previously exceeding the public care-allocation while a decrease effect will occur among those that were exactly consuming the public allocation of care. Three exogenous variables are used as instruments for generosity of the public home care program: (1) the share of the population aged 65 and older in each province over time; (2) the level of provincial spending on education in each province over time; and (3) the provincial tax rate as a share of federal taxes in each province over time.[156] Potential limitations of this study are detailed in Golberstein *et al.* (2009). Goltz and Arnault (2014) estimate a bivariate-tobit model in order to know whether or not incentives to use more formal home care would relieve informal caregivers in France, on a sample of 1687 singles aged 60+, excluding all completely autonomous people (they define "loss-of-autonomy" with having at least one ADL, one iADL, or suffering from Alzheimer's disease. In order to build an instrument for weekly-hours of formal home-care by district, questionnaires were sent to each French Council District to obtain information about formal home-care prices. The authors use the answers to build a district-level variable related to average out-of-pockets expenses (of individuals) for formal-home care. Their results show that the burden of informal care (in terms of hours of care provided) would decrease if the elderly dependents were faced with lower formal home-care prices. Thus, financial incentives to use more formal home-care would relieve informal caregivers.

Most of the empirical work has, conversely, focused on the opposite direction of causality, that is, how a change in the informal-care utilization can affect the probability and/or the intensity of receiving formal-care. Typical findings of this literature are that informal care can delay admission into nursing homes (Charles & Sevak, 2005; Lo Sasso & Johnson, 2002), as well as it substitutes for total - skilled *and* unskilled – formal home-care (Bolin *et al.*, 2008; Van

[156] The F-statistic on the excluded instruments is 5.97.

Houtven & Norton, 2004) and would reduce Medicare expenditures for long-term care (Van Houtven & Norton, 2008). The substitution effect is stronger when recipient's vulnerability level is low, while a complementary relationship exist for higher levels of disability (Bonsang, 2009). An interesting findings related to our research question is that, when skilled formal-care is considered, the relationship turns positive (complementarity) and significant (only at the extensive margin in (Bonsang, 2009)), though negligible (Balia & Brau, 2013).

2.2.2 A novel instrument: the role of LTC eligibility frameworks

In order to account for the potentially endogenous nature of the formal-care utilization decision, we evaluate the change in the hours of informal-assistance caused by a change in the hours of formal-assistance by exploiting individual-specific information on eligibility status to local public programmes of home-based care. The estimation of causal effects through instrumental variable strategies where the eligibility status is introduced to solve for the endogeneity of the regressor of interest has been often presented in the economic literature[157] but not, to the best of our knowledge, in Long-term Care empirical applications, due to the substantial heterogeneity and – often – fragmentation in the regulations.

Why are insights on LTC eligibility frameworks useful to our empirical issue? The analysis developed in Chapter One of this dissertation provides us with least two reasons. First, access to formal long-term home-care is by and large not discretionary (at least in principle) for older adults in Europe. Every main public LTC programme across countries or regions requires elderly individuals to meet certain criteria in order to become eligible to the benefits, i.e., a condition of "objective vulnerability" must be ascertained (this holds also for main private LTC insurances, which often borrow their eligibility criteria from the public regulations). Second, the definition of "objective vulnerability" is highly heterogeneous among programmes (both within and between countries).

Indeed, utilization of formal LTC require some degree of interaction between the applicant and the institution providing the benefit (the nature of the benefit, i.e., in-kind rather than in-cash, is irrelevant for our argument). A commonly adopted approach describes this interaction under three perspectives: the *availability* of the service, its *accessibility* and its *utilization* (i.e. realized accessibility) by the applicant (see Levesque *et al.* (2013) for a detailed review of this approach and its variants). *Availability* pertains to the existence of a LTC programme in the nation / region / community where the applicant lives. With respect to the public framework, this points to the existence of a legislation that regulates the programme. *Accessibility* refers to the circumstances determining whether an individual can or cannot benefit from the programme, given her health- and socio-economic characteristics. *Utilization* (or *realized accessibility*) refers to the extent to which an individual can benefit from the programme, given that entitlement was granted. In the context of this dissertation, *availability* and *accessibility* were first detailed in Chapter One, then adopted in this Chapter as an identification instrument to analyse patterns of *utilization* among older Europeans.

Although access to LTC home-based care is affected by individuals circumstances[158], its main determinants reside in the eligibility rules characterizing each programme. As reviewed in Section 1.5, main public LTC programmes in European countries define access to service in two sequential steps: first, an assessment-of-need is performed in order

[157] E.g., Battistin *et al.* (2009), who investigate the size of the consumption drop associated with retirement in Italy by exploiting the exogenous variability in pension eligibility.

[158] E.g., having higher income or wealth allow to sustain higher care-costs; educational attainment can improve or impede access to care among "objectively vulnerable" elders, as shown in Section 1.4

to build a "vulnerability profile" of the elder applicant; second, a decision on her eligibility status is taken by comparing the vulnerability profile with a set of eligibility rules defined by the legislation. Furthermore, the eligibility status conveys two sorts of information: at the extensive margin it discriminates between eligible and non-eligible individuals (i.e., having *access* to the program, or not) while at the intensive margin it characterizes the individual degree of eligibility and, therefore, the extent to which a recipient can benefit from the programme (i.e., the *utilization* of the service). What need to be stressed is that assessment and eligibility processes and criteria act as compulsory gateway to long-term support in all countries, while they also perform other functions in some cases, such as acting as a pathway to reablement or to care planning (Eleftheriades & Wittenberg, 2013). Hence, these regulations' characteristics are likely to be crucial factors in determining individuals' access to and utilization of formal home-based care in Europe.

The way in which the vulnerability assessment and the eligibility processes are operationalized varies significantly in Europe. While we refer to Section 1.3 for a comprehensive discussion, the analysis in Chapter One could be summarized by the "one-size does not fit all" motto. Relevant heterogeneities exist among countries (and even within countries, when multiple nationwide programmes are implemented) on the very issue of defining vulnerability. Even when restricting the perspective to a comprehensive set of functional (mostly ADL and iADL tasks) and cognitive limitations[159], it appears that there is almost no regulation that includes them altogether in the assessment-process, to detect a vulnerable condition. Moreover, the health-outcomes are often un-equally weighted within an assessment-scale: some limitations are given more importance than others in determining eligibility, and there are legislations that characterize some deficit as necessary and/or sufficient for eligibility. As a consequence, an individual with a given medical-profiles may well result to be eligible for LTC services under one legislation while being ineligible under others.

Coming back to the endogeneity issue at stake, we aim at building an individual-specific dichotomous variable for eligibility status, which takes value 1 if the individual fulfils the minimum requirements of at least one LTC programme implemented in her region/country of residency (i.e., she is *eligible* to LTC home-care services) and 0 otherwise. This variable would then be used to instrument our potential endogenous regressor (annual hours of formal home-care utilization). It is important to notice that all the eligibility regulations in the selected set of countries reviewed in Chapter One are *carer-blind*, i.e., eligibility is need-tested (through validation of ADL- iADL- and cognitive limitations), while no role is played by other factors like informal-care availability, quality of family or neighbourhood environment, social-network of the patient. Monetary resources are sometimes taken into account for redistributive purposes (determining the monetary amount of the benefits), but they do not have discriminatory power to define eligibility.[160]

In light of previous considerations, we believe that information on the eligibility status to LTC home-based care can provide strong identification power to our analysis, when used as instrument of formal home-care utilization, for several reasons: (1) eligibility status is exogenous, in that it is determined by a medical team following clear-cut regulations, based solely on medical-status.[161] In this respect, eligibility per se should not influence informal-care

[159] Although medical literature describes frailty as determined by a larger set of symptoms, nearly all studies on frail individuals report deteriorations in ADL and iADL, that are therefore considered to be effective measures of the need-of-assistance (Pel-Littel *et al.* (2009)).

[160]. See Eleftheriades and Wittenberg (2013) for a discussion on the implications that adopting "carer-blind" rather than "carer-sighted" eligibility rules might have for the equity and efficiency of the care system, for incentives to provide unpaid care and for costs.

[161] We are neglecting the possibility that individuals consistently fake or aggravate their health conditions in order to become eligible, thus deceiving multi-professional assessment units.

provision (our dependent variable); (2) eligibility is relevant to formal-care utilization for the aforementioned reasons but does not perfectly match the endogenous utilization of formal-care (a perfect-overlapping instrument would raise endogeneity issues); (3) eligibility has variability across countries or regions, so that the same individual may be labelled as eligible under one legislation while being non-eligible under others; and (4) it is defined at the individual level in our sample.

The methodology followed in building the instrument is detailed in paragraph 2.2.4 and in Section 1.7.3.

2.2.3 Data and sample selection

We use data from the first and the second wave of SHARE[162] (Survey on Health, Ageing and Retirement in Europe), a European multidisciplinary survey on individuals aged 50 or older and on their spouses. Data were collected in 2004 and 2006, respectively, through a computer assisted personal interviewing (CAPI) program; they cover a wide variety of disciplines, such as demography, economics, epidemiology, psychology and sociology. The original sample consists of 63,948 observations from 13 European countries, plus Israel. The design of SHARE is based on the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). We refer to Börsch-Supan *et al.* (2005) and Börsch-Supan and Jürges (2005) for a detailed review of the survey, its methodological details and the sample procedures.

SHARE data are particularly useful to investigate individual choices on health-care utilization. The survey provides detailed information about respondent's morbidity and disability status, based on self-reports of objective limitations and health conditions.[163] In particular, it contains a set of questions that allow us to build, for each individual, a simplified medical-profile (Table 1-3) comparable with the LTC regulations of the countries in our sample (see Appendix 1.7.3). Respondents are asked to report their dependency status in performing fourteen activities of daily livings[164], which conform to the ADL and iADL taxonomies by Katz *et al.* (1970) and Lawton and Brody (1969). Furthermore, the survey includes ten specific questions on *mobility limitations*[165]. All the aforementioned tasks are assessed on a dichotomous scale: a limitation can either occur or fail to occur, but no intensity is measured.

Depression and loss of orientation are covered by two different set of variables. *First*, the questionnaire assesses a set of 12 mood- and behavior-related conditions (pessimism, depressed mood, suicidal thoughts, guilt, trouble sleeping, loss of interest, irritability, fatigue, inability to concentrate, lack of appetite, incapacity of enjoyment, tearfulness), that

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[162] See note 39 for a disclaimer on utilization of SHARE data.
[163] All the questions are worded in order to be comparable across countries.
[164] These are: (i) dressing, including putting on shoes and socks; (ii) walking across a room; (iii) bathing or showering; (iv) eating, such as cutting up one's food; (v) getting in and out of bed; (vi) using the toilet, including getting up and down; (vii) using a map to determine how to get around in a strange place; (vii) preparing a hot meal; (ix) shopping or buying groceries; (x) making telephone calls; (xi) taking medicines, following medical prescriptions; (xii) doing work around the house or garden; and (xiii) managing money, such as paying bills and keeping track of expenses. An additional question covers the dependency over incontinence, or the involuntary loss of urine. Details on ADL and iADL are included in Appendix 1.7.1.
[165] The tasks covered are: (i) walking 100 meters; (ii) sitting for about two hours; (iii) getting up from a chair after sitting for long periods; (iv) climbing several flights of stairs without resting; (v) climbing one flight of stairs without resting; (vi) stooping, kneeling, or crouching; (vii) reaching or extending your arms above shoulder level; (viii) pulling or pushing large objects like a living room chair; (ix) lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries 10; (x) picking up a small coin from a table.

are then summarized in the EURO-D scale[166], whose values range from 0 to 12 depending on the number of occurring symptoms. A EURO-D value of 4 (or higher) has been demonstrated to be associated with a clinically significant level of depression.[167] *Secondly*, four questions on mental orientation and coherence ask respondents to report the current date, month, year and day of week; the number of correct answers is summarized in a generated variable (*orientation*) whose values range from 0 to 4 (the higher the better oriented). We choose to label as impaired (*orientation impairment*) those respondents who gave zero or one correct answers.[168]

As for Long-term care (LTC) services, SHARE encompasses both formal and informal assistance performed at a patient's own dwelling. Home-care is defined, conforming to OECD guidelines (OECD, 2013a), as a range of services required by persons with a reduced degree of functional capacity, physical or cognitive. *Formal home-care* refers to the assistance provided in the context of formal employment regulations, such as through contracted services, by professional care workers (Colombo *et al.*, 2011). Such services can be paid either out-of-pocket by the care-receiver or through public or private care-insurance schemes. SHARE distinguishes between *personal/nursing care* (help with basic activities of daily living, medical services such as wound dressing, pain management, medication, health monitoring, prevention, rehabilitation or services of palliative care), *domestic help* (lower-level care provided by low or unskilled workers, typically related to help in instrumental activities of daily living), and *meals-on-wheels* (services that deliver meals to individuals at home). Respondents are asked to report whether they made use of any of these three care-services in the last twelve months because of health problems. Specifically, for *personal/nursing care* and *domestic-help*, information are collected on the number of weeks (per year) and the average number of hours (per week) of care received, from which a continuous variable for the average annual number of hours of formal care received per year can be built.

Informal care is defined as unpaid help received from outside the household from any family member, friend or neighbour. The informal help received is either categorized as *personal care* (help with difficulties in ADL such as dressing, bathing or showering, eating, getting in or out of bed, using the toilet), *help with practical household tasks* (mainly iADL-related tasks such as home repairs, gardening, transportation, shopping, housework) or *help with paperwork* (such as filling out forms and settling financial or legal matters). Recipients indicate the nature of the relationship with the caregivers[169], the frequency (daily, weekly, monthly or annual) and the average number of hours received. In order to build a continuous variable for the average annual hours of informal care received, we follow the methodology in Bolin *et al.* (2008): "if the respondent answered that he/she received informal care almost every day, we multiplied the number of hours received on a typical day by 365. If the respondent answered almost every week, the number of hours per week was multiplied by 52. In a similar vein, if the respondent answered almost every month, the number of hours per month was multiplied by 12. Finally, if the respondent answered that he/she received informal care less often than

[166] Prince *et al.* (1999).
[167] Colombo *et al.* (2011). Primary reference: Dewey and Prince (2005).
[168] Verbeek - Oudijk *et al.* (2014) perform and validate a Mokken analyses for cognitive impairment on SHARE data, resulting in a scale ranging from less to more impaired. They show that not being able to remember the name of the current month or year are the most severe signals of impairment.
[169] A maximum of three caregivers can be named.

each month, he/she was asked to give an estimate of the total number of hours of informal care received past year". Moreover, we also assume that informal care provision is substantially stable throughout the year.

The survey also includes information on *chronic conditions* and *symptoms* that the individual may suffer from,[170] her subjective well-being and life satisfaction as well as on other forms of health-care utilization (e.g., visiting the GPs or the dentist) and health-related behaviors (e.g., smoking, drinking, doing physical activities). Labour-market variables and economic variables are collected, e.g., details on current and past occupations, job opportunities in retirement age, sources and composition of income and wealth, as well as consumption and saving choices. Further socio-economic characteristics include education (both the ISCED classification[171] and the number of years of completed education), involvement in social activities, as well as information on respondents' children.

Our sample selection consists of non-institutionalised individuals aged 60 and older[172], having children[173] but not living with them. [174] SHARE does not include quantitative information about the assistance provided by any caregivers (spouse, children) from *within* the household, while it reports details on the source and the amount of informal care received from *outside* the household (from children, relatives, friends and neighbours). It is therefore hard to distinguish the way and the type of transfers that take place within a family in terms of informal care. Furthermore, we restrict our data to four European countries, present in both waves: Austria, Belgium (Flanders, Wallonia and Bruxelles), Germany and France. As highlighted in the previous paragraph, all of these countries implement LTC programmes featuring explicit and nation- or region-wide eligibility rules based on individuals' health conditions (functional and cognitive limitations), i.e., they are *carer-blind* (see note 160).[175] Details on these LTC frameworks are included in Section 1.5. Regarding the provision of formal home-care, SHARE distinguishes between nursing/personal care, domestic help, and meals-on-wheels. On the latter, respondents only report the number of weeks (per year) in which the service was

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[170] The chronic conditions should have previously been diagnosed to the respondent by a doctor. They include: (i) heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; (ii) high blood pressure or hypertension; (iii) high blood cholesterol; (iv) stroke or cerebral vascular disease; (v) diabetes or high blood sugar; (vi) chronic lung disease such as chronic bronchitis or emphysema; (vii) asthma; (viii) arthritis, including osteoarthritis, or rheumatism; (ix) osteoporosis; (x) cancer or malignant tumor, including leukaemia or lymphoma, but excluding minor skin cancers; (xi) stomach or duodenal ulcer, peptic ulcer; (xii) Parkinson disease; (xiii) cataracts; (xiv) hip fracture or femoral fracture. Other reported symptoms (if they were present for the 6 months before the interview) include: (i) pain in the back, knees, hips or any other joint; (ii) heart trouble or angina, chest pain during exercise; (iii) breathlessness, difficulty breathing; (iv) persistent cough; (v) swollen legs; (vi) sleeping problems; (vii) falling down; (viii) fear of falling down; (ix) dizziness, faints or blackouts; (x) stomach or intestine problems, including constipation, air, diarrhea.

[171] For details on the 1997 International Standard Classification of EDucation, see OECD (1999).

[172] We restrict our attention to this age sub-group, as this is the population most likely to present vulnerability symptoms and therefore need of domiciliary LTC. It is worth recalling that the age profile of users of home care is noticeably younger than that of residents of institutional care (see Rodrigues *et al.* (2012), pag 90). Moreover, this is the lowest explicit age-requirement among the LTC regulations in Europe (e.g., the French APA, see paragraph 1.5.6). In Section 2.5 we will test other commonly adopted sample-selections, setting the age-limit at 55, 65 and 70. Various are the sample choices in the current literation: some select the population aged 65+ (e.g., Balia and Brau (2013), Bonsang (2009), Kalwij *et al.* (2014)), other studies opt for different thresholds (e.g., Van Houtven and Norton (2004) set it at 70, de Meijer *et al.* (2011) at 55, Bolin *et al.* (2008), Bakx *et al.* (2014) at 50). Our findings will prove to be robust to different age-selections.

[173] Besides biological children, we also account for fostered and adopted children.

[174] These are quite common assumptions in recent empirical health economics analyses, e.g., Balia and Brau (2013), Bonsang (2009), Kalwij *et al.* (2014), and will be all subjected to robustness tests in Section 2.5.

[175] Although main LTC programmes in Czech Republic, Spain and some Italian regions feature clearly-cut assessment-of-need methods and objective eligibility rules, we excluded them from the analysis because their LTC legislations were introduced after 2006, i.e., after the SHARE data were collected.

received, without a corresponding amount in hours. Since choosing a standard time-value to quantify the meals-on-wheels provision would be an arbitrary choice, we exclude from the main specification those individuals who receive only this kind of formal-care without receiving also personal or domestic help.[176] Finally, some observations had missing or unreliable values for the variables of interest or the other explanatory variables and were therefore dropped. The resulting sample includes 9342 individuals.

As shown in Table 2-1, the average sample age is 70.5 years old, with the 25-th percentile at 64 years old, the median age at 69 and the 75-th percentile at 75. The population aged 80+ accounts for 13.2% of the sample. Females account for 55.4% of the whole population, while retired individuals and homemakers are, respectively, 80% and 13%. A typical individual has 9.7 years of completed education and 2.4 children.

As far as the health-conditions are concerned, statistics show that limitations in iADL are more frequent than in ADL. On average, 19.6% of population have lost at least one iADL while 16.8% have at least one loss in ADL. As already mentioned in paragraph 1.3.2, a reason for this is that iADL require a more complex neuropsychological organization and a higher involvement of cultural and environmental influences, and therefore are more likely to be the first to "fall" in the context of the vulnerability process (LaPlante, 2010). In order to highlight more severe vulnerability conditions, we report the share of individuals with at least two ADL limitations, as well as the share of those with at least one loss in ADL and one in iADL. Among the ADL and iADL taxonomies, there are some deficits that appear more frequently in the population: limitation in dressing and in washing are the most frequent ADL, while difficulties in doing housework, cooking and moving outdoor are the most frequent iADL. This is, again, due to the different intrinsic complexity of the single tasks and on the hierarchical nature of the ADL and iADL.[177] Regarding mental limitations, the typical individual in the whole sample suffers from 2.3 mood- and behaviour-related conditions of the EURO-D scale, while 2.4% of the sample is labelled as cognitively impaired. Furthermore, 45.5% of the sample was told by a doctor to be suffering from two or more chronic conditions, while 46.7% reports two or more (out of 10) mobility deficits. Subjective health-indicators report a higher share of individuals in bad health than the objective ADL/iADL measures do: a 38.3% of the sample define their health-status as "fair" or "poor" in a scale that also comprises "excellent", "very good" and "good", while 52.7% feel limited ("severely" or "limited, but not severely"), because of a health problem, in activities people usually do.[178]

Table 2-1 summarizes some descriptive statistics of our sample.

Around 9.5% of the sample receive formal nursing/personal home-care, while almost 18.5% receive informal-care from outside the household, by at least one provider among children, relatives, friends or neighbours. Assistance from children is an important share of the total informal-care provision: 14% of the sample receive assistance from their offspring.. Statistics on formal- and informal-care utilization confirm previous findings (see, e.g., Kalwij *et al.* (2014)): the total number of hours of formal care is on average lower than the total hours of informal care (accounting both

[176] Using a different assumption, e.g. transforming the meals-on-wheels variable into hours of care by assuming that it is one hour per meal (see Kalwij *et al.* (2014)), or half-hour per meal, leaves the main conclusions of this paper unchanged.
[177] On the hierarchical structure of ADL and iADL see Kempen *et al.* (1995), Thomas *et al.* (1998), LaPlante (2010). As LaPlante (2010) highlights, the paediatric development model implicit in the ADL scale implies that "as a child matures, the simplest activity, eating, is mastered first, then continence, transferring, toileting, dressing, and bathing, in order of increasing complexity. As a person ages, or experiences certain chronic illnesses, performance is lost in the reverse order, from bathing to eating".
[178] This question is often defined as the GALI, Global Activity Limitation Indicator.

for incidence and hours of care), and this could be partly explained by a difference in care efficiency. Moreover, the provision of formal-care increases with age among couples, and is generally higher for singles. Among those who receive informal assistance from children, 32% report having two and 11% report having three informal home-care providers. We also notice significant differences across European countries, both in terms of care-utilization incidence and of the number of annual hours received, reflecting both cultural differences and heterogeneity in the countries Welfare States, and specifically in LTC frameworks (see Section 2.2.2).

Table 2-1, Descriptive statistics

	Whole sample	Austria	Germany	France	Belgium Flanders	Belgium Wallonia
observations	9342	1235	2746	2486	1961	915
Receiving formal personal/nursing care	9.5 %	3.6%	3%	16.5%	10.6%	15.4%
Receiving informal care from any provider	18.5%	20.6%	21.2%	14.4%	17.9%	19.9%
Receiving informal care from children	13.9%	15.7%	16.1%	10.8%	13.6%	13.9%
Annual hours formal personal/nursing home-care	9.6	19	7.3	7.6	10.9	6.1
Annual hours informal care (any provider)	77	80	90	68	78	57
Annual hours informal care from children	57	63	72	48	52	37
Age	70.5	70.1	69.6	71.2	70.7	71
Aged 80+	13.2%	11.6%	10%	16.6%	13.3%	15%
Females	55.4%	60.3%	51.6%	58.3%	53.9%	55.4%
Retired	79.9%	81.3%	79.2%	84.2%	74.6%	75.4%
Homemaker	13.1%	14.5%	9.7%	10.2%	19.5%	18%
Years of education	9.7	7.8	13	7.6	9.1	9.6
Number of children	2.4	2.29	2.22	2.469	2.509	2.56
Fraction of daughters	50.4%	50.3%	52.1%	49.6%	49.5%	49.6%
At least 1 ADL lost	16.8%	14.4%	13.9%	17.6%	16.3%	25.8%
At least 1 iADL lost	19.6%	20%	15.1%	21.3%	19%	28.3%
At least 1 ADL & 1 iADL lost	10%	9%	8%	10.6%	9.7%	16.1%
At least 2 ADL lost	6.3%	5.7%	6.2%	7.1%	6.6%	9.8%
# chronic conditions (out of 14)	1.8	1.57	1.76	1.86	1.76	2.19
# mobility deficits (out of 10)	1.7	1.77	1.75	1.81	1.49	2.24
Orientation impaired	2.4%	1%	2.4%	3.4%	2.3%	1.8%
EURO-D score	2.3	2	1.9	2.8	2	2.8
Bad subjective health	38.3%	32.5%	44.3%	42.1%	28.9%	38.2%

Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 60, with children (no co-residence), not institutionalized.

The correlation between the hours of formal- and informal-care is positive, controlling for various (arbitrarily defined) degrees of limitation:

Table 2-2, Spearman's correlation between hours of FC and IC

	Whole sample	1+ iADL	1+ ADL	2+ ADL and 2+iADL
Observations	9352	1838	1561	431
Spearman's correlation between yearly hours of formal home-care and informal-care from any provider	0.16***	0.18***	0.22***	0.21***

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home
Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 60, with children (no co-residence), not institutionalized.
**** p<0.01, ** p<0.05, * p<0.1*

2.2.4 The eligible population

Based on the institutional information reviewed in Section 1.5 and on the health variables included in SHARE, we are able to implement countries' eligibility rules for public LTC programmes on our selected sample (details on the correspondence between SHARE and the LTC legislations are reported in Appendix 1.7.3, while Section 1.3 compares the main LTC eligibility frameworks in Europe). As a result, we identify two peculiar population subsets. The first is composed of those individuals who are in a condition of "objective vulnerability", because of their health-conditions and according to their own country-specific legislation, and are therefore "eligible" to at least one public programme of formal care; the second is made of those "non-eligible" respondents whose vulnerability status lies below the minimum threshold set by the legislation. The eligibility status is therefore exogenously determined on the basis of the rules adopted by LTC regulations to assess the degree of vulnerability of individuals and, consequently, to determine who is entitled to receive public home care services. The eligibility variable is dichotomous, and it takes value 1 if the individual fulfils the minimum requirements of at least one LTC programme implemented in her region/country of residency (i.e., she is *eligible* to LTC home-care services) and 0 otherwise.

We now propose a formalization on the methodology adopted to build the eligibility variable, adapted from paragraph 1.3.3.1.

As highlighted in the paragraph 1.3.1, the degree of vulnerability and the minimum eligibility threshold for public LTC services are mainly defined as functions of a patient's health conditions (her medical-profile) in Austria, Belgium, France and Germany (details can be found in Section 1.5)

A comprehensive list of the health conditions included (to various extents) in each assessment scale includes ADL, iADL, additional mobility limitations, cognitive limitations, behavioural/depression status, as summarized in Table 2-3, summary of LTC assessment-of-need scales. Among the ADL set, we split the ambulation item in the "moving" and the "transferring" tasks (the latter being originally present in the ADL list), since they are often assessed separately in actual LTC regulations. Albeit the original ADL + iADL taxonomies, two additional categories are included, which are: "behavioural / cognitive impairment" and "hygiene for post-surgery conditions or advanced medications". The former concerns patient's depression, mental stability and coherence, (coherence and mental impairment are included

– to various extents – in a conspicuous number of regulations); the latter refers to those patients who have difficulties in performing advanced medications ("advanced" with respect to taking pills or following medical prescriptions) like enemas or maintenance of tubes/bags resulting from surgical operations. Furthermore, additional mobility limitations are included, as crouching and walking down stairs.

Table 2-3, summary of LTC assessment-of-need scales

ADL	**Non ADL**
Bathing & hygiene ✓	Communication ✓
Dressing ✓	Shopping for groceries/medicines ✓
Using the toilet ✓	Cooking ✓
Transferring ✓	Housekeeping ✓
Continence ✓	Doing laundry ✓
Feeding ✓	Moving outdoor ✓
Moving indoor ✓	Responsibility for own medications ✓
Hygiene for post-surgery conditions or advanced medications ✗	Behavioral/Cognitive impairment ✓
	Other mobility limitations ✓

✓ = information available in SHARE; ✗ = information missing from SHARE
The underlined tasks do not belong to the Katz's ADL scale, but are treated as basic activities of daily livings in the LTC regulations that include them.

Let us state some definitions:

DEFINITION 1: Let us define $\mathbf{c}$ *as the vector of the aforementioned health-conditions, such that* $\mathbf{c} = \{c_1, \ldots, c_k, \ldots, c_H\}$ *where* $|\mathbf{c}| = H$ *is the total number of health-conditions for which we have information.*

DEFINITION 2: A generic vulnerability medical-profile i would be a vector $\boldsymbol{\pi}_i = \{\alpha_{i_1}, \ldots, \alpha_{i_k}, \ldots, \alpha_{i_H}\}$*, where each element is such that:*

$$\alpha_{i_k} = \begin{cases} 1 & \text{if limitation } c_k \text{ occurs} \\ 0 & \text{if limitation } c_k \text{ is absent} \end{cases}$$

As an example, $\boldsymbol{\pi}_i = \{1,1,0,0,0,\ldots,0,0,0,1\}$ is a vulnerability profile in which only three limitations are validated (namely the first, second and last) while the others are not present. Generalizing, we define:

DEFINITION 3: Let us define $\Pi = \{\pi_1, \ldots \pi_i, \ldots, \pi_P\}$ *as the set of all the theorical medical-profiles that can be built from the H elements of* $\mathbf{c}$*.*

Given that each profile $\boldsymbol{\pi}$ has H elements, the set Π will contain $P=2^H$ profiles, which correspond to all the possible combinations of the deficits related to ADL, iADL, cognitive and mental functioning, which are summarized in Table 2-3.

In the SHARE micro-data, respondents provide self-reported information about the occurrence of each of the H health-conditions included in the **c** vector. For a generic individual *i* living in country *J*, it would therefore be possible to build a medical-profile $\pi_{i,J}$.

Each country *J* defines its specific assessment-of-need and eligibility criteria for LTC benefits. As mentioned in the previous section, multiple programmes can be implemented in the same country. Let us suppose that a country *J* implements *R* programmes of care. We, then, make the following assumption:

> *ASSUMPTION 1: the health-conditions included in vector* ***c*** *exhaust all the possible vulnerability outcomes that can be assessed by a LTC program's regulation.*

Assumption 1 guarantees that, once the limitations in **c** have been assessed, there are no other dimensions which need to be evaluated by a medical-team in order to provide a vulnerability assessment. This is a simplifying assumption since authorities operates with a potential degree of flexibility and there could be local subjectivity and variation in the need-assessment process; yet, we believe that choosing **c** as a *core-set* of outcomes is legitimate, given that, in principle, the regulations are explicated in the laws and are fixed nationwide (or region-wide).

> *DEFINITION 4:* $\tilde{J}_r \left(\subset \Pi\right)$ *is a sub-set a subset of objectively vulnerable (eligible) medical-profiles, determined by the eligibility rules for a generic program "r" in country J, among all the possible medical-profiles (set Π).*

Alternatively stated: if an individual *i* living in country *J* would have her profile $\pi_{i,J}$ assessed by a medical-team following the regulations of LTC program *r*, this would determine whether $\pi_{i,J}$ belongs to the eligible-set $\tilde{J}_r$. That being the case, she would be entitled to receive the benefits from the *r-th* program of care.

We are interested in the extensive margin of eligibility at the *national-framework* level, i.e., whether an individual is eligible to any LTC program in her country. A simplified notation can therefore be adopted through

> *DEFINITION 5: let* $\tilde{J}$ *be the set of those medical-profiles which are eligible according to at least one of the LTC programmes implemented in country J.*[179]

As long as $\tilde{J}$ is a set of medical-profiles, it is also a subset of Π, therefore $\tilde{J} \subset \Pi \neq \varnothing$.

At this point we can define an "eligibility function" *f:*

> *DEFINITION 6: define* $f_{\tilde{J}} : \Pi \to \{0,1\}$,
>
> *where* $f_{\tilde{J}}\left(\pi_{i,J}\right) = \begin{cases} 1 & \text{if } \pi_{i,J} \in \tilde{J} \\ 0 & \text{if } \pi_{i,J} \notin \tilde{J} \end{cases}$ *is the characteristic function of set* $\tilde{J}$.

[179] We do not investigate the intensive margin of eligibility, i.e., *how much* an individual scores in the eligibility scale and the amount of benefits that she is entitled to receive. Moreover, we do not distinguish between individuals who are eligible to multiple national programs of care and those that are eligible to just one.

The function f_j determines the eligibility status of an individual *i* (living in country J), according to the rules of all the LTC programmes implemented in country J. In other words, this stage determines whether the i-th individual is eligible to LTC programmes in her nation/region.[180]

As described in Appendix 1.7.3 and Section 1.3, which compares the main LTC frameworks in Europe, the characteristic function *f* is a typical example of non-linear combinations of health-indicators included both in the assessment of need scales and in our dataset.[181] An example will help to clarify the nature of the *f* function.

> *The Austrian national LTC programme (Pflegegeld) assesses individuals' on fourteen dimensions (items), between ADL, iADL and cognitive limitations (paragraph 1.7.3). For each item, the legislation defines a nationwide amount of care-time (in hours per month), which is plausibly needed by individual who is limited in that item. When the assessment is complete, the sum of all the amounts of care-time corresponding to the respondent's limitations is taken. The regulation defines as eligible all the medical profiles that present a need-of-care of at least 50 hours per month (raised to 60h since 2011), and has at least one limitation in ADL and one in iADL. In order to build the eligibility status for Austrian citizens, we compute the overall need-of-care of each respondent in Austria, then apply the aforementioned eligibility rule: the minimum need-of-care should be 50h per month, and at least one ADL and one iADL limitations should be reported.*

It is worth highlighting that the "eligibility" status does not necessarily identify those individuals who are actually "treated" by public programmes; furthermore, SHARE does not include information on whether an individual did made an application for LTC benefits and consequently received a positive, rather than a negative, response. As argued in Section 2.2.2, our eligibility variable can be interpreted as a necessary requirement to obtain publicly funded long-term care, i.e., a signal of an "intention to treat" and a proxy for the country-specific perspectives on the concept of vulnerability. It therefore allows us to account for the heterogeneities in both the assessment-of-need procedures and the eligibility rules in the countries included in out sample.[182]

Descriptive statistics on the eligible population are reported in Table 2-4, compared with three other benchmark-samples, namely: the whole sample population, the population of individuals with some functional limitations (*at least* one ADL, iADL) and the sample of non-eligible elderly. A comparison between the second and the other columns shows how the eligibility status detects a peculiar subsample of the population and does not correspond to an arbitrary selection of "dependent" individuals. Indeed, the characteristics of the sample of eligible individuals, built according to country- or region- specific regulations, is notably different from the one that adopts an arbitrary (and fixed-for-all) definition of dependency based on the number of functional limitations (third column).

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[180] We are implicitly assuming that the laws and the guidelines are carefully followed by the medical evaluators and by the medical-board who takes the final decision on eligibility. This is, admittedly, a simplifying assumption and yet, we believe, a necessary step to take in order to perform a comparative analysis.

[181] Details on the correspondence between SHARE and the LTC legislations are reported in Appendix 1.7.3

[182] See Section 1.5 for a review and a comparative analysis of European LTC programmes.

Table 2-4, Formal care utilization among sub-samples

	Eligible	Individuals with 1+ ADL, 1+ iADL	Whole sample	Non-eligible
Observations	728	2461	9352	8624
% individuals receiving:				
formal-care	41.4%	19.8%	8.1%	5.9%
informal care from any provider	39.7%	32.5%	18.5%	16.1%
informal care from children	34.4%	25.9%	13.9%	11.6%
Average annual hours of:				
formal care	100	34.7	9.6	2
informal care	356	193	77	54
informal care from children	279	148	57	38
formal care (among receivers)	268	176	116	35
informal care from any provider (among receivers)	896	577	420	324
informal care from children (among receivers)	830	555	418	321
Age	77.3	74.2	70.5	70
Number of ADL lost	2.5	1.1	0.29	0.12
Number of iADL lost	2.8	1.5	0.38	0.20
EURO-D score	4.1	3.56	2.3	2.15
Orientation impaired	25.7%	5.7%	2.4%	0.46%

Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 64, with children (up to 4; no co-residence), not institutionalized.

Formal-care users are nearly 40% among eligible individuals, while their percentages were 8.1% in the whole sample and 19.8% in the sample of minimum functionally impaired (at least 1 ADL, 1 iADL). Moreover, in the eligible population, the incidence of formal-care provision is almost equal than the informal-care's, while it was substantially lower in the other samples (e.g., 8% versus 18% in the whole sample). This highlights the increasing relative importance of professional (skilled) assistance services as long as the patient's conditions start to constitute an objective vulnerability-risk. When looking at the intensive margin of elderly-care utilization, the eligible sample receive considerably larger amounts of hours-of assistance, both informal and formal. Again, the ratio between the mean annual amounts of informal- and formal-care narrows down among objectively vulnerable elderlies (896 hours vs 268 hours), with respect to the other benchmark samples. Indeed, this ratio is maximum among the non-eligible (324 hours of informal care, 35 hours of formal-care). Finally, the eligible population is characterized by a much higher incidence of cognitive impairments and depression symptoms.

2.3 EMPIRICAL SPECIFICATION

Dependent variable and main variable of interest

In this paper, we introduce two distinct classifications of *informal care*. The first (broad definition) concerns home assistance received from outside the household by children, relatives, friends and neighbours. Respondents who receive this kind of assistance indicate the nature of the relationship with the caregivers[183], the frequency (daily, weekly, monthly or annual) and the average number of hours received. We therefore build a dichotomous variable that assumes value 1 if respondents receive (during the twelve months preceding the interview) any informal-care, as well as a continuous variable for the average annual hours of informal care received. The second (narrow definition) regards informal assistance provided by children, grandchildren and children-in-law. Similarly, we construct two distinct variables: (1) a dummy assuming value 1 if respondents receive any informal assistance by children; (2) a continuous variable for the average annual hours of informal care provided by children. In both cases, informal home-care corresponds to unpaid help with personal care, practical household tasks and paperwork. We adopt this broad definition because our goal is to address how the *overall* informal coverage is affected by a chance in the formal care provision. As it has been pointed out in the literature, a categorisation of informal care provision can be problematic, due to the inherently multi-dimensionality of this source of assistance (Bonsang, 2009). Moreover, splitting the informal provision, following the categorisation in SHARE, into a "nursing/personal care", a "domestic help" and a "help with paperwork" leads to estimation issues because of low number of observations for the category of interest (179 for personal care).

We consider an individual as receiving *formal-care* if she reports to have been provided professional or paid personal-care/nursing-care in her own home, in order to perform activities that she could not performed otherwise. We construct a dichotomous variable for formal home-care utilization that assumes value 1 if respondents receive professional or paid nursing or personal care during the twelve months preceding the interview. We do not consider the category "professional or paid domestic help" included in the SHARE question because this type of care, usually labelled as "unskilled" (not supplied by qualified caregivers), is not likely to fall within the public LTC schemes offered by different countries. Indeed, personal and nursing care are the types of assistance covered by the eligibility status we introduced in the previous paragraph.

2.3.1 Empirical model

Our empirical model aims at analyzing the relationship between formal and informal care. To be more precise, we examine the effect of receiving formal home care on the utilization of informal care, both at the extensive (i.e. the probability of receiving informal care) and at the intensive margin (i.e. the hours of informal care received).

Similarly to previous studies (Bolin *et al.*, 2008; Bonsang, 2009; Duan *et al.*, 1983; Van Houtven & Norton, 2004), we use a standard two-part model, which specifies the probability of receiving care and the quantity of care received as two different processes, for both formal and informal care. The two part model allows for the separation of the individual behavior into two stages: first, a decision concerning receiving some care and second, a decision concerning the amount of care, conditional on receiving any. This kind of model is appropriate for estimating actual outcomes (or conditional outcomes), i.e. fully-observed variables. In our case, zero values for actual formal home care indicate that

[183] A maximum of three caregivers can be named.

zero hours of care were received. We refer to these actual zero values as corner solutions, because individuals cannot receive a negative amount of hours of care. Two-part models are often used in these contexts in order to model data that include many zero observations (Cameron & Trivedi, 2005; Dow & Norton, 2003; Duan *et al.*, 1983; Wooldridge, 1995) Buntin et al., 2004.

The first part of the two-part model is a probit model that predicts the probability of receiving informal care. Following (2.1), we assume that the parent's utilization of informal care ($TIHC_i$), is a function of hours of formal home care (FHC_i), health-status (HS_i) , and a vector of socio-demographic covariates (CV_i). Part one is described by the following binary probit model, estimated by Maximum Likelihood (STATA's *inprobit* command):

(2.2) $$\Pr\left[TIHC_i > 0 \middle| X_i, FHC_i\right] = \Phi\left(HS_i\gamma_{HS}, CV_i\gamma_{CV}, \ln\left(FHC_i\right)\gamma_{fc}, \varepsilon_1\right)$$

Where $\Phi(.)$ is the cumulative density function of the standard normal, and $\gamma_{HS}, \gamma_{CV}, \gamma_{FHC}$ are parameters to be estimated. The second part uses the standard two-stage least square estimation to predict the continuous amount of annual log-hours of informal care, conditioning on receiving any. Part two corresponds to the following equation assuming that the log of the positive values of $TIHC_i$ is linear in HS_i, CV_i and $\ln(FHC_i)$:

(2.3) $$\begin{aligned}\mathrm{E}\left[\ln\left(TIHC_i\right) \middle| TIHC_i > 0, HS_i, CV_i, FHC_i\right] &= HS_i\beta_{HS} + CV_i\beta_{CV} + \beta_{FHC}\ln\left(FHC_i\right) \\ &+ E\left[\varepsilon_2 \middle| TIHC_i > 0, HS_i, CV_i, FHC_i\right] \\ &= HS_i\beta_{HS} + CV_i\beta_{CV} + \beta_{FHC}\ln\left(FHC_i\right)\end{aligned}$$

Where the β_s are the set of parameters to be estimated by OLS.

Our interest is to address separately the results of the model, i.e., the extensive and the intensive margins.[184]

As previously mentioned (paragraphs 2.2.2 and 2.2.4), we introduce a novel instrument for formal care, based on the eligibility criteria defined by local or national legislations. The eligibility status is exogenously determined on the basis of the assessment-of-need scales used by different country legislations to assess the degree of vulnerability of individuals and, consequently, to determine who is entitled to receive public home care services. The variable is dichotomous, and it takes value 1 if the individual fulfils the minimum requirements of at least one LTC programme implemented in her region/country of residency (i.e., she is *eligible* to LTC home-care services) and 0 otherwise. As exemplified in paragraph 2.2.4 (See also Sections 1.3, 1.5 as well as Appendix 1.7.3) eligibility is a non-linear combination of a set of health-indicators included both in the assessment of need scales and in our dataset.

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[184] As explained in the literature , e.g., Dow and Norton (2003), the estimation of actual outcomes in the two-part model involves the product of the expected values from the first and the second part:

$$\mathrm{E}\left[ic_i \middle| X_i, fc_i\right] = \Pr\left[TIHC_i > 0 \middle| X_i, FHC_i\right] \cdot \mathrm{E}\left[TIHC_i \middle| TIHC_i > 0, HS_i, CV_i, FHC_i\right]$$

This estimation has to deal with the log-transformation of the dependent variable in the second-part of the model. On his, see also, e.g., Hertz (2009) and Jones (2010).

We assume that our exclusion variable affects the amount of formal home care received, but not directly influences the amount of informal care by the parent. The identification of "eligibility "effects on receiving formal home care comes from the variation of the eligibility regulations across countries (or regions): similar individuals (in terms of health conditions) may have a different degree of "eligibility", or may be eligible or not eligible for public programmes according to the assessment criteria of their country (or region) of residence. Another source of variation of our instrument is at the individual level, and relies on the health status and level of vulnerability of each respondent. However, eligibility does not identify who are actually "treated" by formal home care programmes.

2.3.2 Covariates' description

The utilization of formal (informal) care is assumed to rely on various individual's characteristics. We include a set of socio-demographic variables: age, gender, education, occupation (being retired or not), household composition (whether the parent lives with a spouse or a partner, or not). Regarding education, SHARE includes the ISCED-97 classification to measure the level of schooling of respondents. ISCED is organized into 7 levels: Isced 0 (pre-primary schooling); ISCED 1 (primary education); ISCED 2 (lower secondary); ISCED 3 (upper secondary); ISCED 4 (post-high school); ISCED 5 (university); ISCED 6 (postgraduate). From this information, a variable for the number of years of completed education is generated.

Additionally, we consider several measures of the health-status of parents. We include a continuous variable that takes value 1 if the respondent has been diagnosed to suffer from at least one chronic condition (see note 170). Moreover, we control for a self-reported measure taking value 1 if the respondent reports to suffer from some long-term illness, including mental health problems.

Among the measures of physical dysfunctions, we include a binary variable that captures mobility limitations (see note 165), the number of limitations in ADL as well as in iADL (see note 164). Moreover, we add an interaction term as a further control in order to capture the combined effect between having at least one mobility limitation and the number of ADL limitations.

Cognitive impairments and limitations in daily living activities (ADL and IADL) are likely to be correlated but involve separate domains of functioning (Wiener et al., 1990). In other words, not all individuals with substantial cognitive impairment have ADL or IADL disabilities. Consistently with this, we include in our analysis two measures of cognitive ability: the first is a dummy variable assessing mathematical skills of elderly respondents (numeracy), and the second a binary indicator measuring the sense of orientation in space and time (orientation). Furthermore, we introduce a continuous variable based on EURO-D scale. All these variables are described in Section 2.2.3.

Then, we consider a binary variable that captures the self-perceived health of individuals. It assigns value 1 if the respondent reports a bad self-perceived health status ("fair", or "poor"), measured on a five-point scale from "excellent" (score 5) to "poor" (score 1). The use of self-perceived health status (SPHS) is supported by evidence that shows a strong predictive relationship between individuals' self-rating of health and morbidity (Idler and Benyamini, 1997; Kennedy et al., 1998).

In addition to the health-related variables, we introduce a set of dummies to capture country- and region- fixed effects as well as and the characteristics of the respondent's residential area (whether he/she lives in a big city, in the suburbs of big city, large town and small town). Finally, we also include a set of dummies related to the country-specific wealth quintiles and household income quintiles.

2.4 RESULTS

This section presents the results from the two-part model for informal care described in the previous section, and is organized as follows: we first determine the strength of our exclusion restriction - eligibility - in instrumenting the utilization of formal home-care; we then report the outcomes for the extensive and the intensive margins of the analysis. Our interest is to address separately the results of the model, i.e., the extensive and the intensive margins (see note 184).

We adopt two definitions of informal-care: one (broad definition) encompasses home assistance received from outside the household by children, relatives, friends and neighbours; alternatively (narrow definition), we consider just the help received from children living outside the household (which allows us some comparability with most of empirical literature on this topic). A comprehensive discussion of the results will be developed in Section 2.6, after conducting several robustness tests (Section 2.5).

2.4.1 First-stage results

It is well known in the literature of instrumental-variable regression that an instrument should be (1) exogenous (i.e., it should be uncorrelated with the error term in the structural equation), (2) correlated with the endogenous variable being instrumented and in particular it should be (3) strongly correlated with it. Failure to satisfy (1) would lead to invalid instruments, an uncorrelated instrument (2) would be labelled as irrelevant, while a low correlation (3) would mean that the instrument is only marginally relevant (i.e., weak).[185] While we discussed the exogeneity of our exclusion restriction in the previous section, we now turn to test properties (2) and (3), in order to make sure that our variable of interest (log-hours of received formal home-care) is being meaningfully instrumented and that, in the words of Bound *et al.* (1993), our "cure" (the instrument) is not worse than the "disease" (the potential endogeneity of the original variable).

The first-stage outcome of our empirical model for the extensive margin of informal-care utilization (Table 2-5) shows that, indeed, the individual's eligibility status for public programmes of domiciliary assistance is a strong predictor for the log-hours of received formal home-care as defined in section 2.2.3[186]. The estimated coefficient for eligibility is positive, as expected[187], notably higher than the other covariates' included in the model, and statistically significant at the 1% level (p-value = 0.000). The first-stage F-statistic, which tests the null hypothesis that the instrument do not enter the first-stage regression, reports a value of 21.02 with a p-value of 0.000.[188] The overall first-stage regression has a R^2 of 0.254.

[185] See, e.g., Stock *et al.* (2005) and Cameron and Trivedi (2005).
[186] In this paper we consider as formal home-care the paid or professional nursing assistance or personal-care.
[187] See also the descriptive statistics on the eligible population in section 2.2.4.
[188] We perform the Kleibergen-Paap Wald statistic (Kleibergen and Paap (2006)) in place of the Cragg-Donald's one, since we adopt a heteroskedastic- and cluster- robust specification (see Baum *et al.* (2007))

Table 2-5, fist-stage outcome for formal home-care use (OLS)

Dependent variable: annual log-hours of formal home-care received			
	OLS coefficient		Robust st. error
Being eligible	0.495	***	0.107
Age	0.009	***	0.002
Being retired	0.026		0.024
Female	0.031		0.020
Living with spouse	-0.099	***	0.028
Years of education	0.005	**	0.002
Having l.t. Illness	0.032	*	0.018
Euro-D score	0.008		0.006
Low numeracy-score	0.026		0.027
Low orientation-score	-0.274	*	0.145
Having mobility limitations	-0.041	***	0.015
# ADL	0.040		0.092
# iADL	0.175	***	0.026
Mobility*ADL	0.134		0.097
# Chronic dis.	0.017	*	0.009
Bad subjective health	0.039	*	0.021
Living area (w.r.to rural area)			
Big city	-0.057		0.036
Suburbs big city	-0.001		0.031
Large town	-0.048		0.033
Small town	-0.004		0.026
Intercept	-0.580	***	0.163
F-test for excluded instrument	F(1, 6380)=21.02 ***		
Observations	9342		
Adjusted R^2	0.254		

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home.
Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.
Standard errors are robust to heteroskedasticity and clustered at the individual level.
Additional controls include dummies for country-, income-, wealth-, wave- effects.
Years of education based on ISCED codes.
**** p-value <0.01, ** p-value <0.05, * p-value <0.1*

When eligibility is taken account, other factors still appear to play a role in determining the amount of formal home-care received by older adults. The coefficients for (1) age and for (2) living arrangement (i.e., whether the individual lives alone or with a spouse/partner) take the expected signs and highlight (1) the increasing demand for care as long as age increases and (2) the role of within household informal-caregivers already established in the literature. The coefficients for years of education suggests that lower educated individuals receive less formal home-care. As highlighted in Chapter 1, section 1.4, this result appears when the eligibility status is taken into account in the empirical model. Moreover, even after controlling for eligibility status, which depicts a condition of country-specific "objective vulnerability", health-conditions are still significant determinants of the intensity of home-care received. This confirms

the existence of discretionality in the decision regarding formal home-care provision. Finally, dummies for living arrangements are not significant.

2.4.2 Informal care from children, relatives, friends (broad definition)

Table 2-7 reports the coefficients for the determinants of informal home-care from children, relatives, friends and neighbours both at the extensive and at the intensive margin. Each part of the model is first estimated by assuming exogeneity of the variable of interest, formal home-care, on the utilization of informal-care, and then by adopting the instrumental variable approach described in paragraphs 2.2.2 and 2.3.1. The preferred specification is determined after conducting, for each part of the utilization model, a test of the exogeneity of the log-hours of formal home-care variable.

Regarding the first part - the extensive margin of the analysis (where the dependent variable is dichotomous and labelled as "any informal-care from any provider") - results from the model assuming endogeneity are reported in the IV-probit column. The first-stage's outcomes reported in the previous paragraph highlighted the relevance of our exclusion restriction. However, the Wald test for exogeneity of formal-care cannot be rejected (p-value = 0.25), suggesting that there is not sufficient information in the sample to accept the hypothesis of endogeneity at this margin. We therefore conclude that the un-instrumented probit specification (column "probit") is appropriate for this part of the model.

Results from the probit model suggest that formal-care utilization increase the likelihood of receiving any informal home-care (p-value <0.001), even though the magnitude of this complementarity effect is rather low. A 10% increase (decrease) in the annual hours of personal/nursing domiciliary care leads to a 0.15 percentages point increase (decrease) in the probability of receiving assistance from one's own offspring, relatives, friends or neighbours. Given that the average annual hours of personal/nursing home-care provision is 9.6 among the whole sample, and that the average probability of receiving informal-care is 18.43%, an increase of average formal domiciliary assistance by 1 hour per year would lead to a 18.58% likelihood of informal-care use.

The second part of the model – the intensive margin – is the equation for the yearly log-hours of informal-care received from any informal provider (conditional to receiving any) and it is estimated both through OLS (assuming exogeneity of formal home-care use) and through 2SLS (where individuals' eligibility status is adopted as instrument). Conversely to what was found in the first part, the null hypothesis of the Wu-Hausman test for exogeneity of formal-care is now significantly rejected (p-value = 0.027), thus indicating that decisions about hours of formal assistance are endogenously determined with respect to the informal-care decision. The 2SLS specification is therefore the preferred specification. Because of the reduced sample-size, the first-stage of the 2SLS reports a lower F-statistics (F(1,1468)) for the excluded instrument (dummy variable for eligibility status) of 6.7 but still strongly significant (p-value of 0.009).[189]

[189] Results for the first-stage are available upon request.

Table 2-6, Two-part model for overall informal-care from outside the household

Dependent variable	any informal-care from any provider						annual log-hours of informal home-care from any provider, among receivers					
	probit			IV probit			OLS			2SLS		
	marg. coeff.		S.E.	marg. coeff.		S.E.	marg. coeff.		S.E.	marg. coeff.		S.E.
Log-hours FHC	0.015	***	0.004	0.067		0.043	0.059	***	0.023	0.599	*	0.331
Age	0.005	***	0.001	0.005	***	0.001	0.018	***	0.005	0.010		0.007
Being retired	0.005		0.010	0.004		0.010	-0.121		0.081	-0.168	*	0.095
Female	-0.012		0.009	-0.014		0.009	0.070		0.080	0.076		0.091
Living with spouse	-0.222	***	0.010	-0.217	***	0.011	-0.048		0.090	0.025		0.107
Years of education	-0.001		0.001	-0.001		0.001	-0.019	*	0.011	-0.031	**	0.014
Having l.t. Illness	0.015	*	0.009	0.013		0.009	0.072		0.078	0.069		0.084
Euro-D score	0.007	***	0.002	0.006	***	0.002	0.030	*	0.016	0.012		0.022
Low numeracy-score	-0.019	**	0.010	-0.021	**	0.010	0.112		0.074	0.085		0.088
Low orientation-score	-0.048	*	0.026	-0.040		0.027	0.484	***	0.179	0.575	**	0.234
Any mobility deficit	0.068	***	0.009	0.070	***	0.010	0.042		0.086	0.102		0.097
# ADL limitations	0.060	**	0.030	0.056	*	0.031	0.102		0.211	-0.040		0.282
# iADL limitations	0.024	***	0.005	0.014		0.010	0.210	***	0.033	0.086		0.086
Mobility*ADL	-0.072	**	0.031	-0.081	***	0.031	-0.068		0.212	-0.132		0.274
# Chronic dis.	0.004		0.003	0.004		0.003	-0.049	**	0.024	-0.059	**	0.027
Bad subjective health	0.021	**	0.009	0.019	*	0.010	0.144	*	0.076	0.139	*	0.081
Living area (w.r.to rural area)												
Big city	-0.005		0.015	-0.003		0.016	-0.215	*	0.122	-0.100		0.150
Suburbs big city	-0.001		0.013	-0.001		0.013	-0.025		0.107	0.027		0.125
Large town	-0.010		0.013	-0.008		0.014	0.043		0.106	0.088		0.125
Small town	-0.020	*	0.011	-0.020	*	0.011	-0.070		0.086	-0.076		0.097
Testing the null of formal-care exogeneity				p-value = 0.20						p-value 0.058		
Observations	9342			9342			1721			1721		
Additional controls include dummies for country-, income-, wealth-, wave- effects.												

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from outside the household by children, relatives, friends and neighbours corresponds to unpaid help with personal care, practical household tasks and paperwork.
Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.
Standard errors are robust to heteroskedasticity and clustered at the individual level.
Years of education based on ISCED codes.
**** p-value<0.01, ** p-value <0.05, * p-value <0.1*

2SLS estimates for yearly log-hours of formal home-care confirm the lack of crowding out of informal- by the formal-care. Indeed, results suggest that an increase of 1% in the intensity of formal-care provision leads to an increase of 0.59% in the intensity of informal-care, among those who were already receiving some informal assistance. The complementarity effect is more substantial than it was at the extensive margin, and it is better appreciated when computing the cross-elasticity between the two sources of care, evaluated at averages (420 yearly hours of informal-care, 30 hours of formal-care, both conditional to receiving informal-care from any provider). An increase of 1 hour

per year in the formal-care provision leads to an increase of 8.26 hours in the overall informal-care from outside the household.

Being older statistically increases the likelihood of receiving care from children from outside the household, and this is probably due to unobserved health characteristics affected by the ageing process. At the extensive margin, the dummy capturing the presence of a spouse in the household is characterized by a significant negative marginal coefficient, in line with the literature underlining the importance of informal assistance from inside the household for married couples (see, e.g., Kalwij *et al.* (2014) and Motel-Klingebiel *et al.* (2005)).

The number of years spent in education is significantly negatively related to informal-care utilization at the intensive margin.[190] This effect (elsewhere found, e.g., in Bonsang (2009)), could depend from latent cultural factors and from the fact that higher educated individuals might tend to have weaker family ties (Kalmijn, 2006).

Individuals' medical conditions appear as important determinants of the informal-care provision at the extensive margin. In particular, results show significant positive effects for both functional limitations (limitations in ADL, iADL, or other mobility deficits) and disease-specific conditions (long-term illnesses). A similar effect appears for mental and behavioural conditions captured by the Euro-D score, the "numeracy" and "orientation" dummies, as well as for subjective health. The interaction term between the dummy for mobility limitations and the number of ADL deficits takes a significant and negative value, suggesting that for those that have mobility limitations the marginal effect of a further loss in ADL is a lower probability of informal care. This effect captures the fact that as long as the vulnerability condition becomes highly severe, the elderly individuals will more likely rely on other – more skilled – help providers rather than on their offspring's help.

Among those who already receive care, cognitive impairment, chronic conditions and bad subjective health still play a significant role in determining informal-care utilization. Conversely, most of the coefficients for functional health-limitations (ADL, iADL, mobility) lose significance: increase in ADL or occurrence of mobility limitations do not have particular effects on the amount of care received. Again, this might suggest that informal caregiving is not going to fully intervene when vulnerability conditions reach levels that require a higher skilled care.

Categorical variables for respondents' income and wealth were not significant. Additional controls include dummies for country and for waves.

2.4.3 Informal care from children (narrow definition)

We now adopt a narrower definition of informal-care, limiting our focus to the domiciliary assistance provided by respondents offspring from outside the household. Table 2-7 reports the coefficients for the determinants of informal home-care from children, both at the extensive and at the intensive margin. As before, each part of the model is first estimated by assuming exogeneity of the variable of interest, formal home-care, on the utilization of informal-care, and then by adopting the instrumental variable approach described in paragraphs 2.2.2 and 2.3.1. The preferred specification is determined after conducting, for each part of the utilization model, a test of the exogeneity of the log-hours of formal home-care variable.

[190] We tried a modified specification with ISCED levels 0,1,2 and 3,4 and 5,6 being grouped together, respectively. The results hereby reported are confirmed, with a significant negative coefficient for the *low* education category.

In the first part, the extensive margin of the analysis (where the dependent variable is dichotomous and labelled as "any informal-care from children"), results are similar to those found in the previous paragraph. The Wald test for exogeneity of formal-care cannot be rejected (p-value = 0.42), and we therefore turn our attention on the simple probit specification (column "probit"). This result finds a correspondence in the paper by Bonsang (2009), who analyses the other direction of causality (i.e., the role of informal-care in determining formal-care utilization) using data from SHARE and a similar sample selection and finds that exogeneity of informal home-care from children on nursing/personal home-care cannot be rejected.[191]

Results from the probit model suggest that formal-care utilization increase the likelihood of receiving any informal home-care from children (p-value <0.001). As before, the magnitude of this effect is rather low. A 10% increase (decrease) in the annual hours of personal/nursing domiciliary care leads to a 0.09% point increase (decrease) in the probability of receiving assistance from one's own offspring. Given that the average annual hours of personal/nursing home-care provision is 9.6 among the whole sample, and that the average probability of receiving informal-care from children is 13.8%, an increase of average formal domiciliary assistance by 1 hours per year would lead to a 13.9% likelihood of informal-care use.

The second part of the model – the intensive margin – is the equation for the yearly log-hours of informal-care received from children (conditional to receiving any) and it is estimated both through OLS (assuming exogeneity of formal home-care use) and through 2SLS (where individuals' eligibility status is adopted as instrument). Similarly to what was found at the extensive margin, the null hypothesis of the Wu-Hausman test for exogeneity of formal-care cannot be rejected (p-value = 0.30), thus indicating the OLS specification as the preferred specification. This results contrasts with the findings in Section 2.4.2, when the dependent variable included all the possible sources of informal care and where endogeneity was detected.[192]

OLS estimates for yearly log-hours of formal home-care confirm the lack of crowding out of informal- by the formal-care: an increase of 1% in the intensity of formal-care provision leads to an increase of 0.064% in the intensity of informal-care from children, among recipients. At averages (418 yearly hours of informal-care, 37 hours of formal-care), an increase of 60 minutes per year in the formal-care provision leads to an increase of 43 minutes in the informal-care assistance from children living outside the household.

[191] Further analysis conducted in paragraph 2.6.1 will confirm this result.
[192] Because of the reduced sample-size, the first-stage of the 2SLS reports a lower F-statistics for the excluded instrument (eligibility) of 7.1 and still strongly significant (p-value of 0.008). Results are available upon request.

Table 2-7, Two-part model of informal home-care provision from children-only

Dependent variable	any informal-care from children				annual log-hours of informal home-care received from children, among receivers			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.009 ***	0.003	0.032	0.033	0.064 ***	0.023	0.300	0.239
Age	0.005 ***	0.000	0.005 ***	0.001	0.022 ***	0.005	0.017 ***	0.006
Being retired	-0.001	0.008	-0.002	0.008	-0.135	0.087	-0.171 *	0.092
Female	0.003	0.007	0.003	0.007	-0.046	0.090	-0.042	0.095
Living with spouse	-0.144 ***	0.008	-0.143 ***	0.008	0.011	0.101	0.014	0.119
Years of education	-0.003 ***	0.001	-0.003 ***	0.001	-0.036 ***	0.011	-0.045 ***	0.013
Having l.t. Illness	0.018 **	0.007	0.017 **	0.008	0.117	0.089	0.083	0.091
Euro-D score	0.003 **	0.002	0.003 **	0.002	0.033 **	0.017	0.024	0.020
Low numeracy-score	-0.006	0.008	-0.007	0.008	0.066	0.080	0.067	0.084
Low orientation-score	-0.027	0.019	-0.023	0.020	0.637 ***	0.183	0.674 ***	0.189
Any mobility deficit	0.049 ***	0.008	0.050 ***	0.008	-0.059	0.099	-0.001	0.106
# ADL limitations	0.058 **	0.024	0.056 **	0.024	-0.167	0.218	-0.243	0.240
# iADL limitations	0.020 ***	0.004	0.016 **	0.007	0.237 ***	0.035	0.189 ***	0.068
Mobility*ADL	-0.069 ***	0.024	-0.073 ***	0.025	0.152	0.218	0.138	0.227
# Chronic dis.	0.004	0.002	0.003	0.002	-0.028	0.025	-0.031	0.026
Bad subjective health	0.011	0.008	0.010	0.008	0.124	0.087	0.117	0.088
Living area (w.r.to rural area)								
Big city	0.005	0.012	0.007	0.012	-0.216	0.136	-0.173	0.142
Suburbs big city	0.005	0.011	0.005	0.011	0.045	0.123	0.099	0.132
Large town	-0.008	0.011	-0.007	0.011	0.185	0.117	0.250 *	0.130
Small town	-0.010	0.009	-0.010	0.009	-0.105	0.095	-0.095	0.098
F-test excluded instrument			F(1, 6380)=21.02***				F(1,1101) = 6.7***	
Testing the null of formal-care exogeneity			p-value = 0.42				p-value 0.15	
Observations	9334		9334		1283		1283	
Adjusted R^2	0.234				0.296		0.249	
Additional controls include dummies for country-, income-, wealth-, wave- effects.								

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from children corresponds to unpaid help with personal care, practical household tasks and paperwork
Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.
Standard errors are robust to heteroskedasticity and clustered at the individual level.
Years of education based on ISCED codes.
**** p-value<0.01, ** p-value <0.05, * p-value <0.1*

Effects of covariates like age, education, spousal support and health-conditions are consistent with the findings of the previous paragraph. Categorical variables for respondents' income and wealth were not significant. Additional controls include dummies for country and for waves.

2.5 ROBUSTNESS

Before discussing the results previously obtained and performing some further analyses, it is useful to perform sensitivity tests to check whether our findings are robust. In the following paragraphs we will relax a number of assumptions regarding the empirical specification, the sample selection and the definition of our dependent variable. Overall, our findings appear to be substantially robust to robustness tests.

2.5.1 A Tobit specification

The results presented in the previous section come from the adoption of a two-part model in which the extensive and the intensive margins of informal-care utilization are modelled separately and assumed to be independent. In this section we test, with robustness purposes, a Tobit model as an alternative specification to investigate the determinants of our dependent variable. The Tobit specification allows for zero-hours of care from children (a corner solution of the decision process on the amount of care) but, conversely to the two-part model, it assumes that the same probability mechanism generates both the first hurdle and the positive outcomes of utilization. That is, we will estimate a model for $y_i^* = \beta_1 + \beta_{fc} \ln(1+fc_i) + \underline{\beta}_X' X_i + \varepsilon_i$ with $\underline{\varepsilon} | fc, X \sim N(0, \sigma^2)$, $y_i = \max(0, y^*)$ and $y_i^* = \ln(1+ic_i^*)$, where ic_i represents the annual hours of home-care received from children. As for the two-part model, we face the potential endogeneity of the formal-care variable, which we instrument with the dummy for the eligibility status in an instrumental-tobit framework.

Table 2-8 reports the results for both the broad and the narrow specification of the dependent variable (informal-care hours received from children, relatives, friends and neighbours, rather than just from children). Exogeneity of formal-care is not rejected in both specifications (Wald test of exogeneity have p-values of 0.17 and 0.38, respectively), therefore we only discuss the results from the non-instrumented Tobit model (full results are available upon request).

In particular, we report the estimated marginal coefficients for the probability of being uncensored and for the conditional mean of the dependent variable on the left-truncated sample (Wooldridge, 1995). The former coefficients estimate how the change in a regressor affects the probability of observing positive values of hours of informal-care.[193] The latter show how a change in a regressor affects the uncensored (i.e., positive-valued) observations.[194]

[193] That is, we look for $\partial \Pr[y > 0] / \partial x_k$

[194] That is, $\partial E[y | y > 0] / \partial x_k$

Table 2-8, results from the Tobit specifications

Dependent variable	annual hours of informal-care from children, relatives, friends				annual hours of informal-care from children			
	Marginal coeff. on probability		Marginal coeff. on left-truncated obs.		Marginal coeff. on probability		Marginal coeff. on left-truncated obs.	
	coeff.	S.E.	coeff.	S.E.	coeff	S:E	coeff.	S.E.
Log-hours FHC	0.012 ***	0.003	0.063 ***	0.017	0.008 ***	0.003	0.054 ***	0.017
Age	0.005 ***	0.001	0.028 ***	0.003	0.005 ***	0.000	0.032 ***	0.003
Being retired	0.004	0.010	0.019	0.052	-0.002	0.008	-0.012	0.052
Female	-0.012	0.009	-0.063	0.047	0.001	0.007	0.009	0.048
Living with spouse	-0.220 ***	0.010	-1.135 ***	0.046	-0.142 ***	0.008	-0.926 ***	0.047
Years of education	-0.001	0.001	-0.007	0.006	-0.003 ***	0.001	-0.019 ***	0.006
Having l.t. Illness	0.016 *	0.009	0.083*	0.048	0.019 **	0.008	0.125 **	0.049
Euro-D score	0.007 ***	0.002	0.036 ***	0.010	0.004 **	0.002	0.025 **	0.010
Low numeracy-score	-0.018 *	0.009	-0.091 *	0.049	-0.006	0.007	-0.041	0.048
Low orientation-score	-0.036	0.024	-0.188	0.124	-0.015	0.018	-0.099	0.116
Any mobility deficit	0.069 ***	0.010	0.358 ***	0.050	0.050 ***	0.008	0.319 ***	0.052
# ADL limitations	0.063 **	0.030	0.325 **	0.154	0.057 **	0.023	0.370 **	0.150
# iADL limitations	0.024 ***	0.004	0.124 ***	0.022	0.020 ***	0.003	0.128 ***	0.021
Mobility*ADL	-0.073 **	0.030	-0.375 **	0.155	-0.067 ***	0.023	-0.437 ***	0.150
# Chronic dis.	0.003	0.003	0.018	0.015	0.003	0.002	0.020	0.015
Bad subjective health	0.023 **	0.009	0.121 **	0.048	0.013 *	0.008	0.086 *	0.050
Living area (w.r.to rural area)								
Big city	-0.008 *	0.015	-0.042	0.077	0.002	0.012	0.014	0.079
Suburbs big city	-0.002	0.013	-0.008	0.068	0.003	0.011	0.023	0.069
Large town	-0.008	0.013	-0.043	0.068	-0.004	0.011	-0.026	0.069
Small town	-0.022 **	0.011	-0.116 **	0.055	-0.012	0.008	-0.077	0.055
Observations	9342 (1721 uncendored)							

Additional controls include dummies for country-, income-, wealth-, wave- effects.

Estimations with robust standard errors clustered at the individual level

Results from the Tobit specifications confirm those obtained with the two-part model, since the hypothesis of informal-care being crowded-out is again not supported by our data. It is also interesting to notice how both the marginal Tobit coefficients for the probability of informal care being greater than zero and those of the truncated samples resemblance those from the two-part models (Table 2-6, Table 2-7) in the previous section (this reflects in very similar elasticity of informal-care on formal-care). Nevertheless, the Tobit specification lacks some explanatory power with respect to the two-part alternative: characteristics like "spousal support" as well as various health-related variables were found to be important determinants of the extensive margin of the analysis but not of the intensive one. In the Tobit model this information is missing, and the aforementioned variables have all significant coefficients. Moreover, the additional effect of the orientation impairment found in the equation for the hours of informal-care is not captured in the Tobit output.

2.5.2 Alternative Sample selections

We tried numerous alternative sample selections to test the robustness of our results.

Our main specification includes both couples and single-living individuals (not living with their children). We account for the role of spousal support, for which we do not have quantitative information in SHARE, through a dummy variable that capture the presence of a spouse in the household (as in, e.g., Bonsang (2009), Kalwij *et al.* (2014), Bakx *et al.* (2014)). Other studies using SHARE proposed to restrict the focus to the single-only subsample, in order to avoid potential underestimation of informal caregivers (Balia & Brau, 2013; Bolin *et al.*, 2008). As a robustness, we replicate our model on the latter specification. The reduced dimensionality causes a drop in the performance of our instrument's relevance ($F(1, 1781) = 8.8$), although it remains strongly statistically significant (at 1%). The complementarity interplay between formal and informal care is confirmed both at the extensive margin (where endogeneity is rejected) and at the intensive margin (where endogeneity is detected).

Table 2-9, Two-part model for the population of single-only

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.023 **	0.009	0.112	0.088	0.066 ***	0.025	0.794 *	0.433
Testing the null of formal-care exogeneity			p-value = 0.343				p-value 0.005	
First-stage weak-instrument test			F(1, 1781) = 8.8***				F(1, 880) = 5**	
Observations	2570		2570		1062		1062	

Standard errors are robust to heteroskedasticity and clustered at the individual level.

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from outside the household by children, relatives, friends and neighbours corresponds to unpaid help with personal care, practical household tasks and paperwork.
Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.
Standard errors are robust to heteroskedasticity and clustered at the individual level.
Years of education based on ISCED codes.
**** p-value<0.01, ** p-value <0.05, * p-value <0.1*

Next, we test different age-selections of our sample. Our main specification includes individuals aged 60 or older. As sensitivity tests, we try to focus on the population over 55 (de Meijer *et al.*, 2011), 65 (Bonsang, 2009) and 70 (Van Houtven & Norton, 2004). Under all these restrictions, our instrument remains strongly relevant and all findings are confirmed. Results are available in the following tables.

As for the population aged 55+, results confirm our previous findings. The coefficient of formal-care is positive and significant in the un-instrumented probit, as well as in both the specifications in the second-part. Exogeneity of formal care is rejected in the second-part of the model. When informal-care is limited to children, exogeneity of formal-care cannot be rejected and previous findings are fully confirmed. Detailed results are available upon request.

Table 2-10, Two-part model for the population over 55 years old

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.013 ***	0.003	0.068	0.043	0.050 **	0.022	0.673 *	0.388
Testing the null of formal-care exogeneity			p-value = 0.193				p-value 0.022	
First-stage weak-instrument test			F(1, 7852) = 19.5***				F(1, 1688) = 5.7**	
Observations	11581		11581		1964		1964	

Standard errors are robust to heteroskedasticity and clustered at the individual level.

Sample selection: individuals over 55 from waves 1&2 from SHARE, having children but not living with them.
*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

As for the population aged 65+, results confirm our previous findings, in that the effect of formal-care is positive and significant. Exogeneity of formal care is rejected in the both the first and the second part of the model, and our instrument remains highly relevant with an F statistics of 20 in the first stage. When informal-care is limited to children, exogeneity of formal-care cannot be rejected, and results confirm those of Section 2.4.3. Full results are available upon request.

Table 2-11, Two-part model for the population over 65 years old

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.013 ***	0.004	0.107 **	0.048	0.055 **	0.023	0.500 *	0.286
Testing the null of formal-care exogeneity			p-value = 0.04				p-value 0.051	
First-stage weak-instrument test			F(1, 4850) = 19.9***				F(1, 1245) = 7.4***	
Observations	7019		7019		1470		1470	

Standard errors are robust to heteroskedasticity and clustered at the individual level

Sample selection: individuals over 65 from waves 1&2 from SHARE, having children but not living with them.
*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

Lastly, for the population aged 70+, formal care is found to be endogenous at the extensive and the intensive margins. The coefficients of interest are always positive and significant. Thus, our main results are confirmed. As before, when informal-care is limited to children, exogeneity of formal-care cannot be rejected and previous findings are entirely confirmed. Full results are available upon request.

Table 2-12, Two-part model for the population 70+

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.016 ***	0.005	0.099 **	0.050	0.060 **	0.024	0.429 *	0.259
Testing the null of formal-care exogeneity			p-value = 0.099				p-value 0.096	
First-stage weak-instrument test			F(1, 3269) = 19.0***				F(1, 979) = 7.64***	
Observations	4635		4635		1164		1164	

Standard errors are robust to heteroskedasticity and clustered at the individual level

Sample selection: individuals over 70 from waves 1&2 from SHARE, having children but not living with them.
*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

Furthermore, we are interested to determine whether the lack of crowding-out of informal-care by the formal-care depicted in the previous section is mainly driven by the oldest-old population, who could be more inclined to "accumulate" any available form of long-term care to fulfil residual needs of assistance. In order to test this hypothesis, we repeat our analysis on the sub-sample of individuals aged 80+ (1232 observations)[195]. The eligibility variable is still a good instrument for annual hours of formal home-care (the weak-instrument test returns an F-statistic of 12.5 and 9.5 at the extensive and intensive margin, respectively), and it allows us to implement our two-part model of informal-care utilization. When adopting the broader definition of informal-care (assistance from outside the household by children, relatives, friends, neighbours), results are weaker as reported in Table 2-13. At the extensive margin, exogeneity of formal-care cannot be rejected and a complementarity effect is found: the marginal coefficient for formal-care has a higher magnitude but a lower significance level with respect to the results in the main specification. At the intensive margin, endogeneity is not detected and the outcome of the OLS model confirms the lack of crowding-out. The elasticity on the uncensored sample is lower than in the main specification, but one has to consider that the average hours of informal care are much higher now; therefore, the elasticity effect evaluated at averages is stronger. Under the narrower definition of informal-care (help by children from outside the household), results are much weaker, and no significance effect of formal-care on informal-care appears at any level of the two-part model (exogeneity of

[195] The eligible population is 23.3%, the incidence of formal home-care utilization is 21.2%.

formal-care is never rejected, as before). When the informal-care is limited to children, exogeneity of formal-care cannot be rejected, and results confirm those of Section 2.4.3. Full results are available upon request.

Table 2-13, Two-part model for the oldest old (80+) population

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.017 *	0.010	0.085	0.064	0.042	0.030	0.281	0.194
Testing the null of formal-care exogeneity			p-value = 0.335				p-value 0.20	
First-stage weak-instrument test			F(1, 929) = 12.5***				F(1, 433) = 9.56***	
Observations	1232		1232		521		521	

Standard errors are robust to heteroskedasticity and clustered at the individual level

Sample selection: individuals over 80 from waves 1&2 from SHARE, having children but not living with them.
*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

Another robustness we want to perform regards the "very sick" population, who could drive the overall result because of their need to accumulate every possible source of home-care, in a similar fashion to the oldest-old.[196] Since it is not feasible to re-run our two-part model on a sub-sample of highly vulnerable individuals (the eligibility dummy becomes a weak instrument), we follow the opposite strategy, by excluding those respondents from the main sample. We define "high vulnerability" with having at least three limitations in ADL and at least one limitation in iADL (300 observations). Results obtained by excluding these observations confirm entirely the findings described in the previous section and are shown in the following table (full results are available upon request). Endogeneity is not detected neither in the first part nor in the second.

[196] Albeit being a condition that increase exposure to vulnerability, ageing is not a disease per se. Indeed, looking at the "highly vulnerable" population with at least three limitations in ADL and at least one limitation in iADL, the share of individuals aged 80+ is only 44%.

Table 2-14, Two-part model for the population aged 60+, excluding high-vulnerability cases.

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.014 ***	0.004	0.008	0.041	0.069 ***	0.025	0.464	0.310
Testing the null of formal-care exogeneity			p-value = 0.80				p-value 0.11	
First-stage weak-instrument test			F(1, 6217) = 22.9***				F(1, 1385) = 6.5***	
Observations	9042		9042		1600		1600	

Standard errors are robust to heteroskedasticity and clustered at the individual level

Sample selection: individuals over 60 from waves 1&2 from SHARE, having children but not living with them. Individuals with at least 3 ADL and at least 1 iADL are excluded.
*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

Our main specification excludes from the sample all the individuals living with at least one of their offspring, since SHARE data do not allow us to quantify the amount of care provided by household members. Since the role of this kind of help (when available) is likely to be important, following Bonsang (2009) we replicate our analysis by including in the sample selection all those individuals having *at least one* child living outside the household (thus not ruling out living arrangements that see children living with their parents). Co-residence is accounted for with a dummy indicating whether any of respondent's children live in the same household. Results from this specification entirely confirm the positive relationship between formal and informal home-care previously reported. Endogeneity is detected at both hurdles of the two-part model.

Table 2-15, Two-part model for the population aged 60+, including households with cohabiting children.

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.013 ***	0.003	0.083 *	0.043	0.067 ***	0.021	0.593 *	0.325
Testing the null of formal-care exogeneity			p-value = 0.095				p-value 0.028	
First-stage weak-instrument test			F(1, 6897) = 20.9***				F(1, 1578) = 6.56**	
Observations	10221		10221		1855		1855	

Standard errors are robust to heteroskedasticity and clustered at the individual level

Sample selection: individuals over 60 fro[[[[[[m waves 1&2 from SHARE, having children. At least one child lives outside the household.

*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

We ran our model separately for wave 1 (4846 observations) and wave 2 (4499 observations) and fully confirm the results of a positive relationship between formal and informal care utilization (available upon request).

Finally, we tried to exclude Austria (1235 observations) from the sample, given that its LTC regulations (at 2004, 2006) was rather unclear on the boundaries to the discretionary use of the allowance and no clear obligation to pay for care or to use care services was identifiable. After reducing the country-sample, the instrument' strength remains intact and results are by and large confirmed (results are available upon request).

2.5.3 Alternative (ordered) dependent variable

As explained in Section 2.2.3, we built our dependent variable for annual hours of informal-care basing on respondents' answers to questions on how often and for how many hours (per session, on average) informal-care was received in the twelve months previous to the interview. The former question allows us to generate an ordinal variable which takes the following values: (1) almost daily; (2) almost every week; (3) almost every month; (4) less often. Combining this information with the estimated amount of hours of care received on each occasion allows us to build the continuous variable adopted as dependent variable so far in the paper. This mechanism of building a continuous variable from an ordinal variable could raise some doubts on the accuracy of our adopted measure of informal-care. In order to check for the robustness of our results, we perform an ordered-probit analysis in place of the linear specification in the second part of our two-part model. As detailed in Section 2.2.3, SHARE respondents reports information for the assistance received by a maximum of three informal caregivers. We build a categorical variable called "highest IC frequency" which reports the information on the assistance received by the most frequent care-provider among children, friends, relatives and neighbours.[197] This variable outcomes are naturally ordered from low to high frequency of care and is distributed as in Table 2-16. In order to deal with this kind of dependent variable, we adopt a standard model as the ordered probit (Cameron and Trivedi (2005), pag. 519) for the population that receives some informal-care. As in the previous specifications, we estimate a model where potential endogeneity of formal-care hours is accounted for, as well as a model in which exogeneity is assumed.

Table 2-16, Frequency of IC received by any provider

Highest frequency of IC received from any provider	Less often	Almost every month	Almost every week	Almost daily	Total
Frequency	421	301	661	338	1721

Results reported in Table 2-17 show how previous findings are confirmed. An increase in formal-care utilization results in significantly higher probabilities of receiving high frequency informal-care (daily and weekly) and significantly lower probabilities of receiving low frequency care (monthly or less frequent).

[197] As an example, suppose that a respondent reports to receive care from two informal caregivers "almost every day" and "almost every week", the dependent variable will report the "almost every day" category.

Table 2-17, Results for the ordered-probit specification

Dependent variable: informal care frequency	Daily		Weekly		Monthly		Less frequent	
Variables	marg. coeff	IV coeff	marg. coeff	IV coeff	marg. coeff	IV coeff	marg. coeff	IV coeff
Yearly log-hours FC	0.014***	0.071	0.007***	0.038	-0.003***	-0.015**	-0.017***	-0.094
Robust standard errors	(0.004)	(0.059)	(0.002)	(0.033)	(0.001)	(0.006)	(0.006)	(0.087)

Observations: 1721

Additional controls include health, socio-economic, country-, wave- effects.

*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, # ADL limitations, # iADL limitations, interaction mobility*ADL limitations, # chronic diseases.*
Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.
Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from children, relatives, friends and neighbours corresponds to unpaid help with personal care, practical household tasks and paperwork.

2.6 ENDOGENEITY AND UNMET DEMAND: DISCUSSION

Results in Section 2.4 highlighted two main features of the relationship between formal and informal home-care for the Elderly in Europe. First, endogeneity of the formal-care decision is detected when attention is paid to the aggregate supply of informal-assistance by respondents' children, relatives, friends and neighbours (broad definition). Second, the positive relationship between formal and informal care (both under the broad and the narrow definition of the latter) suggests that a substantial unmet demand of long-term care exist among European elderlies, which is addressed with a combination of both formal and informal interventions.

Before commenting on these results, it is important to recall that our variable of *formal* domiciliary care encompasses activities labelled as *nursing/personal* care, which are usually defined as *skilled care activities* as opposed to *unskilled care* like help with domestic tasks (Colombo *et al.*, 2011; OECD, 2013a). *Nursing* and *personal* assistance are the most demanding care activities (psychologically, economically and logistically), since they relate to limitations in basic activities of daily livings or in cognitive abilities, and are the kinds of elderly-care more often provided or subsidised by public LTC programmes.[198] Indeed, it is mainly through this channel that policy decisions on LTC are implemented: reforms of LTC regulations are much debated in Europe, with respect to both the level of coverage (i.e., the target population of public programmes of care) and its intensity (i.e., the amount of in-kind or in-cash benefits allowed to entitled individuals). Access to formal-care is only partially under recipients' control since, as we showed in Chapter One and depicted again in this Section 2.2.2, official regulations determine specific and clear-cut definition of eligibility rules and of "objective vulnerability" conditions in order to identify those elderly adults entitled to receive formal care. Nevertheless, some discretionality exist. In Section 2.2.4 we showed that eligible individuals can end up not being treated by the formal care (i.e., discretionality in access to care). In Section 2.4.1 we showed that respondents (and

[198] On the health burden for informal caregivers see, e.g., Bobinac *et al.* (2010), Coe and Van Houtven (2009), Colombo *et al.* (2011) and Stroka (2014).

institutions) adjust the care-provision according to health-conditions (the need-of-care), above and beyond the individual's eligibility status to LTC (i.e., discretionality in the levels of care). Moreover, Section 1.4 in Chapter One provide evidence that educational attainments are important determinants of the lack of accessibility of LTC programmes (i.e., failure to receive formal home-care although being legally entitled to).

Economic theory provides several reason to think that observed utilization of formal home-care by elderly adults might be endogenous to their utilization of informal-care. Our empirical strategy introduced a novel instrumental variable approach that address this issue by considering the (exogenous) eligibility status to LTC formal home-based care, determined by nation- or region wide regulations. The instrument, a dichotomous variable, is shown to be relevant under many specifications (paragraph 2.4.1 and Section 2.5). In analysing the causal effect of a change in the use of formal-help on the informal provision, we adopt both a broad and a narrow definition of the latter, depending on whether the assistance by relatives, friends and neighbours is accounted for or not. Findings in Section 2.4 highlight that endogeneity in the observed use of formal-care arises when the contributions of multiple providers are included in the analysis, i.e., when we consider that an elderly-adult can "allocate" the overall amount of care-need between the State, the inner family-circle (spouse and children) and the outer social-network (relatives, friends and neighbours), according to her own preferences. This result is confirmed and strengthened by our robustness tests, where exogeneity is rejected also at the extensive margin for some alternative sample selections. Conversely, endogeneity of formal-care is never detected when the dependent variable is narrowed to the assistance supplied by children only. A possible explanation for this result comes from considering that, by excluding the contribution of relatives, friends and neighbours, the analysis is not accounting for the potential economic relationship existing between these sources and the informal-care from children. Recent literature has stressed the fact that elderly-care from the outer social-network is (1) non-negligible and; (2) endogenous with respect to children's care-provision. In particular, Kalwij *et al.* (2014) show that the informal sources of care are substitute between each other: when an elderly individual can rely less on children, she will make alternative home-care arrangements with relatives and friends. With this in mind, it is plausible that an analysis looking at the mechanisms behind the utilization of formal and the sole informal-care from children, is missing part of the story, therefore being unable to empirically identify endogeneity from individuals' actual behaviour. It is worth noticing that endogeneity is detected among respondents that already receive some informal assistance (i.e., on the intensive margin): when analysing the utilization of formal-care as a determinant of the sole decision to receive any informal-assistance, the two choices appear as exogenous.

As already mentioned, policy intervention on formal-care can operate on two main dimensions: a policy can intervene on (1) a programme's coverage, typically by intervening on eligibility rules as it was discussed in Chapter One, or on; (2) the intensity of the coverage offered to eligible individuals, through changes in the amounts of cash-allowances/reimbursements or in the amount of care provided in-kind through nurses, social workers or affiliated NGOs. Either ways, after institutional changes have taken place, elderly individuals will be faced with either a reduced or an increased supply of formal-care. Our main question relates to how this potential increase would affect the overall long-term care received by the dependent adult, that is wondering whether a, say, increase in the formal-care provision would: (1) substitute for the existing informal-care already being provided by family members, friends and neighbours, or; (2) be complemented by the family pillar of social protection, therefore raising the overall amount of care and fulfilling what we would call a previously unmet demand of care.

As far as the relationship between the formal and the informal provision of elderly-care is concerned, our analysis shows that there is no empirical evidence supporting the theory of a crowding-out of informal- by the formal assistance. Conversely, a positive relationship exist between the two sources of care, showing that informal-provision reacts to modifications in the formal-provision in a positive proportionate way. An increase in the formal-care utilization is shown to increase the overall long-term care received by the elderly individual, through a subsequent increase in the overall help by children, relatives, friends and neighbours. This result holds when the informal care is measured considering just the hours of help provided by recipients' offspring.[199] Our findings hint at the existence of an unmet residual demand of long-term care, either due to budget constraint (shadow-prices of informal-care is too high, or formal-care's is poorly reimbursed by the public) or to a lack of supply (informal-caregivers' availability is low, formal programmes' design is inadequate). This residual need-of-care is addressed by a further increment in both the formal and the informal help. Such a result is better understood when we think at the overall need-of-care (the total demand of LTC) as a latent variable which we do not observe. What we do observe, indeed, is the actual care-utilization as an aggregate of the Public, the Family pillars, together with the contribution of the outer social-network. If the total (latent) demand of care would correspond to the actual care-utilization, then respondents would already be satisfying their needs and we would expect to find a negative relationship between an increase in help from one source and the amount of help from the remaining caregivers (a sort of "substitution" effect between Public and Family/Friends providers).[200] Conversely, a non-satiation behaviour leads elderly individuals to "accumulate" and demand as much care as possible, especially among the oldest-old, since the total demand of care is not being satisfied yet. In this respect, we could talk of a "complementarity relationship" between the two main sources of elderly-care (public and family/friends). Furthermore, it is important to note that an increase in formal LTC can alert family and non-family potential caregivers to the elderly adult's loss of autonomy, making them more aware of the ongoing vulnerability process, thus stimulating them to, in turn, increase their own provision of assistance and protection. Besides being a hint of an existing unmet demand of care, the positive relationship could, at least partially, be accounted to the different nature of formal- and informal- assistance. As stated earlier in paragraph 2.2.1, if formal and informal-care are not substitute in terms of their efficiency in providing care (meaning that informal caregivers cannot effectively replace formal caregivers in their help-tasks), this could contribute to the findings of a positive relationship between the two. In our specification, the formal-care is labelled as "skilled" (personal/nursing care), while the informal-care is considered without any qualitative distinction. Although it would be probably hard to claim that these two services are perfect substitutes, we cannot, accordingly, posit on an underlying perfect complementarity.

Interpreting our results under the theoretical framework proposed by Stabile *et al.* (2006) allows us to gain further insights. According to their model's predictions, a positive effect on informal-care utilization after an increase in the public-care provision necessarily implies that the need-of-care of the elderly recipient is not exhausted by the provision

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[199] Section 2.5 provided some evidence on the external validity of our results, with respect to age selection, health conditions, presence of cohabiting children or spouse in the household and a different specification of the dependent variable.

[200] If $HC_i = FHC_i + TIHC_i$, where HC represents total home-care, FHC are the hours of formal home-care received and TIHC are the total hours of informal-care provided by children, relatives, friends and neighbours. It is straightforward that, if the total (latent) demand of care (HC*) is already satisfied by HC (i.e., HC = HC*) and will remain constant, the effect of an increase in FHC (because of, say, an increased coverage rate of the national LTC programme) will be a decrease in TIHC. The total differentiation of HC leads to $dHC = \frac{dHC}{dFHC} dFHC + \frac{dHC}{dTIHC} dTIHC$ and, since $dHC = 0$, to $\frac{dTIHC}{dFHC} = -\frac{\partial HC / \partial FHC}{\partial HC / \partial TIHC} < 0$.

of public home-care that he is eligible to receive, and supplements it through the purchase of additional formal-care on the market. When an increase in publicly provided care takes place, the overall care-giving activities increase, both on the formal and on the informal source. It has to be noted, however, that our empirical model is unable to distinguish between public and private formal-care. We decided to focus on the sole formal "personal/nursing" care, in order to avoid the consideration of those low-skilled forms of care that are most likely provided by private agents, but this does not guarantee us that the observed value of formal-care utilization is entirely publicly provided. Nevertheless, the model by Stabile et al., states that, should the formal-care provision be entirely public and fully exhausted (that is: the individual receives all the public care that he is entitled to, and does not supplement it with private provision; M=M1=m; M2=0), we should not observe a positive sign, but rather a negative one. They state: "Thus, in the case of a corner solution, whereby the household exhausts the public allocation of care, an increase in that allocation results in a decrease in informal care-giving activities as publicly financed care substitutes for household care-giving activities". Since we do not observe a negative sign but a statistically significant positive one, we are led to believe that this provides some evidence for the existence of a demand of LTC which is not satisfied by the public provision.

Finally, this results show that further social-protection is needed to address the LTC risk, both with public and private forms, enhancing accessibility, affordability and accessibility of care. Such findings become even more relevant when one recalls the crucial role played by *skilled* formal home-care in promoting the practice of healthy (and active) ageing (Rechel *et al.*, 2013; van Leeuwen *et al.*, 2014). As mentioned earlier in this dissertation, a proactive role of formal-care is needed in order to prevent the loss of autonomy, thus reducing LTC demand and increasing its supply (by healthy youngest-old caregivers), and to boost efficient, cost-effective care provision in home-based care (European Commission, d. o. E., Social Protection Committee, 2014).

Further analysis on these topics can be performed by trying to link our results to those previously obtained in the literature which investigated similar questions. As mentioned in Section 2.2.1, health-economic literature already studied how a change in the informal elderly-care utilization can affect individuals decision on how much formal-assistance to receive (if any). In the following paragraph we investigate this issue and gain further insights on the analysis previously conducted.

2.6.1 A look at the other direction of causality

When trying to set up a two-part model for the other direction of causality (that is: a first part to model the utilization of formal home-care and a second part to explain the intensity of the provision), the main covariate of interest is the annual amount of log-hours of informal care that the elderly adult received. This topic was especially addressed in the well known paper by Eric Bonsang (2009), where formal-care was considered, in separate equations, both in its "nursing/personal care" and in the "domestic help" form, in order to show that the relationship between informal and formal assistance could change, depending on the difficulty degree inherent to the task being performed by the nurse or the social worker. In what follows, coherently to what has been done in the previous Sections, we only concentrate on the *skilled* type of formal-care, defined as personal or nursing care.

For the same reasons discussed earlier in this Chapter, possible endogeneity between the main covariate (hours of informal care) and the dependent variable (hours of formal care) cannot be ignored. If one relies on instrumental variable techniques to sort out this empirical issue, the usual demanding challenge consist in finding an exogenous and relevant instrument for the informal-care, which– in turn – can be defined following a broader or a narrower view (i.e., whether to account for the help provided by relatives, friends and neighbours, besides children), as discussed earlier in

this paper. Eric Bonsang only considers the informal care from respondent's offspring, and propose a set of instrument including the proportion of daughters (out of the total number of respondents' children), and children's geographical proximity (distance of the nearest child from the elderly parent). Although some doubts have been cast on the exogeneity of the children's proximity variable (parents may choose to move nearer to their children when their own health deteriorates, or children may choose to live near their disabled parents, see Bonsang (2009) for details), the information on children gender should not raise any endogeneity concern and should be only evaluated on its explanatory power.

The analysis carried out in Section 2.4 highlighted that including multiple providers of informal-care (besides respondent's children) in the analysis has important consequences on the endogenous nature of formal-care, which was detected with respect to the broad supply of informal-care but not to the one constituted by children only.

Aiming at studying the same relationship from the other direction, we realize that the existing instruments proposed in the literature do not seem suitable to instrument the informal help coming from various providers besides the children. In particular, we are worried about a potentially weak empirical link between the information on children's gender and the overall provision of care (by children, relatives, friends and neighbours)[201]. A reason for this comes from findings in Kalwij *et al.* (2014), where the authors show evidence of substitutability between sources of informal care using SHARE data. Since (1) the fraction of daughters is a significant positive determinant of the help received from children, and given that (2) the latter is a substitute for help from relatives, friends and neighbours, the relevance of children's gender variable as an instrument for the broad supply of informal care (from any provider) could be relatively low.

The statistical relevance of the variable on children's gender (fraction of daughters) in explaining the informal-care by all providers is tested through the Kleibergen-Paap Wald rk statistics, in the first stage of the first part of our two-part model (results are available upon request). Indeed, the resulting statistic $F(1, 6179)$ is equal to 9.25 (p-value = 0.002), which is below the rule-of-thumb of 10 commonly adopted with exactly identified instrumental variable models[202]. Therefore, it seems that the link between the instrument and the endogenous variable is not strong enough to build a model of formal-care utilization having among the regressor the comprehensive definition of informal-help.

Conversely, when choosing to focus on children's informal-care, the information on the fraction of daughters appears like a legitimate and an exogenous instrument, as argued by Bonsang. Indeed, the first-stage equation for informal-care shows that the instrument is stronger, with the Kleibergen-Paap Wald rk statistics being equal to 12 (p-value = 0.000, full results are available upon request).

The first hurdle of the two-part model is estimated as before through an Instrumental variable Probit (via Maximum Likelihood Estimation), and the Wald test of exogeneity of informal-care is performed. The test results confirm the findings by Eric Bonsang, namely, the impossibility of rejecting the null hypothesis (p-value = 0.55) of exogeneity. At the intensive margin (the last two columns), no endogeneity is found either (the null hypothesis of the Wu-Hausman test is not rejected, $F(1,655) = 0.83$ with a p-value of 0.36). This mirrors the findings of Section 2.4.3, when the dependent variable was indeed informal-care from children and the main regressor was formal home-care. As a

[201] We choose not to consider geographical proximity as an instrument, due to its potential endogeneity
[202] See Staiger and Stock (1997) and Stock *et al.* (2005) for further discussion.

consequence, the un-instrumented Probit model is the appropriate model to run for the first part, while the linear OLS is the preferred specification for the second part. Results from the two-part model are reported in Table 2-18, only for the preferred specifications (full results are available upon request).

The coefficient of informal-care annual log hours from children is highly significant and positive, equal to 0.0045. which hints at the presence of a small "trigger effect" similar to the one found in the main specification (Section 2.4): an increase in the amount of informal-care (in this case, by children-only) increases the likelihood of starting receiving formal-assistance, after accounting for the care-recipient's medical status. Indeed, besides offering assistance in activities of daily living, the caregiver can provide help in gathering information on available formal programmes of care. Moreover, an increased informal-care provision can raise the awareness (both of the elderly adult and of the caregiver herself) on the ongoing process of increasing vulnerability and on the opportunity of relying on some additional kind of (formal) help. Although the decision about formal-care utilization also pertain to the institutional framework that regulate LTC provision in the recipient's country or region, this results show that a proactive role in approaching formal assistance is played by informal caregivers.

Looking at the linear specification (OLS) for the intensive margin, no significant effect of an increase in informal-care on formal-care utilization appears, after controlling for socio-economic and health conditions, confirming Bonsang's results. This contrasts sharply with the results of our main specification (Section 2.4.3), where an increase in formal-care utilization led to a significant increase in the informal-care provision from children (a similar effect was found when allowing for a broader definition of informal-care, see Section 2.4.2). Moreover, an overall lack of significance (found also in Eric Bonsang's paper) is evident for most of the covariates included in the specification, apart from the number of limitations in iADL, the presence of long-term illnesses and the respondent's age. Such findings suggests that the amount of formal-care received by elderly adults is relatively unelastic among those that were already granted it: while it might adapt to some changes in medical conditions, there is no evidence of adjustments taking place because of revisions occurring in the provision of informal care. Indeed, the regulations of the main LTC programmes in the four countries included in this empirical analysis do not account for the availability of informal-care (of any kind) in determining the individuals' need-of-care (they are, so called, carer-blind systems), but evaluate vulnerability only on individuals' medical-characteristics.

Table 2-18, Two-part model for formal home-care utilization

Dependent variable	any formal home-care received			annual log-hours of formal-care, among receivers		
	Probit			OLS		
	marg. coeff.		S.E.	marg. coeff.		S.E.
Log-hours IHC	0.005	***	0.001	0.021		0.023
Age	0.001	***	0.000	0.016	**	0.007
Being retired	0.010	**	0.005	0.121		0.145
Female	0.002		0.004	0.138		0.117
Living with spouse	-0.008	*	0.005	-0.040		0.138
Education level (w.r.to low)						
Medium education	0.013	***	0.004	0.018		0.132
High education	0.005		0.005	-0.021		0.178
Having l.t. Illness	0.009	**	0.004	0.264	*	0.136
Euro-D score	0.003	***	0.001	-0.004		0.023
Low numeracy-score	0.001		0.004	0.073		0.115
Low orientation-score	-0.004		0.011	-0.004		0.231
Any mobility deficit	0.010	**	0.005	-0.064		0.158
# ADL limitations	0.013		0.013	0.009		0.354
# iADL limitations	0.008	***	0.002	0.213	***	0.043
Mobility*ADL	0.002		0.013	0.191		0.353
# Chronic dis.	0.004	***	0.001	0.006		0.034
Bad subjective health	0.021	***	0.004	0.101		0.129
Living area (w.r.to rural area)						
Big city	-0.010		0.007	-0.298		0.198
Suburbs big city	-0.006		0.006	-0.094		0.168
Large town	-0.012	**	0.006	-0.233		0.175
Small town	0.000		0.005	-0.052		0.134
Intercept						
Observations	8900			721		
Additional controls include income-, wealth-, country- and wave- effects.						

Formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from children corresponds to unpaid help with personal care, practical household tasks and paperwork. The results from the instrumented specification of the two-part model are available upon request.

Summarizing, in this paragraph we looked at the effect of a change in the informal-care from children (yearly log-hours) in the formal-care utilization by the elderly adult (yearly log-hours). At least four main points have been raised.

First, the analysis of the effects of a change in the overall informal-care (gathering together multiple providers like children, relatives, friends and neighbours) on the formal-care utilization by elderly adults cannot be performed, due to lack of proper instrumental variables to account for the potential endogeneity of informal-care. As a consequence,

the focus need to be limited on the help provided by respondents' children, for which valid instruments exist and can be retrieved from SHARE data. No proper comparisons can therefore hold with the results in Section 2.4.2.

Second, a "trigger effect" of informal-care by children on the formal-care utilization is detected. This shows that an increase in children assistance per se, controlling for the recipient's medical status, stimulate the utilization of formal home-care. Such a finding mirrors what was found in Section 2.4.3, i.e., a higher provision of formal-care stimulates the intervention of informal care providers. Albeit similar, these effects have different policy implications, as we will discuss after this short summary.

Third, endogeneity in the choice of the amount of children's informal-care with respect to the choice of formal-care is not detected (among the population who receive formal-care). Again, this finding mirrors what was found in Section 2.4.3. As argued at the beginning of this Section, the lack of endogeneity could be due to the fact that important sources of informal assistance (i.e., relatives, friends and neighbours) are excluded from the analysis.

Fourth, no significant effect is found at the intensive margin, i.e., nothing can be said on the implication on formal-care utilization of a change in the amount of hours of informal-care by children. When looking at the other direction of causality, a different result was found: an increase in the formal provision of care would lead to a higher utilization of informal-care. In other words, utilization of informal-care is elastic to changes in the formal-care provision, showing that a residual unmet demand of care exist among vulnerable elderlies in Europe, while the utilization of formal-care does not seem to react to different arrangements in the informal-care provision. A reason for this relies in the inherently institutional-nature of formal-care programmes, whose regulations do not account for informal care-supply in defining the need-of-care of individuals (at least, in the countries hereby considered).

A final consideration is due on the different rationale that is behind the two directions of causality investigated in this paragraph (how informal-care affects formal-care use) and in Section 2.4 (how does formal-care use affect informal-assistance). Switching the dependent variable with the main regressor-of-interest does not correspond to a mirroring of the coefficients' interpretation. As already highlighted, it is reasonable to assume that individuals' discretionality in the choice of informal-care provision be higher than in the case of formal-care, for at least two reasons. First, receiving help from children attains to a sort of social-relationship than the one existing between an individual and some (public) formal helper. Elderly adults have a higher chance to discuss their medical condition with their offspring (as well as with relatives, friends and neighbours) than they have with social workers or professional nurses, and it is arguable that they can exercise a higher degree of persuasion in order to increase (or decrease) the amount of care provided by them. Second, a consistent part of the formal-care provision is regulated by national, regional, community-level laws; as repeatedly stressed in this and the previous Chapter, access is need-tested and there is relatively less discretionality at the extensive margin (i.e., decision to receive formal-care or not) on behalf of the elderly adult with respect to what happens with the informal-care, when medical status is accounted for. In other words, looking at the effect of changes in formal-care provision is closer to looking at possible effect of policy interventions (e.g., an increase in LTC coverage or intensity), while looking at the informal-care as the main regressor leads to conclusions which are relatively less informative in terms of policy implications on the formal home-care.

2.7 CONCLUSIONS

This paper investigates the effects of a change in the formal home-care provision on the informal-care by children, relatives, friends and neighbours among elderly adults in Europe. We use data from SHARE wave 1 and wave 2, for Austria, Belgium, France and Germany. Long-term care programmes are facing substantial challenges in dealing with unprecedented demographic changes with tightening public budgets and socioeconomic dynamics that can undermine the role so far played by informal care. We concentrate on home-based services, as they are now prioritized by policy makers with respect to residential/institutional care, with the aim of offering a proactive supply of formal-care that could enhance Healthy Ageing by means of investing in elderly health literacy and developing good-practices of prevention and re-enablement, thus delaying the occurrence of old-age vulnerability. This would slow down the growth in the demand of LTC services and would increase the supply of care by healthy elderly caregivers. This economic relationship has been less studied in the literature, due to the lack of an instrument to address the potential endogeneity of formal-care. We propose a novel instrumental variable approach that accounts for the role of national/regional eligibility rules to home LTC programmes. Our instrument is an individual-level dichotomous variable which indicates whether the individual is eligible to receive public LTC benefits (in-kind or in-cash) and which is based on binding regulations at respondents' national or regional level. Adopting a two-part model for informal-care utilization, we show that an increase in formal-care use (nursing/personal assistance) among elderly Europeans has a positive effect in terms of the informal-care received by family and friends, i.e., we do not find evidence of a crowding-out of informal by formal-care. This result hints at the existence of an unmet residual demand of long-term care, either due to budget constraint or to a lack of supply, that is partially satisfied by both formal and informal care. Furthermore, when interpreting our results in line with the implications of the theoretical framework proposed by Stabile *et al.* (2006), the unmet-demand is likely a result of an insufficient supply of public LTC, which is fully exhausted by elderly individuals who additionally need to rely on private formal-care to meet their need. This shows that further social-protection is needed to address the LTC risk, both with public and private forms, enhancing accessibility, affordability and effectiveness of care programmes.

CHAPTER THREE

Making subjectivity explicit: a multidimensional measure of Social Inclusion for European administrative regions

ABSTRACT

This chapter goes back to the methodology and rationale of measuring multi-dimensional socio-economic phenomena. In particular, we focus on the concept of Social Exclusion, a multi-faceted condition of weakness that prevents groups of individuals from taking part to an active social and working life in a community. Basing on a flexible CES framework, we show how different methodological approaches generate contradictory measures of Exclusion at regional level in Europe, primarily because of different strategies (and hidden shadow prices) in data normalization and aggregation. In particular, we argue that normalization is among these *implicit* forms of weighting and that it is often not made transparent enough, both in terms of how it is performed and in terms of its (economic) implications on the trade-offs which are intrinsic to any multidimensional measure. We then propose and develop an alternative measure of Social Exclusion at European regional level, with normalization parameters elicited through a survey conducted among the Ca' Foscari Alumni of the Departments of Economics and Management in Venice.

3.1 INTRODUCTION

The multi-dimensional approach to well-being follows from the belief that focusing only on monetary indicators of living conditions does not allow to obtain a reliable and comprehensive picture of the levels and of the dynamics of the quality of life in a certain territory (see, e.g., the influential report by Stiglitz *et al.* (2010)).

Numerous theoretical and empirical attempts were made to build synthetic indicators that would go "beyond GDP", as the long-running, well-known and widely debated, Human Development Index of the United Nations (Anand & Sen, 1994; UNDP, 2014), which helped pave the way for a wider scope in the analysis of well-being. Other recent institutional initiatives are the European Commission's "GDP and beyond" (European Commission, 2009a), the Multidimensional Poverty Index for the United Nations Development Programme (Alkire & Santos, 2011; UNDP, 2010), and the OECD Better Life Initiative (OECD, 2013c), recently enlarged with a regional perspective (OECD, 2014). In Italy two reports was recently published, on Sustainable and Fair Well-being, by the National Institute of Statistics and the National Council of Economy and Labour (ISTAT & CNEL, 2013, 2014), which, however, does not

include the creation of a synthetic indicator.[203] The number of composite indicators proposed in the recent years has rapidly grown, not only on the topic of wellbeing but also on other aspects of performance measurement (e.g., the Doing Business Index (World Bank Group, 2013) and the Worldwide Governance Indicators (Kaufmann *et al.*, 2011), both produced by the World Bank). Almost 200 new indices have been published between 2001 and 2010, more than what has been produced between 1960 and 2000, altogether (Kaul, 2013).[204]

Although there is quite a consensus on the need of broadening the scope of the analysis of well-being, there is not equal agreement on how such an ambitious task should be operationalized. Indeed, many authors have debated on the strength of the theoretical foundation behind such measures of performance or efficiency (Klugman *et al.*, 2011a; Maggino & Nuvolati, 2012; Pestieau, 2009; Ravallion, 2011, 2012a; Sen & Anand, 1997; Stiglitz *et al.*, 2010) some investigated their empirical robustness (Kasparian & Rolland, 2012; Lefebvre *et al.*, 2010; Ravallion, 2012b; Saisana *et al.*, 2005). Booysen (2002) pointed out that "not one single element of composite indexing is above criticism", Bhalla and Lapeyre (1997) claimed that aggregation per-se is not necessarily a good strategy, while others prudently favoured it (Atkinson *et al.*, 2002; Stiglitz *et al.*, 2010).

It is well known that arbitrariness exists with respect to the choice of the dimensions to be included in the composite index, the normalization of the variables, the choice of the aggregation function and its parameters (see, e.g., Ravallion (2012a) Decancq and Lugo (2013)). Indeed, "there are countless possibilities for forming composite indices by a different combination of these three main elements" (Martinetti & von Jacobi, 2012). The major focus of many applied works is devoted to the definition of the dimensions' weights. Few studies concentrate on the role played by normalization in influencing the final results (Carraro *et al.*, 2013; Lefebvre *et al.*, 2010; Meyer & Ponthière, 2011; Pinar *et al.*, 2014), while many others just present it as a necessary step but do not detail it as much as it is done for the "weights" (Ravallion, 2012a).

What we try to show in this paper is that, in fact, normalization is a crucial stage where an "early" weighting takes place, which can strongly affect the overall results of the multidimensional analysis. We claim that the unavoidable arbitrariness inherent to the choice of the normalization function should be made transparent to the reader. Moreover, since the standard procedures characterize the rescaling stage as a mainly statistical operation (data-driven normalization), implicit trade-offs and shadow prices thus generated have weak economic justification. We propose an expert-based normalization strategy which allows to relieve these trade-offs from concerns related to data availability, and makes the source of subjectivity (which is inevitably present also in the data-driven strategy) explicit and more transparent.

The architecture of any multidimensional measure relies on the theoretical characterization of the complex phenomenon under study. This corresponds to identifying fundamental conceptual dimensions that represent the phenomenon, and operationalize them into a set of observed measurable variables that can be adopted as more or less direct proxies. In this paper we rely on the work done by (Atkinson *et al.*, 2002) and the European Commission

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[203] An annual report on the Quality of Life in the Italian provinces is published by the financial newspaper Il Sole 24 Ore, since 1990 (http://www.ilsole24ore.com/speciali/qvita_2013/home.shtml). Other notable indices are produced by the financial newspaper Italia Oggi, the Sblianciamoci! Group (http://www.sbilanciamoci.org/tag/quars/) and UnionCamere Veneto (http://www.oltreilpil.it/).

[204] A review of all of the existing indices, up to 2008, is included in Bandura (2008).

(European Council, 2000, 2001) and we focus on the crucial phenomenon of "enlarged" poverty conditions in Europe, referred to as Social Inclusion, for which the need for a synthetic measure has been often expressed (e.g., EUROPEAN COMMISSION 2002). Following this literature, our aim is to build a composite measure of Social Inclusion, whose components are life expectancy at birth, early school-leaving, long-term unemployment and poverty rate (60% of the median equivalised national income).[205]

We will concentrate on additive forms of aggregation[206] and will adopt as baseline the data-driven min-max normalization function, widely used in this field (Anand & Sen, 1994; Boarini & D'Ercole, 2013; Carraro *et al.*, 2013; Cherchye, Knox Lovell, *et al.*, 2007; Giovannini *et al.*, 2008; Lefebvre *et al.*, 2010; Martinetti & von Jacobi, 2012; Murias *et al.*, 2012; Silva & Ferreira-Lopes, 2013). The function is "data-driven" in that its parameters are defined on the basis of the available data at hand, without making any explicit value judgment. We argue that this strategy still encompasses a substantial degree of arbitrariness and subjectivity, and produces trade-offs and marginal rates of substitution that have weak economic justification. Nevertheless, similar arguments on subjectivity and arbitrariness could be raised with respect to several alternative normalization functions, as the Z-standardisation or the percentage distance from the mean (Carrino, 2013; Giovannini *et al.*, 2008).

The fundamental parameters of the min-max (indeed, the *min* and the *max* values that define the resulting 0-100 transformation) are suitable to be elicited through experts' consultation. In this paper we show the results of a survey conducted on a population of 150 professors of Economics or Management at the Ca' Foscari University of Venice (nearly 90 responses), which allows us to present a normalization function which grounds its parameters on some, subjective, economic evaluation rather than on the statistical characteristics of the sample selection.

Indeed, a quote from Sen and Anand (1997) (widely reported, e.g., in Decancq and Lugo (2013)) states that "since any choice of weights should be open to questioning and debating in public discussions, it is crucial that the judgments that are implicit in such weighting be made as clear and comprehensible as possible and thus be open to public scrutiny". We argue that normalization is among these *implicit* forms of weighting and that it is often not made transparent enough, both in terms of how it is performed and in terms of its (economic) implications on the trade-offs which are intrinsic to any multidimensional measure.

Starting from a flexible CES framework, we adopt a simplified linear aggregation model where the normalized dimensions have equal weights and we look at what happens to the aggregate measure of Social Inclusion when only the normalization function changes and weights of normalized dimensions are equal. Our data selection includes 58 administrative regions (from Belgium, Germany, Italy and Spain) from 2004 to 2012. Results indicate that specific normalization choices substantially affect the relevance of each component with respect to the aggregate measure. Elementary indicators are characterized by degrees of importance which are far from being equal and could lead to potentially perverse and hardly defensible trade-offs, even if the weights of the normalized dimensions are set as equal (as it is often assumed). Significant differences emerge in the levels and trends of Social Inclusion at the regional level in Europe, leading to different policy implications and interventions, which are only due to the normalization stage.

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[205] Through this analysis, we do not aim at providing efficiency index for the Welfare States, which would require a much more structured set of information. We, rather, limit ourselves at evaluations of performances, as suggested in (Lefebvre *et al.* (2010); Pestieau (2009)).

[206] Non-additive models (e.g., the use of the Choquet integral) are valid alternatives. See, e.g., Grabisch 1996, Meyer and Ponthière (2011) and Carraro *et al.* (2013).

This shows that normalization is, indeed, an influential stage of the analysis and that it should not be neglected when interpreting the results. Furthermore, we show that changes in the substitutability parameters of the CES functions i.e., switching to a geometric or to a harmonic framework, have very different impacts on the aggregate measures, depending on which normalization is used. Finally, we build a new index with a Data Envelopment Analysis approach, a linear programming tool where weights are endogenously defined for each dimension of Social Inclusion.

The remaining of the paper is organized as follows. Section 3.2 briefly describes the multidimensional concept of Social Inclusion and offers descriptive statistics of this phenomenon for the countries included in this analysis. Section 3.3 sets a standard framework for multidimensional aggregation. Section 3.4 presents and discuss the baseline model: a linear aggregation function with equal weighting and data-driven normalization. Section 3.5 describes the survey adopted to elicit expert preferences on the normalization function among professors in Economics and Management of the Ca' Foscari University in Venice. It then discusses a modified baseline model with the introduction of the newly built normalization function. Section 3.6 discuss the results of applying the aforementioned models on our administrative regional data. Section 3.7 performs further analysis by relaxing the linearity assumption of the previously adopted models, and by implementing a Data Envelopment Analysis approach.

3.2 SOCIAL INCLUSION, DEFINITION AND SAMPLE SELECTION

Social inclusion (and it's corresponding opposite concept, social exclusion)[207] [208] is one of the five priorities selected by the European Commission in the context of the Europe 2020 Strategy, which was approved in 2010 and whose aims are to improve the socio-economic welfare of the Union over the next 10 years. A definition of Exclusion was already drawn in December 1992 by the Commission of the European Communities (European Communities Commission, 1992):

> *"Social exclusion is a multidimensional phenomenon stemming from inadequacies or weaknesses in the services offered and policies pursued in these various policy areas. Such insufficiencies and weaknesses often combine to affect both people and regions via cumulative and interdependent processes of such a nature that it would be futile to try to combat exclusion by tackling only one of its dimensions.*
>
> *The concept of social exclusion is a dynamic one, referring both to processes and consequent situations. It is therefore a particularly appropriate designation for structural changes. More clearly than the concept of poverty, understood far too often as referring exclusively to income, it states out the multidimensional nature of the mechanisms whereby individuals and groups are excluded from taking part in the social exchanges, from the component practices and rights*

[207] In this paper we will refer to social inclusion or exclusion as two interchangeable (opposite) view of the same phenomenon.
[208] The concept of social inclusion/exclusion should not be confused with the variable 'at risk of poverty or social exclusion' in the Eurostat database and defined as follows: an individual is at risk of poverty or social exclusion when she belongs to at least one of the following groups: (a) equivalent household income below 60% of median national income; (b) living in households with at least 4 of the following 9 symptoms of discomfort: i) impossibility to bear unexpected expenses, ii) can not afford a week holiday, iii) have issues with the mortgage, rent, bills or others; iv) can not afford a proper meal every two days; v) not being able to adequately heat the house and not being able to afford: vi) a washing machine vii) a color TV viii) a phone ix) an automobile. (c) living in families whose members aged 18-59 work less than a fifth of their time.

of social integration and of identity. Social exclusion does not only mean insufficient income, and it even goes beyond participation in working life: it is felt and shown in the fields of housing, education, health and access to services".

Social exclusion is, therefore, multi-dimensional in that it encompasses income poverty, unemployment, access to education, information, childcare and health facilities, living conditions, as well as social participation. It is also multi-layered, as its causes can be at the national, community, household or individual levels.

Indeed, Social Inclusion is one of the most important examples of how the European Union, whose coordination policies have, for many years, focused on matters of economic policy and adherence to the fiscal rules adopted at Community level, has begun to systematically monitor[209] social policy issue (European Council, 2000), although the legislative competence on the topic are still full responsibility of individual Members.

The Laeken European Council in 2001 has developed a set of unanimously agreed indicators that could capture the multifaceted aspects and outcomes of social inclusion, thus providing reliable and comparable data to monitor the social and economic conditions of European citizens (European Council, 2001). In particular, four basic dimensions have been identified: the level and distribution of income, the condition of labor market, education and health. The list of the ten primary indicators adopted for each dimension is shown in the following table (the underlined indicators are those adopted in this article):

Table 3-1, primary indicators of Social Inclusion

dimension	indicator
Income	Poverty rate (after social transfers)
	Persistent risk-of-poverty rate
	Relative median at risk-of-poverty gap
	Inequality of income distribution
Labour market	Long-term unemployment
	Regional cohesion
	Persons living in jobless households
Education	Early school leavers
Health	Life expectancy at birth
	Self-defined health status by income level

In this preliminary version of our work, we just refer to (Atkinson *et al.* (2002); Atkinson *et al.* (2004)), as well as to European Commission (2009b) European Commission (2010) for further details on the rationale of Social Inclusion indicators and on the issues related to their measurement.

The target of this paper is to build an aggregate index of Social Exclusion at administrative-regional level in Europe. We choose administrative regions as the main territorial unit of this analysis, with the aim of capturing higher variability than it can be inferred from aggregate national data. Data-availability is often mentioned as a serious constraint for analyses which focus on a wide set of countries for a long time-period (Lefebvre *et al.*, 2010; Martinetti & von Jacobi, 2012). In the context of Social Exclusion at administrative regional level, we are able to gather data for four out of the

[209] Through the introduction of the Open Method of Coordination (see EUROSTAT, 2005).

10 aforementioned indicators, one per dimension: poverty-rate, long-term unemployment, early school-leavers and life expectancy at birth. Our source is the on-line Eurostat Regional Database 2014.[210]

With these four indicators, we are able to cover a sufficient number of years (nine years, from 2004 to 2012) and administrative regions (58) in four countries (Belgium, Germany, Italy and Spain). Moreover, as argued in Lefebvre *et al.* (2010), "these indicators cover the most relevant concerns of a modern welfare state, also reflecting aspects that people who want to enlarge the concept of GDP to better measure social welfare generally take into account". The latter referenced paper, as Atkinson *et al.* (2004), discuss the limitations of these data and the necessary simplifying assumptions that have to be done when translating a complex multidimensional phenomenon like Social Exclusion in empirical terms. Table 3-2 provides a brief definition for our four variables:

Table 3-2, Variable definitions

variable	definition
Poverty rate	Share of persons living in households with an income below 60% national median equivalised disposable income.
Long-term unemployment rate	Total long-term unemployed population (⩾12 months; ILO definition) as proportion of total active population.
Early school-leavers	Share of total population of 18-24-year olds having achieved ISCED level 2 or less and not attending education or training.
Life expectancy at birth	Number of years a person may be expected to live, starting at age 0.

The following table and figure report descriptive statistics on the four indicators for Belgium, Germany, Italy and Spain for the period 2004-2012 (regional data are aggregated at the country level with population weighting).

[210] http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/regional_statistics

Table 3-3, Descriptive statistics for four indicators of Social Inclusion, years 2004-2012

		BELGIUM	GERMANY	ITALY	SPAIN
Longevity	Min	77.5 Wallonie 2004	77.8 Sachsen-A. 2004	79.5 Campania 2005	78.3 Ceuta 2004
	National mean	79.8	80.2	82	81.4
	Max	81.6 Vlaanderen 2011	82.2 Baden-W. 2012	83.8 Marche 2010	84.2 Madrid 2012
Early school leaving	Min	8.6% Vlaanderen 2008	5.4% Thüringen 2009	10.2% Molise 2012	11.5% País Vasco 2012
	National mean	12.1%	12.3%	18.4%	29.3%
	Max	20% Brussels 2007	21% Saarland 2006	32.7% Sardegna 2005	54.2% Ceuta 2005
Long-term Unemployment	Min	1.4% Vlaanderen 2008	1.1% Bayern 2012	0.5% TAA 2004	0.9% Aragón 2008
	National mean	3.8%	4.1%	3.6%	4.8%
	Max	9.9% Brussels 2006	13.8 Sachsen-A. 2004	12.2% Campania 2012	18.2% Ceuta 2012
At-risk-of-poverty rate	Min	9.8% Vlaanderen 2011	10% Baden-W. 2007	5.2% VDA 2006	8.1% País Vasco 2009
	National mean	14.8%	14.5%	16.9%	20.8%
	Max	33.7% Brussels 2011	24.3% Meckl.-Vorp. 2007	44.3% Sicilia 2011	48.9% Ceuta 2008

Source: Eurostat Regional Database 2014

Longevity-at-birth is generally increasing, even though the process slows down in Belgium and Italy since 2010. Italy and Spain show the highest levels of life expectancy, with the Madrid region being the one with the highest levels (observed in 2012). Germany and Belgium report lower levels on average, with Wallonia and Sachsen-Anhalt exhibiting the lowest values below 78 years old in 2004. The same "clusters" of countries can be recognized also in terms of early school-leaving: although the trends are, at least weakly, improving (i.e., declining school dropouts), Italy and especially Spain exhibit much higher values than Belgium and Germany. With regards to long term unemployment the levels are quite similar across countries (even though the regional variation is much higher in Italy and Spain) but the time-trends show an increase in unemployment after the economic crisis (since 2008) in both Italy and Spain, while the rates are always decreasing in Germany and almost constant in Belgium. In terms of the share of individuals below the national relative poverty line, Spain is the country with most worrisome percentages (above 20% and increasing) while the Italian regions average around 17%, with Belgium and Germany below 15%. Regional disparities are smaller in Germany, with respect to the other countries hereby considered.

Figure 3-1, time trends for the four variables of Social Inclusion

The Pearson correlation coefficients in Table 3-4 show the strength and direction of the association between these variables at the administrative regional levels. The highest coefficient regards the (positive) correlation between unemployment and poverty (0.63). Longevity is negatively correlated with both unemployment and poverty, while the latter is positively correlated with school-dropouts (0.50).

Table 3-4, correlation between four dimensions of Social Inclusion

	Longevity	Early school leaving	Long-term unemployment	At-risk-of-poverty rate
Longevity	1			
Early school leaving	0.032	1		
Long-term unemployment	-0.298	0.143	1	
At-risk-of-poverty rate	-0.245	0.505	0.631	1

Data for administrative regions of Belgium, Germany, Italy and Spain, years 2004-2012. Eurostat Regional Database 2014.

3.3 THEORETICAL AGGREGATION FRAMEWORK

In this section we describe a standard theoretical framework widely used in the economic literature of multidimensional measurements (we refer to Decancq and Lugo (2013) for a comprehensive review).

Let us consider *m dimensions* (hereinafter also *variables*, *attributes*) of social inclusion, observed for n territorial units (in our case, regions). For a generic region *i* we will therefore observe a vector $\mathbf{x}^i = \left(x_1^i,...,x_m^i\right)$, while $\mathbf{X} \in \mathbb{R}^{n\times m}$ is the distribution matrix of *m* dimensions for *n* regions. An aggregated measure over the *m* dimensions for the region *i* is performed by the function *F*, defined as in (3.1):

$$F^i\left(v\left(\mathbf{x}^i\right)\right) = \left[w_1 v_1\left(x_1^i\right)^\beta + \cdots + w_m v_m\left(x_m^i\right)^\beta\right]^{1/\beta} \tag{3.1}$$

which can be referred to as a CES (constant elasticity of substitution) function, or a generalized mean of order β. Its arguments are the elements $v_1, \ldots, v_m$ which are transformations of the original variables $x_1,\ldots,x_m$. The function *F* is non-decreasing, separable, weakly scale-invariant and homogenous of degree-one in its arguments *v;* we refer to Blackorby and Donaldson (1982) and (Decancq and Lugo (2008), 2009)) for an analytic characterization of these properties.

Provided that a choice of the *m* dimension has been performed, the main methodological task is now the selection of the set of functions $v_1,\ldots,v_m$, of parameters $w_1,\ldots w_m$, as well as of β.

The component $v_i(x_j)$ is a continuous normalization function that maps the values of the j-th variable x_j on the closed interval [0,100], i.e., $v_j(x_j) \in [0,100]$, such that higher values of $v_j(x_j)$ correspond to better performances in the *j-th* dimension. The normalization function thus ensures that *F* will be bounded between 0 and 100 when the weights *w* sum to one. It also ensures the monotonicity of *F*, since higher values of *v* are always preferred to lower ones, regardless of whether the original variable is positively or negatively related to social inclusion (e.g., longevity is an example of the former while poverty is an example of the latter). This feature will be detailed in the next paragraph. The vector $\mathbf{v}^i = \left(v_1^i,...,v_m^i\right)$ represents the normalized values for the *m* dimensions observed in region *i*.

The parameters $w_1,\ldots,w_m$ are the weights of the normalized dimensions *v* , they are non-negative and sum to one, i.e., $w_j \geq 0$ for each *j* and $\sum_j w_j = 1$. The available methodologies for choosing the weights are multiple, and are well reviewed in Decancq and Lugo (2013). Among the possible strategies we mention data-driven choices as frequency,

statistical and most-favourable weights, hybrid choices as self-stated and hedonic weights, normative choices as equal (or arbitrary), expert-opinion and price-based weights. Another brief remarks should be done on the choice of applying a unique set of weights to different territorial units and different countries. Indeed, at this point, the $w_1, w_2,\ldots,w_m$ are chosen at once and for all regions involved in this analysis (i.e., we do not have region-specific weights w^i_j). It could be argued that such a strategy, which imposes the same weights to, e.g., Spanish and German administrative regions, do not account for heterogeneities in cultures nor for other forms of local peculiarities, that would require a different set of weights. Such a criticism is often summarized by labelling the aggregation strategy as "paternalistic" (Cherchye, Moesen, *et al.*, 2007), and alternative frameworks have been proposed, as the Data Envelopment Analysis (a linear programming aggregation), where weights are endogenously determined for each territorial unit (Cherchye, Knox Lovell, *et al.*, 2007; Lefebvre *et al.*, 2010; Murias *et al.*, 2012). It must be noted, however, that if the rationale of an aggregate index is to provide policy makers and institutions with a measure of a certain phenomenon which is uniquely defined - as should be Social Exclusion in the European Union – the objections of paternalism are, in our view, weakened. If the European Institutions are to make policy decisions and design interventions on their country or regions-members basing on the information coming from an aggregate measure, then, once a definition of the latent phenomenon has been adopted, its operationalization through a multidimensional index can be unique. Since, in this paper, we are adopting a unique definition of Social Exclusion, and since we are adopting a Communitarian normative approach to the topic, we believe that a common set of weights across regions and countries is an acceptable choice.

The parameter β determines the elasticity of substitution $\varepsilon_{k,j}$ between any pair of normalized v_k, v_j. In the CES function, the elasticity between any pair k, j is, indeed, constant and equal to $1/1-\beta$ (derivation is shown in Appendix 3.9.1). The elasticity of substitution determines the percentage change in v_j/v_k which would result from a percentage change in the slope along a level-set (the MRS along an indifference curve, see Figure 3-2, adapted from Decancq and Lugo (2008)). The smaller is β, the smaller is the allowed substitutability between pairs of normalized dimensions in **x**, the higher is the increase in dimension v_j needed to keep constant the overall level of social inclusion after a one-unit decrease in dimension v_k. As explained, e.g., in Bourguignon and Chakravarty (2003), in order to generate iso-inclusion contours convex to the origin in the two-dimensional region of the space of attributes, the parameter β must be lower than one. Indeed, for $\beta = 1$, the function $F(v)$ reduces to a linear weighted average with linear indifference curves, constant marginal rate of substitution and infinite elasticity of substitution between pairs of normalized dimensions (3.2).

(3.2)
$$F^i(v(x)) = \begin{cases} \left[w_1 v_1(x_1^i) + \cdots + w_m v_m(x_m^i)\right] & if\ \beta = 1 \\ v_1(x_1^i)^{w_1} * \cdots * v_m(x_m^i)^{w_m} & if\ \beta = 0 \\ \left[w_1 \frac{1}{v_1(x_1^i)} + \cdots + w_m \frac{1}{v_m(x_m^i)}\right]^{-1} & if\ \beta = -1 \\ \min\left[v_1(x_1^i) + \cdots + v_m(x_m^i)\right] & if\ \beta = -\infty \end{cases}$$

A lower β corresponds to an increasing preference for a more equal vector of (transformed) variables in a given region (Decancq & Lugo, 2013) or, equivalently, to a higher willingness to penalize situations in which there is high variability between dimensions' performances (Figure 3-2). The lower is β, the higher is the assumed dependence between the m dimensions in the framework of social-inclusion. For $\beta=0$, F corresponds to the weighted geometric mean, with convex indifference curves, variable marginal rate of substitution and unitary elasticity between dimensions. For $\beta=-1$, F becomes the harmonic mean. For β going towards negative infinity, the aggregation function tends to a *Leontief*

framework where the aggregate measure corresponds to the worst performance among the m observed indicators, perfect complementarity exist between dimensions and no substitution is allowed (the elasticity of substitution is zero).

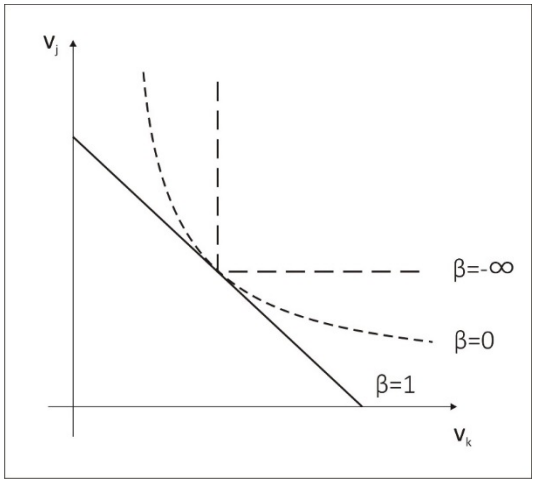

Figure 3-2, indifference curves for different values of β

So far, we briefly characterized how the CES framework manipulates the transformed dimensions $v_1,\ldots,v_m$. Normalized-attributes obviously depend on the arbitrary characterization of the v function, while real-data ($x_1,\ldots x_m$) usually come from official statistics which are, hopefully, much less arbitrary. Moreover, since no such things as normalized-longevity or normalized-unemployment rates exist in reality, it is particularly useful to investigate how observed-attributes contribute to the overall measure of social inclusion, and what characterize the relationship between attributes within the CES framework.

Equation (3.3) derives the marginal contribution of observed-indicator x_j on the overall measure of social-inclusion F (region-specific indices are conveniently dropped).

$$\begin{aligned}\frac{\partial F(v(\mathbf{x}))}{\partial x_j} &= \frac{1}{\beta}\left[w_1 v_1(x_1)^{\beta} + \cdots + w_m v_m(x_m)^{\beta}\right]^{\frac{1-\beta}{\beta}} \beta w_j v_j(x_j)^{\beta-1} v_j'(x_j)1 \\ &= w_j v_j'(x_j)\left(\frac{\left[w_1 v_1(x_1)^{\beta} + \cdots + w_m v_m(x_m)^{\beta}\right]^{1/\beta}}{v_j(x_j)}\right)^{1-\beta} \\ &= w_j v_j'(x_j)\left(\frac{F(v(\mathbf{x}))}{v_j(x_j)}\right)^{1-\beta}\end{aligned} \tag{3.3}$$

From (3.3) we can identify four main drivers that determine how the aggregate measure F reacts at small changes in the j-th real-valued dimension x_j , namely, (1) the weight w_j ; (2) the normalization function v_j ; (3) the relative performance of the normalized j-th dimension with respect to the overall social-inclusion measure; and (4) the parameter β. The higher is the weight of the normalized j-th dimension, the higher will be the marginal variation in the F. The steeper is the normalization function, the higher will be the effect of a change in the j-th dimension on the aggregate measure. The worse is the starting condition in the j-th dimension with respect to the aggregate measure, the

higher will be its marginal contribution. Finally, the lower is the degree of substitutability β, the more sensitive F will be to bad performances in the j-th attribute.

The same insights can be gained from (3.4), who explicates the marginal rate of substitution between a pair of observed-indicators x_j and x_k.

$$MRS_{x_k,x_j} = -\frac{dx_j}{dx_k} = \frac{\dfrac{\partial F(v(\mathbf{x}))}{\partial x_k}}{\dfrac{\partial F(v(\mathbf{x}))}{\partial x_j}} = \frac{w_k}{w_j}\frac{v_k'(x_k)}{v_j'(x_j)}\frac{\left(\dfrac{F(v(\mathbf{x}))}{v_k(x_k)}\right)^{1-\beta}}{\left(\dfrac{F(v(\mathbf{x}))}{v_j(x_j)}\right)^{1-\beta}} = \frac{w_k}{w_j}\frac{v_k'(x_k)}{v_j'(x_j)}\left(\frac{v_j(x_j)}{v_k(x_k)}\right)^{1-\beta} \tag{3.4}$$

When $\beta=1$ (i.e., when perfect substitutability between dimensions is assumed and the F function becomes a weighted linear average), both the marginal contribution of the j-th attribute and its MRS will still depend on the shape of the normalization function v_j. Only in the peculiar case when the transformation function is the identity function ($v_j(x_j) = x_j$), the effect of a change in x_j will be uniquely determined by its weight w_j and the MRS between a pair of dimensions j and k will depend just on the ratio between their weights.[211]

This brief theoretical recap of the inherent properties of the CES aggregation framework leads us to conclude that the choice of the set of weights $w_1,\ldots w_m$ is not the only step which determines the relevance of each dimension. Crucial roles are played by the choice of the parameter β and by the normalization phase. Indeed, rather than on weights, it is on the latter element that we will concentrate in the following Sections.

3.4 BASELINE MODEL WITH DATA-DRIVEN NORMALIZATION

In this Section we will define the baseline model of Social Inclusion by setting $\beta=1$, as well as equal weighting across normalized dimensions ($w_1 = w_2 = \ldots = w_m$), and a min-max normalization function τ with data-driven benchmarks, which we now turn to describe.

3.4.1 Data-driven normalization

In order to build a synthetic measure through the framework described in the previous Section, a normalization (or transformation) function is required, for at least two main reasons. First, the dimensions which are to be aggregated are usually observed and measured with different measurement units; and second, they might be positively or negatively related to the socio-economic concept described by the synthetic measure (see Giovannini *et al.* (2008) for a comprehensive discussion). In this paper, a Social Inclusion aggregate measure is built from four attributes who refer to different socio-economic phenomena and whose units of measurement span from years (longevity), to percentages of active population (long-term unemployment), percentages of total population (poverty rate) and percentages of

[211] The MRS between two observed dimensions will be equal to their "weights" also if the derivatives of their normalization functions are equal, i.e., if $v_k'(x_k)/v_j'(x_j) = 1$

population aged 18-24 (early school leavers). Moreover, three of them are negatively related to the overall concept of Inclusion (unemployment, poverty and school dropouts), while one has a positive connotation (life expectancy). In order to ensure monotonicity of the F function (3.1), each observed variables x must be transformed in such a way that its increase would never lead to a decrease in F.

Our starting specification for the normalization is the *data-driven min-max function* τ. This is a transformation method widely used in the literature of multidimensional measures (see, e.g., (Carraro *et al.* (2013); Cherchye, Knox Lovell, *et al.* (2007); Lefebvre *et al.* (2010); Martinetti and von Jacobi (2012); Murias *et al.* (2012); Silva and Ferreira-Lopes (2013))), it is also the default choice of the Human Development Index (Anand & Sen, 1994) and of the OECD Better Life Initiative (Boarini & D'Ercole, 2013).

For each region i where an attribute x is observed at a time t (we drop the previously used attribute-specific j index to ease readability), the corresponding normalized value $\tau^{i,t}\left(x^{i,t}\right)$ is determined as:

$$\tau^{i,t}\left(x^{i,t}\right) = 100 * \frac{x^{i,t} - \min_{t\in T}\min_{i}\left(x^{t}\right)}{\max_{t\in T}\max_{i}\left(x^{t}\right) - \min_{t\in T}\min_{i}\left(x^{t}\right)} = \frac{x^{i,t} - \mathrm{d}\min(x)}{\mathrm{d}\max(x) - \mathrm{d}\min(x)} \tag{3.5}$$

when x is an attribute positively related to the latent variable of social-inclusion (i.e., it is a "good") and *d-min* and *d-max* are the benchmarks observed in the data for the x variable, i.e., *data-driven*. Similarly, we have:

$$\tau^{i,t}\left(x^{i,t}\right) = 100 * \frac{\max_{t\in T}\max_{i}\left(x^{t}\right) - x^{i,t}}{\max_{t\in T}\max_{i}\left(x^{t}\right) - \min_{t\in T}\min_{i}\left(x^{t}\right)} = \frac{\mathrm{d}\max(x) - x^{i,t}}{\mathrm{d}\max(x) - \mathrm{d}\min(x)} \tag{3.6}$$

when x is an attribute negatively related to the latent variable of social-inclusion (i.e., it is a "bad").[212]

The min-max normalizes indicators to have an identical range [0, 100] by subtracting the minimum value and dividing by the range of the indicator values. In particular, the minimum and maximum for each indicator are calculated across countries and time, in order to take into account the evolution of indicators (Giovannini *et al.*, 2008).

Through the transformations τ_j for each indicator j, comparability between the arguments of the F function is guaranteed, to the extent to which we define two observed attributes x_j and x_k as being *equally satisfied* when their transformed values are equal, i.e., when $\tau_j(x_j) = \tau_k(x_k)$. A caveat regarding the interpretation of the normalized-values will be issued at the end of this paragraph.

A better insight on the relationship between the original variable x and its normalization $\tau(x)$ can be gained from the partial derivatives in (3.7):

$$\frac{\partial \tau^{i}\left(x^{i}\right)}{\partial x^{i}} = \frac{\partial}{\partial x^{i}}\left(100 * \frac{x^{i} - \min(x)}{\max(x) - \min(x)}\right) = \frac{100}{\max(x) - \min(x)} \tag{3.7}$$

when x is an attribute positively related to the latent variable of social-inclusion.

[212] A detailed mathematical analysis on this transformation strategy is performed in Aiello and Attanasio and Terzi and Moroni (in Italian).

$$\frac{\partial \tau^i(x^i)}{\partial x^i} = \frac{\partial}{\partial x^i}\left(100 * \frac{\max(x) - x^i}{\max(x) - \min(x)}\right) = -\frac{100}{\max(x) - \min(x)} \tag{3.8}$$

when x is an attribute negatively related to the latent variable of social-inclusion.

The effect of a one-unit increment in x on the transformed $\tau(x)$ is constant, since the transformation function is linear, and depends solely on the benchmarks *max* and *min*. The higher is the range between these thresholds, the weaker will be the marginal contribution of a unitary increase in x. This poses further stress on the relevance of the choice for the two benchmarks (see also Carraro *et al.* (2013)).

Accordingly, in our baseline model we adopt (3.5) and (3.6) as normalization functions, where the benchmarks *min* and *max* are calculated across countries and time from our observed data (Lefebvre *et al.*, 2010; Murias *et al.* (2012); Silva & Ferreira-Lopes, 2013). We refer to this strategy as to a *data-driven* normalization. This corresponds to assigning a value of 0 to the administrative region, across Belgium Germany Italy and Spain, which reports the worst-observed performance in a given indicator, while assigning a value of 100 to the one which performs "relatively-better", in the period of time from 2004 to 2012. The following table displays the resulting thresholds, based on the Eurostat Regional Database 2014:

Table 3-5, data-driven benchmarks

	Observed minimum	Observed maximum
Longevity	77.5 years (Wallonie, 2004)	84.2 years (Madrid, 2012)
Early school leaving	5.4% (Thüringen, 2009)	54.2% (Ciutat de Ceuta, 2005)
Long-term unemployment	0.5% (Trentino – Alto. Adige, 2004)	18.2% (Ciutat de Ceuta, 2012)
At-risk-of-poverty rate	5.2% (Valle d'Aosta, 2004)	48.9% (Ciutat de Ceuta, 2008)

Note: data from the Eurostat Regional Database 2014, for administrative regions in Belgium, Germany, Italy and Spain.

Basing on the collected data, the min-max normalization for, say, the life-expectancy variable, will assign value 0 to regions who report less than or equal to 77.5 years of longevity, and value 1 to those with longevity equal or higher than 82.2.[213] All the intermediate levels will be proportionally converted into the 0-100 scale according to *(3.5)*. Conversely, poverty rates close to 5.2% will be transformed in values close to 100, while regions with higher poverty will receive proportional lower normalized-score, down to a minimum of 0 corresponding to a poverty-rate of 48.9% (3.6). A similar procedure holds for early-school leaving and long-term unemployment.

Two issues on this data-driven min-max function are worth stressing.

The first issue would be sensitivity to variables' distribution: the presence of outliers in the observed variables would stretch the range over which the normalization is performed, therefore weakening the original variable's contribution to the overall index, through a reduction in its marginal effect on the normalized variable *(3.7)*. Figure 3-3 depicts the distribution of the four observed indicators hereby considered. Possible outlier observations are, e.g., the rates of early school leavers in the autonomous cities of Ceuta and Medilla (Spain), which report values higher than 45% in several

[213] In this case, by construction, no region can report a value lower than, or higher than the minimum and the maximum thresholds, respectively.

years. Since these territories are substantially different from other Spanish regions (they are both located on the Mediterranean coast of Morocco but belong to Spain since XV century), it could be argued that their exclusion from the sample would be acceptable. This would decrease the upper bound of the distribution to a rate of 43%, reported by the Region of Murcia in 2004 and the Illes Balears in 2007, 2008 (both are Spanish regions), without significant implications on the trade-offs. For long-term unemployment, this exclusion would reduce the maximum bound from 18.2% to 15% (Andalucia, Spain, 2012. For poverty rate, the reduction would be from 48.9% to 44.5% (Sicilia, Italy, 2006).

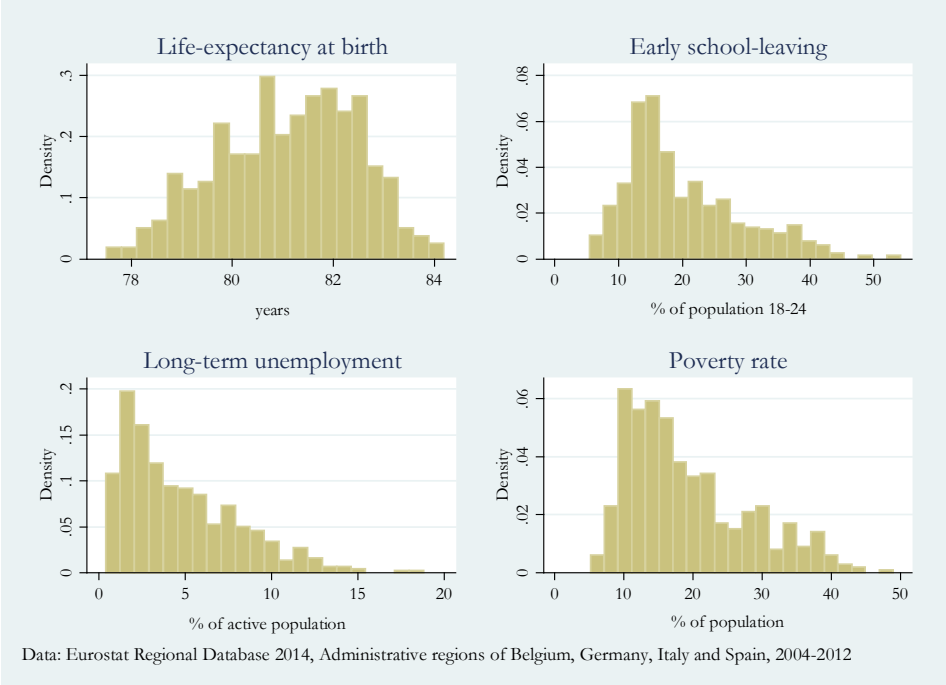

Figure 3-3, variables' distribution

Moreover, as often noted (e.g., in Giovannini *et al.* (2008)), this transformation is not stable when data for a new time-points or new regions become available, thus potentially affecting the previously selected thresholds and requiring a re-calculation of the aggregate measure. An example of the former possibility (new time-points) is straightforward, while the latter case (more territorial units) could arise when data for more recent EU member states are added to the sample (Lefebvre *et al.*, 2010). A shift in the territorial dimension of the analysis (e.g., from a regional to a provincial-level or a national-level analysis) will cause similar inconsistencies, since the provincial data are likely to exhibit higher variability than the regional ones, while the opposite is plausible for national-data (which are population-average of regional data, thereby, less disperse).

As an example, if we include data from statistical regions from Greece, Czech Republic and Norway[214] to the previous country-set (data from Eurostat Regional Database 2014) several thresholds change.[215] The minimum level of early-school-leavers lowers to 1.8% (the Czech area Praha, 2006), as does the minimum threshold of long-term unemployment (to 0.3% in the Norwegian area Vestlandet), and the minimum longevity (to 74.2 years, in the Czech area Severozápad).

Second, it is important to discuss what should be the interpretation of the normalized values obtained from the data-driven min-max transformation. Consider a pair of indicators *j, k* (e.g., longevity and poverty rate), and suppose that in a region *i* at a time *t* we observe $x_j^{i,t} = 81$ years and $x_k^{i,t} = 27\%$ of poverty rate. Implementing the min-max transformation ((3.5), (3.6)) according to benchmarks in Table 3-5, leads us to $\tau_j(81 \text{ years}) = 50$ and $\tau_k(27\% \text{ poverty-rate}) = 50$. Equality in the transformed values τ_j, τ_k implies that the two attributes *j* (longevity) and *k* (poverty-rate) are equally satisfied in our Social Inclusion framework. Whether it can also be interpreted as an equality in the levels of welfare "revealed" by the two variables, is debatable. A prudent approach should probably limit to acknowledging that both values lie at equal distance between the observed-minimum and the observed-maximum in their respective data-series. Furthermore, applying (3.7) with the thresholds in Table 3-5, we are able to gain some insights on the marginal contribution of each observed-variable on its correspondent normalized-one.

Table 3-6, derivatives of the data-driven normalization

	1 year increment in longevity	1% increment in early school leavers	1% increment in long-term unemployment	1% increment in poverty-rate
$\frac{\partial \tau_j(x_j)}{\partial x_j}$	14.9	-2.05	-5.65	-2.28

The coefficients in Table 3-6 imply that the steepness of the normalization function varies significantly across dimensions. An increment of 1 unit in the τ function requires much less increase in life-expectancy than it does for the other three observed-indicators. That is not enough to conclude that life expectancy has a higher relevance with respect to the remaining variables, since the role that each indicator plays in determining the overall Social Inclusion measure depends also, as we saw in the previous paragraph, from the weights w and the parameter β.[216]

Nonetheless, since these marginal effects depend uniquely on the *max* and *min* benchmarks adopted in (3.5) and (3.6), the economic intuition under such coefficients appears weak, exactly because of the data-driven choice of the benchmarks.

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[214] Data are available for statistical-areas-only, in Czech Republic (Praha, Střední Cechy, Jihozápad, Severozápad, Severovýchod, Jihovýchod, Střední Morava, Moravskoslezsko), Greece (Voreia Ellada, Kentriki Ellada, Attiki, Nisia Aigaiou) and Norway (Oslo og Akershus, Hedmark og Oppland, Sør-Østlandet, Agder og Rogaland, Vestlandet, Trøndelag, Nord-Norge).

[215] As mentioned in Section 3.2, our sample selection only includes available data for *administrative* regions in Europe.

[216] However, when the aggregation model assumes perfect substitutability ($\beta=1$) and equal weighting for the scaled dimensions ($w_j=1/m$), as in model (3.18) in the next Section, normalization is the only determinant of heterogeneity in the relevance of the original variables to the aggregate measure.

3.4.2 Baseline model: linear aggregation with equal weighting

Let us now adopt the aggregation framework in (3.1), with normalization function determined according to (3.5) and (3.6), with data-driven benchmarks as of Table 3-5. Furthermore, let us fix $\beta=1$, therefore obtaining a linear weighted-average approach with perfect substitutability, and let the weights of the normalized-dimensions be equally distributed (equal weighting), i.e., let $w_1 = w_2 = \ldots = w_m = 1/m = 1/4$. The resulting model will be, for a generic region i (time subscript are omitted) an aggregation function LD as in *linear, data-driven:*

$$LD^i\left(\tau\left(\mathbf{x}^i\right)\right) = \frac{1}{m}\tau_1\left(x_1^i\right) + \cdots + \frac{1}{m}\tau_m\left(x_m^i\right) = 0.25 * \frac{x_1 - 77.5}{84.2 - 77.5} + 0.25 * \frac{54.2 - x_2}{54.2 - 5.4} + 0.25 * \frac{18.2 - x_3}{18.2 - 0.5} + 0.25 * \frac{48.9 - x_4}{48.9 - 5.2} \tag{3.9}$$

The arbitrary choice of setting equal weights is a widely adopted strategy in the literature of multidimensional measurement. As Hoskins and Mascherini (2009) and Decancq and Lugo (2013) highlight, this approach is often justified with the argument that all the dimensions are equally important or, conversely, that there is insufficient knowledge for setting a more detailed weighting scheme (an *agnostic view*). Its adoption derives from its apparent simplicity, and alleged *neutrality*. In the words of Martinetti and von Jacobi (2012), the implicit assumption for equal weighting is that "in absence of any objective mechanism for determining the relative importance of the considered dimensions, the most neutral method is assigning an equal weight to each of them". Alternatively, it could be argued that, under some circumstances, the dimensions of the complex phenomena are intended to be equally relevant (e.g., Atkinson *et al.* (2002) suggest that the weights in a multidimensional poverty measure should be roughly equal). Indeed, both Chowdhury and Squire (2006) and Nguefack - Tsague *et al.* (2011) provide evidence in favour of equal weighting.

Which are the underlying mechanism in such an aggregation strategy? Applying (3.3) we derive the "relevance" of each observed-indicator with respect to the synthetic measure LD, that is, the impact that a unitary change in the original attribute has on the overall measure. For comparability purpose, we normalize the so-obtained "relevance" coefficients, in order for them to sum to one.

Table 3-7, dimensions' relevance under linear data-driven model

	longevity	early school leavers	long-term unemployment	poverty-rate
$\left\|\frac{\partial LD(\tau(\mathbf{x}))}{\partial x_j}\right\|$	3.72	0,512	1,412	0,57
Relative weight	59.8%	8.2%	22.7%	9.1%

Note: administrative regional data from the Eurostat Regional Database 2014, for Belgium, Germany, Italy and Spain (2004-2012)

Moreover, using (3.4), the marginal rates of substitution between any pairs of indicators x_j, x_k can be computed. Results are reported in Table 3-8.

Table 3-8, MRS in linear data-driven model

MRS for an increase of:	longevity years	% points early school leavers	% points l.t. unemployment	% points poverty rate
one-year in longevity	-	-7.26	-2.63	-6.52

one % point in early school leavers	-0.13	-	0.36	0.89
one % point in l.t. unemployment	-0.37	2.75	-	2.47
one % point in poverty rate	-0.15	1.11	0.4	-

Note: administrative regional data from the Eurostat Regional Database 2014, for Belgium, Germany, Italy and Spain (2004-2012)

Both of the previous tables highlight which are the implicit assumptions embedded in the baseline model (3.18). A one-year increase in longevity is worth the same, in terms of the Social Inclusion measure, as a reduction in long-term unemployment by 2.63 percentages points. Similarly, e.g., an increase of 1% in the poverty rate lowers the overall Inclusion as an increase of 1.11 points in school-dropouts. In general, the health-dimension of the multidimensional measure is substantially more relevant than the others.

Overall, these insights lead us to stress at least three points. First, "equal weighting" does not mean no weighting, because it implies an implicit judgment on the weights being equal (Hoskins & Mascherini, 2009). Second, a misconception relies in the belief that (3.18) implies equal relevance to the m dimensions x_j included in the aggregate measure. Indeed, the equal weighting affects only the normalized dimensions τ_j. The relevance of the original indicators is necessarily determined also by the normalization function. Moreover, in a linear aggregation model with $\beta=1$ and $w_j=1/m$ for all the $j=1,\ldots,m$ indicators, the crucial determinant of a dimension's relevance relies in the normalization function. For a more detailed discussion on the "equal weighting" implications, we refer to, e.g., Decancq and Lugo (2013) Cherchye, Knox Lovell, *et al.* (2007). Third, as Lefebvre *et al.* (2010) pointed out, it is hard to determine what do these marginal rate of substitutions reflect. Indeed, the lack of economic justification for the benchmarks in the normalization functions makes it hard to interpret the assumed trade-offs between indicators, thereby also their relative weights.

Results for the baseline model of Inclusion will be presented in Section 3.6.

3.5 AN ALTERNATIVE STRATEGY: EXPERT PREFERENCES FOR NORMALIZATION

As mentioned in the Introduction, composite measures are inherently arbitrary in the choice of the dimensions, as well as of the aggregation function and of its parameters. It is hard to imagine aggregations that are "neutral", i.e., unaffected by researchers' subjectivity. Therefore, a prudent approach to the topic would probably enhance transparency: since arbitrariness is largely unavoidable, it is convenient to make its implications explicit, so that the multidimensional measure can be correctly interpreted in the light of the underlying mathematical, statistical and economic assumptions.

In the previous Section we showed that a major source of subjectivity relies in the normalization stage. Normalization corresponds to defining a "common-language" for an effective comparison among heterogeneous attributes, and is mainly characterized by the choice of the extreme values (*min* and *max*) used for benchmarking.[217] How these benchmarks should be determined is always an arbitrary choice, which resemblances the issue of defining the set of weights $w_1,\ldots,w_m$. We already stressed how data-driven normalization, albeit relying on statistical techniques, is itself an arbitrary choice. Nevertheless, this arbitrariness does not rely on explicit social preferences or economic

[217] In this paper we do not focus on a further potential source of arbitrariness, i.e., the shape of the normalization function. Hereby, indeed, we do not argue with the largely adopted linearity in the min-max transformation, which could – in principle – be replaced with a convex / concave / S-shaped / step-wise characterization.

justifications (other than those embedded in the preliminary choice of the dataset, which is often driven by availability constraints rather than on the researcher's aims). As a consequence, its implications in terms of trade-off and MRS between dimensions have a mathematic rather than an economic interpretation.

Indeed, in the data-driven normalization, a variable with transformed-value equal to "0" just implies it being "the last one", or "the worst one" among the observed, which does not necessarily corresponds to an undesirable condition of wellbeing. Similarly, a value of "100" refers to a territorial unit being "the best one" among the observed data, which is not necessarily a good or satisfactory condition. Yet, as already argued, the absence of economic value judgments does not prevent such a normalization from suffering from a potential lack of robustness due to data availability (enlarging/narrowing the geographical- or time- dimensions of the analysis.

An alternative to the data-driven normalization would require to incorporate some value judgments (e.g., social preferences, policy targets, expert opinions, see (Decancq & Lugo, 2013)) in the normalization. This translates to linking the extreme values "0" and the "100" with, e.g., a certain definition of desirability, thus making the normalization independent from the data-sample. When an indicator lies above or below such fixed bounds, further variations do not contribute to the latent variable under study (see e.g., the discussion in Anand and Sen (1994), Klugman *et al.* (2011a), Ravallion (2012b), Lefebvre *et al.* (2010) and Gidwitz et al. (2010)). A major example of fixed threshold is the Human Development Index that, since 1994, adopted "goalposts" as minimum and maximum values in the normalization function. The interpretation behind these fixed thresholds relies on the belief that objective upper and lower bounds can be identified, defined as "subsistence" minimum or "satiation" points, beyond which additional increments would not contribute to the expansion of capabilities. In the worldwide perspective of Human Development, the minimum "subsistence" point for longevity-at-birth was set to 25 years old in 2009, with "satiation" threshold at 85. Literacy rates' boundaries were set at 0% and 100%, as was the gross enrolment ratio, while GDP per capita was limited between 100$ and 40,000$. Among the changes made since 2010, the upper values were now set to observed maxima over the time series between 1980 and the most recent year available, while the lower bounds were set equal to subsistence minima (Klugman *et al.*, 2011a; UNDP, 2010).

Social Exclusion, conversely to the Human Development, is a phenomenon whose conceptual foundation (briefly reviewed in Section 3.2) has been developed with reference to advanced industrialized economies, as are those of the European Union members. Therefore, talking about "subsistence" could be not entirely appropriate in such socio-economic frameworks, and indeed "subsistence" is not the core concept which lies *in nuce* in the phenomenon of Social Exclusion. Rather, as explained in Section 3.2, the focus is posed on the "unacceptability" and "undesirability" of living conditions, as in an enlarged definition of poverty.

In order to set fixed thresholds for an index of Social Inclusion, a possible strategy would be, indeed, to impose that normalized values of 100 correspond to "certainly desirable and favorable conditions of wellbeing", while values of 0 correspond to "certainly undesirable and harmful conditions of wellbeing". How to operationalize such value judgements in practical terms is, again, an arbitrary choice. Indeed, this strategy requires to determine what is, e.g., a level of longevity-at-birth that should correspond to a normalized value of 100 (i.e., a "certainly desirable" level of life-expectancy), and what is the one that should correspond to a normalized value of 0 (i.e., a "certainly undesirable" level of life-expectancy).

Specifically, in order to propose such a preference-based normalization, we decided to elicit expert preferences on the specification of the normalization functions for our four variables of Social Inclusion (longevity, early-school-leaving, long-term unemployment, poverty rate). That is, we would like a group of experts to determine which should be the thresholds *min* and *max* for each of the four variables, through a simple survey. In order to do this, we first needed to consistently define the *min* and the *max* thresholds (in the data-driven normalization, they were defined as the *minimum* and the *maximum* performance observed in a given dataset).

As Chowdhury and Squire (2006) and Hoskins and Mascherini (2009), we intended to involve informed persons and therefore we selected the population of professors and researchers in the Departments of Economic and Management of the Ca' Foscari University of Venice. Specifically, our population consisted of 149 professors (57 + 38 full or associate professors of Economics and Management, respectively; 29 + 25 assistant professors (*ricercatore universitario*) of Economics and Management, respectively)[218]. The survey was done in Italian and conducted in electronic-form-only, between July and November 2013, through the QUALTRICS software, a web-based tool that enables users to build fully customizable surveys that are easy to distribute through email.[219] Professors were sent an email with an invitation and a link to take part to the on-line questionnaire on an anonymous basis.

The overall Survey was composed by 4 core pages and one additional page where auxiliary information were asked. An introduction discussed the purpose of the study and provided a definition of Social Inclusion (based on (Atkinson *et al.* (2002); Atkinson *et al.* (2004)) and European Communities Commission (1992) and briefly explained the contents of the survey. Next, a randomization led the respondent to a page devoted to one of the four main variables of Social Inclusion described in Section 3.2. All of the pages were homogeneously designed:

- a description of the variable at hand was presented, using definitions from Eurostat. Next, descriptive statistics for the specific indicator were shown through a bar graph, for 25 European countries and two years (2000 and 2011), using data from the Eurostat Database (updated to 2011).
- An example was offered, by using a mock variable "X", for the task of identifying, according to one's own opinion, two main thresholds among the possible values of the selected indicator. These threshold should represent, respectively, a certainly undesirable (harmful) and a certainly desirable (favorable) condition of wellbeing in a generic territorial context. The example accurately explained how to deal with the Qualtrics layout in order to identify the thresholds.
- The last section of each page required the actual choice of harmful and favour thresholds for the real variable at hand, by dragging a slider (using the mouse left-click) on a predetermined interval of values,[220] and releasing

[218] Although, in principle, it would be of interest to widen the Survey population to professors of other Departments (Asian and North African Studies, Environmental Sciences, Humanities, Linguistic, Molecular Sciences and Philosophy), we were led by time and resources constraints to focus on those Faculty more specifically connected to the issues of Social Inclusion and to the disciplines related to the four indicators over which a judgment was asked.
[219] For further details, please refer to http://www.qualtrics.com/
[220] Fixed intervals of values were imposed in order to avoid extreme and implausible choices (like 0 years old of longevity as "harmful" threshold). The predetermined intervals were: [90-60 years] for longevity; [0%, 50%] for early-school-leaving; [0%, 50%] for long-term unemployment; and [0%, 50%] for poverty-rate. No respondents chose one of the non-zero extremes as their preferred threshold.

it to identify the preferred value (Figure 3-4 provides a snapshot for the choice of the harmful threshold for life-expectancy).

As an example, let us consider the survey-page devoted to the life-expectancy-at-birth indicator. First, a definition of life-expectancy was provided. Then, data for 25 European countries (years 2000 and 2011) were shown. At this point, respondents are faced with the summary of what they will be asked to do, i.e., identifying both a favorable and a harmful threshold for life-expectancy-at-birth, according to their own opinion. The harmful threshold is defined as a "level of longevity which represents a certainly negative and undesirable condition". The favor threshold is defined as a "level of longevity which represents a certainly positive and desirable condition". Before reaching the actual question, a full example was provided with a generic variable "X". Respondents had, then, to determine the harmful threshold by dragging a slider on an interval of values (with the left mouse-click), and dropping it at the point that corresponded to their view of a certainly undesirable level of longevity. Figure 3-4 illustrates the choice that respondents were facing for the harmful threshold of longevity. The choice was not entirely free, since we constrained respondents to select a level of life-expectancy between a predetermined interval ranging from 60 to 90 years old, in order to avoid extremely implausible choices (like 0 years old). Similar steps characterized the choice of the favorable threshold, where respondents had to select their answer in the same interval between 60 and 90 years old. A cautionary disclaimer was emphasized at this point, stressing the fact that the favorable threshold should, by construction, be higher than- or equal to- the harmful threshold previously selected.[221]

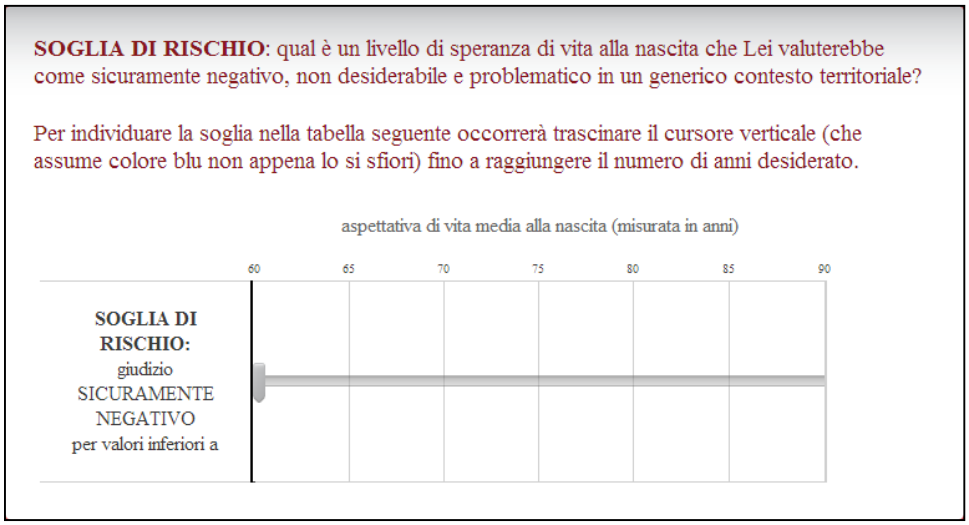


Figure 3-4, survey's example

Regarding, the other three variables (poverty rate, long-term unemployment rate, early-school-leaving), respondents were always faced questions with consistent phrasing, i.e., the harmful threshold was always described as a "value of the selected variable which conveyed a certainly undesirable and problematic condition", while the favorable threshold was always described as a value "which conveyed a certainly desirable and virtuous condition". Recall that the min-max normalization differs between "good" and "bad" indicators, thereby for the latter group the lower bounds (the

[221] The disclaimer aimed at avoiding inconsistent choices, e.g., a respondent who would choose, say, 81 years old as a harmful threshold, and subsequently choose 80 as a favourable threshold. No such patterns occurred.

minimum) will correspond to a value of 100 while the upper bounds (the *maximum*) will correspond to a normalized value of zero.

The last section of the questionnaire included questions on respondents' age, gender and affiliation (either Economics or Management).

3.5.1 Survey-elicitation of benchmarks

Out of 149 invitations, we received 88 responses. 59 were faculty members of the Department of Economics, 29 from the Department of Management. The following table provide brief descriptive statistics on our sample.

	Economics	Management	Overall
responses	59	28	88
Age:			
less than 40	36.1%	13%	28.6%
between 40 and 49	29.9%	43.5%	34.3%
between 50 and 59	23.4%	26.1%	24.3%
60 or more	10.6%	17.4%	12.6%
Female respondents	40.4%	34.8%	38.6%

Results of the survey indicate that our experts' evaluation of harmful and favor thresholds differ from the "statistical" ones adopted in the data-driven normalization. For each question, we chose the median response as a measure of central tendency to summarize a representative answer, as it is often done in the literature (e.g., Hoskins and Mascherini (2009)) because of its lower sensitivity to outliers with respect to the mean, especially when the sample size is small. Median responses and interquartile range are reported in Table 3-9.

Table 3-9, survey-elicited benchmarks

	Median elicited minimum (25p – 75p)	Median elicited maximum (25p – 75p)
Longevity	73 years (70 – 75)	83 years (80 – 85)
Early school leaving	10% (5 – 10)	20% (15 – 25)
Long-term unemployment	3% (2 – 4)	9% (5.25 – 10)
At-risk-of-poverty rate	5% (3 – 7)	20% (17 – 21.5)

Note: on-line survey (QUALTRICS software), 88 responses from professors in Economics or Management at the Ca' Foscari University of Venice.

The representative favorable threshold for life-expectancy is chosen at 83 years old, while the negative threshold is 73 years old. Early school-leaving's range lies between 10% (which corresponds to the EUROPE 2020's target for members of the European Union). A rate of 9% (or higher) of long-term unemployment denotes a certainly undesirable condition, while the positive threshold is determined at 3%. As for poverty rate, a certainly harmful level is set at 20%, while desirability corresponds to 5% (or lower) share of population below the poverty-line set by the Eurostat. The interquartile ranges are always relatively small, except for the harmful threshold of early-school-leaving (15%-25%). Nevertheless, we are aware that no "true values" exist, with respect to these thresholds. In the words of Mascherini

and Hoskins (2008), "the judgment of one of the outline may be correct, and those who share a consensus view may be wrong". Figure 3-5 reports the histograms for the responses. The blue thick-dashed lines represent the answers for the favorable thresholds. A quick comparison of Table 3-9 and Table 3-5 suggests that, according to median responses, "certain desirability" as well as "certain undesirability" may very well differ from observed minimum or maximum achievements. Indeed, a minimum observed level of longevity (77.5 years in Wallonia) is considered to be "certainly undesirable" by only a small fraction of respondents, while the median undesirability is set at 73 years old. An opposite adjustment occurs with poverty, long-term unemployment and early school-leaving rates, for which our experts-population set a threshold of "certain undesirability" which is much lower than the observed maximum. Indeed, any rate of long-term unemployment beyond 9%, any rate of school dropouts higher than 20%, any poverty-rate beyond 20% are regarded as unacceptable, while the actual observed maximums are quite higher. A similar capping occurs for those regions which report long-term unemployment or early school leaving rates lower than 3% and 10%, respectively, while no territories in our sample reach 5% poverty-rate or 73 years in longevity-at-birth.

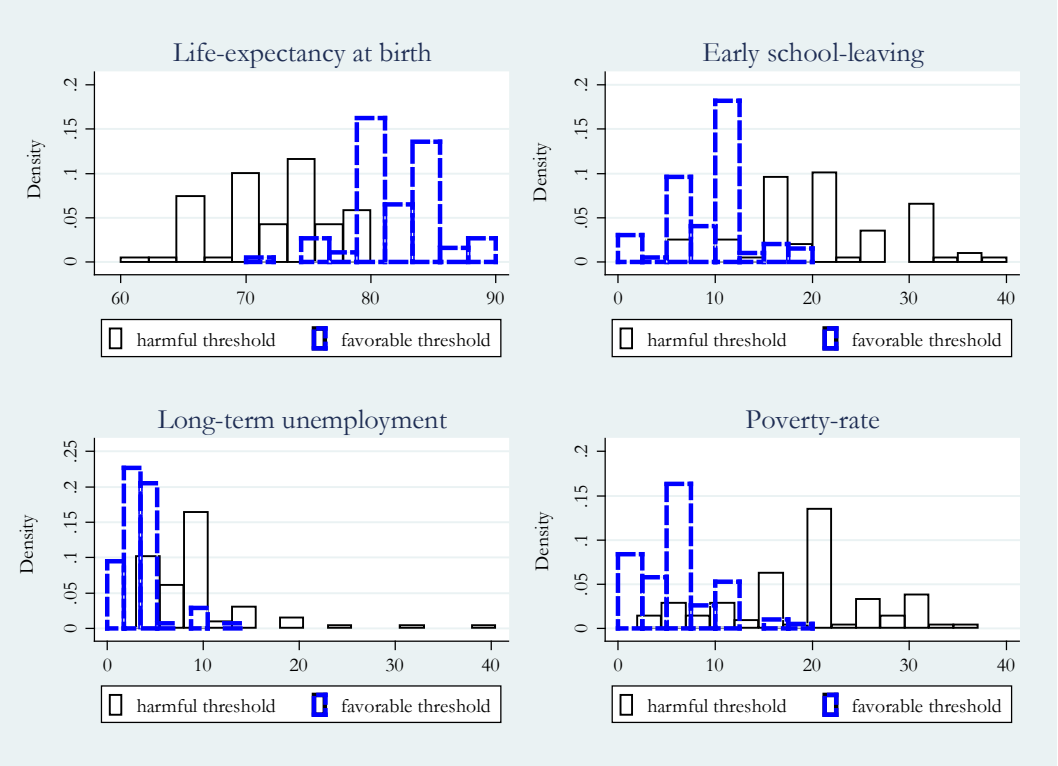


Figure 3-5, survey's results

When the elicited thresholds are used as benchmarks in the min-max normalization framework, we obtain four normalization functions $\varsigma_j\left(x_j\right)$ with *j=1,2,3,4* which have the same structure as *(3.5)*, *(3.6)*) but with different benchmarks (Table 3-9).

For each region *i* where an attribute *x* is observed at a time *t* (we drop the previously used attribute-specific *j* index to ease readability), the corresponding normalized value $\varsigma^{i,t}\left(x^{i,t}\right)$ is determined as:

(3.10) $$\varsigma^{i,t}(x^{i,t}) = 100 * \frac{x^{i,t} - \mathrm{emin}(x)}{\mathrm{emax}(x) - \mathrm{emin}(x)}$$

when x is an attribute positively related to social-inclusion (i.e., it is a "good"), and where *e-min* and *e-max* are the benchmarks determined by the panel of experts, for variable x. Similarly, we have:

(3.11) $$\varsigma^{i,t}(x^{i,t}) = 100 * \frac{\mathrm{emax}(x) - x^{i,t}}{\mathrm{emax}(x) - \mathrm{emin}(x)}$$

when x is an attribute negatively related to social-inclusion (i.e., it is a "bad").

A substantial difference emerges with respect to the data-driven strategy (paragraph 3.4.1), as Figure 3-6 illustrates. The steep of the ς normalizations are higher, except for longevity. This implies that, with respect to the data-driven transformation, a unitary increase in, say, the poverty-rate has now a higher impact on the normalized variable, while the effect of an increase in life-expectancy is lower. As a result, regions with a poverty rate of 30% will now get a normalized value of zero (with the data-driven normalization the transformed value was 40), levels of life expectancy of 80 years old will now result in a transformed value of 70 (it was 36 in the data-driven normalization). Overall, there are a number of regions which lie outside the elicited boundaries for each dimension, thus receiving a normalized value of 100 or 0, regardless of marginal changes in performance.

Trade-offs between dimensions can be computed as before, following *(3.7)*, to obtain what is shown in Table 3-10, but are valid only for those observation that lie inside the min-max range. When the thresholds are binding, i.e., when a variable exceeds the maximum or is below the minimum, the derivative is zero.

Table 3-10, derivatives of the survey based normalizations

	1 year increment in longevity	1% increment in early school leavers	1% increment in long-term unemployment	1% increment in poverty-rate
$\frac{\partial \varsigma_j(x_j)}{\partial x_j}$	10	-10	-16	-6.6

Conversely to what was found for the data-driven normalization (Table 3-6), the long-term unemployment is the dimension for which a unitary increase has the highest effect on the respective normalized variable: a change of one percentage point leads to a change of 16 points in the normalized 0-100 scale. This does not come as a surprise, since this is the variable with the smallest range between the min and the max thresholds [3; 9], as it was previously the case for longevity.

Our survey-driven normalization has several technical and economic implications. At first, the normalization functions should now be interpreted more as "social value-functions", in that each variable is rescaled according to how much it fulfills a given degree of "desirability". More generally, setting fixed bounds in the normalization methodology (through expert-elicited thresholds or policy-determined best practices) are the realization of a normative approach which brings to the surface the unavoidable subjectivity inherent in the construction of a composite indicator. In a way, a-priori determined normalization bounds are analogous to the very common adoption of fixed weights in the aggregation framework (e.g., the choice of equal weighting). As a result, the normalization function may become weakly monotonic (instead of being *strongly monotonic*), when the elicited constraints are binding for some observed variable.

In other words, the usual *non-satiation* hypothesis, which claims that more of a "good" is always preferred to less, is maintained only in a weaker form: more of a "good" is simply *non ill-favored* with respect to less of it, after a certain performance is reached (and, conversely, more of a "bad" is *non-preferred* to less). As a rough realisation of the diminishing sensitivity hypothesis, the effects of a change in variables' score on the social utility is negligible (i.e., zero, in our simple case), after the "certainly desirable" rather than the "certainly undesirable" thresholds are crossed. In our case, according to the experts' valuation, no significant increase in social-desirability is gained from, e.g., a decrease of long-term unemployment under 3%: this discontinuity can be interpreted as a form of diminishing marginal effects of reduction in long-term unemployment on the wellbeing of a territory. On the other end of the scale, no further dis-utility is accumulated when unemployment exceeds 9%. Again, the undesirability is perceived as so high already at 9%, that a supplementary increase in unemployment rates will not have significant impact on the evaluation of the condition in this specific dimension (again, a rough manifestation of diminishing marginal effects). From a normative point of view, although a 2% rate of long-term unemployment is surely not worse than a 3% rate, they are both beyond the "virtuous" threshold of desirability. From a policy-implication point of view, this suggests to focus on those dimensions whose performances lie farther away from the "desirability" level.

The point we would like to stress in this paper is that, to the extent to which rescaling is a requirement for composite measures, what is actually aggregated are the transformed variables, in place of the observed performances. There is an unavoidable and intrinsic difference between the interpretation of original and normalized performances. The common unit of measurement (e.g., between zero and one) can be interpreted as a sort of degree of fulfilment of some criterion. Whether this criterion should be purely statistical (e.g., being far or close to the observed minimum or maximum achievements), or whether it should encompass some informed value judgements related to the topic at hand (as in the expert elicitation or in the adoption of policy benchmarks), relies on the researcher's choice.

In the former case, standard properties as strong non-satiation and continuity of the normalization function are guaranteed, yet trade-offs might be hard to interpret in economic terms and debatable from a social desirability perspective (e.g., assigning equal normalized scores to a 10% long-term unemployment rate, a 30% of school dropouts and a life expectancy at birth of 81 years old).

In the latter case, conversely, we face discontinuities that are the result of the intersection between explicit value judgements and the observed data. Indeed, there can be intermediate ways that soften the "truncation" effect imposed by fixed thresholds, while maintaining the min-max framework. A possible strategy could be, e.g., to use the elicited thresholds as internal points of the normalization function (instead of as extreme points), thus building a step normalization function with multiple slopes, restoring strong monotonicity. The "certainly undesirable" threshold could be made corresponding to a normalized value of, e.g, 10 (instead of 0), while the "certainly desirable" one could correspond to a value of 90 (instead of 100). The slope of the function outside these extremes could be left free to vary in order to assign value of 100 to the best observed performance out of the range, and 0 to the worst observed performance outside the range (continuity could be maintained by smoothing the function at the corner points when slopes change). However, the precise choice of how this step-function should be implemented is, again, arbitrary.[222]

[222] Further alternatives are discussed, e.g., in Ravallion (2012b), Lefebvre *et al.* (2010), Martinetti and von Jacobi (2012), Meyer and Ponthière (2011) and Cruciani *et al.* (2013).

To sum up: the aforementioned elicited thresholds and the consequent trade-offs are arbitrary, as were those of the data-driven normalization. In terms of economic justifications, the elicited thresholds reflect the median preferences of an actual, and rather homogeneous, group of experts. Therefore, by definition, they are subjective. At the same time, they are independent from the data chosen (in terms of time-span and geographic coverage), and characterize the analysis as an aggregation of "desirability levels" rather than of raw indicators. In our view, neither method is neutral. Data-driven normalization does not allow for any judgment evaluation, other than the arbitrary *agnostic* choice of "letting the data talk", thus resulting in trade-offs which have weak economic justifications. The elicitation method suffers from the arbitrariness of any survey exercise (choice of the population, bias in the framing of questions), and internalize the subjective judgments of the respondents. We argue that, with elicited preferences, this unavoidable subjectivity is made explicit, transparent and, possibly, slightly more anchored to economic sensibility.

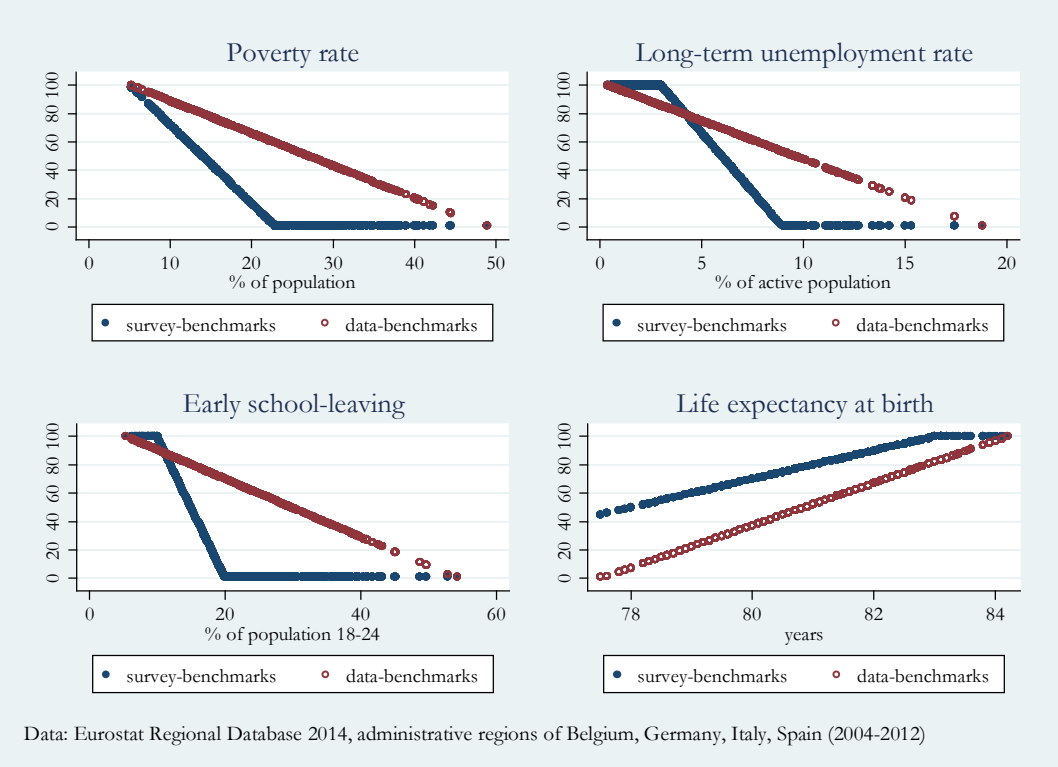


Figure 3-6, Normalization comparisons

3.5.2 Baseline model: linear aggregation, equal weighting and survey-based normalization

We now set-up an aggregation model that departs from the one in (3.18) for the characteristics of the normalization function. Indeed, starting from the aggregation framework in (3.1), with set the normalization function according to (3.10) and (3.11), with benchmarks as of Table 3-9. Furthermore, let us fix $\beta=1$, as before, therefore obtaining a linear weighted-average approach with perfect substitutability, and let the weights of the normalized-dimensions be equally distributed (equal weighting), i.e., let $w_1 = w_2 = \ldots = w_m = 1/m = 1/4$. The resulting model will be, for a generic region i (time subscript are omitted) an aggregation function LS as in *linear, survey-driven:*

$$
\begin{aligned}
LS^i\left(\varsigma(\mathbf{x}^i)\right) &= \frac{1}{m_1}\,\varsigma_1(x_1^i)+\cdots+\frac{1}{m}\varsigma_m(x_m^i) \\
&= 0.25*\frac{x_1-73}{83-73}+0.25*\frac{20-x_2}{20-10}+0.25*\frac{9-x_3}{9-3}+0.25*\frac{20-x_4}{20-5} \\
&\text{with} \\
&\varsigma_1(x_1)=0 \text{ if } x_1<73 \text{ and } \varsigma_1(x_1)=100 \text{ if } x_1>83 \\
&\varsigma_2(x_2)=0 \text{ if } x_2>20 \text{ and } \varsigma_2(x_2)=100 \text{ if } x_2<10 \\
&\varsigma_3(x_3)=0 \text{ if } x_3>9 \text{ and } \varsigma_3(x_3)=100 \text{ if } x_3<3 \\
&\varsigma_2(x_4)=0 \text{ if } x_4>20 \text{ and } \varsigma_4(x_4)=100 \text{ if } x_4<5
\end{aligned}
\tag{3.12}
$$

Following the same steps in paragraph 3.4.2, we derive the "relevance" of each observed-indicator with respect to the synthetic measure LS, that is, the impact that a unitary change in the original attribute has on the overall measure, by applying (3.3). Results are shown in Table 3-11. For comparability purpose, we normalize the so-obtained "relevance" coefficients, in order for them to sum to one. Furthermore, for each dimension, we report the computed derivatives only for those values of the original variable lying inside the intervals [emax(x_i)-emin(x_i)]. As discussed in the previous paragraph, the normalization functions are strictly monotonic only when the corresponding observed variable is included in these intervals. For all the values outside the boundaries, the derivative of the normalization functions, thereby also of the aggregate measure LS, would be zero.

Table 3-11, dimensions' relevance under linear survey-driven model

	longevity	early school leavers	long-term unemployment	poverty-rate
$\left\lvert\frac{\partial LS(\varsigma(\mathbf{x}))}{\partial x_j}\right\rvert$	2.5	2.5	4	1.65
Relative weight	23.5%	23.5%	37.6%	15.4%

Note: administrative regional data from the Eurostat Regional Database 2014, for Belgium, Germany, Italy and Spain (2004-2012)

Moreover, using (3.4), the marginal rates of substitution between any pairs of indicators x_j, x_k can be computed. Results are reported in Table 3-12. These MRS are only valid when the variables lie inside the boundaries [emax(x_i)-emin(x_i)], otherwise the MRS would be either zero, or infinite, or indeterminate, according to whether the numerator, the denominator, or both, in the ratio $v_k'(x_k)\big/v_j'(x_j)$ in (3.4) is zero.

Table 3-12, MRS under linear survey-driven model

MRS for an increase of:	longevity years	% points early school leavers	% points l.t. unemployment	% points poverty rate
one-year in longevity	-	-1	-0.62	-1.51
one % point in early school leavers	-1	-	0.62	1.51
one % point in l.t. unemployment	-1.6	1.6	-	2.42
one % point in poverty rate	-0.66	0.66	0.41	-

Note: administrative regional data from the Eurostat Regional Database 2014, for Belgium, Germany, Italy and Spain (2004-2012)

As noted in paragraph 3.4.2, the linearity of the aggregation function, together with the equality of the weights attached to the normalized dimensions, implies that relevance of the original (non normalized) attributes is entirely determined

by the characteristics of the normalization functions (see equation *(3.3)*), which is now the results of an expert elicitation process. Both Table 3-11 and Table 3-12 report trade-offs which are significantly different from those implicit in the previous model (Table 3-7 and Table 3-8), and these differences are only due to the change in the normalization strategy. The dimensions' relevance is more homogeneous, with the unemployment indicator being the one with the highest marginal effect on the aggregate measure, and the role of longevity being reduced with respect to the previous specification (where its relative contribution was beyond 50%).

3.6 RESULTS FROM THE BASELINE MODELS

By implementing the specification in (3.18), a linear aggregation with equal weights and data driven normalization, we compute an aggregate measure of Social Inclusion for 58 administrative regions in Belgium, Germany, Italy and Spain for years between 2004 and 2012. Table 3-13 reports the aggregate index at country levels (regional indexes are averaged in a country indicator through population weights), together with coefficients of variation within countries. Full results are available in the Appendix, in Table 3-17, Table 3-18 and Table 3-19. Throughout this discussions of our results, we will concentrate more on commenting the levels of the composite indices, rather than the rankings of the regions, following the recommendations in (Atkinson *et al.* (2002); Atkinson *et al.* (2004)). The authors argue that the ultimate concern of the policy should lie on performance levels, since rankings might conceal the actual distances between territorial units, thus leading the reader to misleading conclusions.

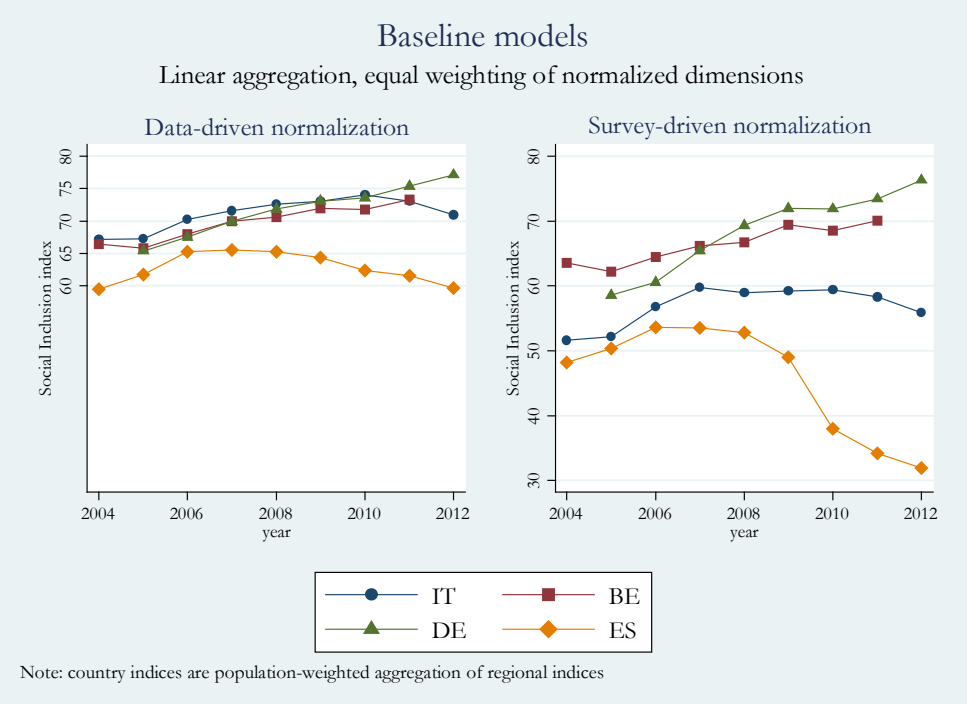
Table 3-13, Social Inclusion measure and coefficients of variation, baseline model

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	66.5	65.8	68.0	69.9	70.6	71.9	71.8	73.3	
Germany		65.4	67.5	69.9	71.8	73.1	73.6	75.4	77.1
Spain	59.5	61.8	65.3	65.5	65.3	64.4	62.4	61.6	59.7
Italy	67.2	67.3	70.2	71.6	72.6	73.0	74.1	73.0	71.0
COV regions BE	0.15	0.18	0.18	0.18	0.18	0.16	0.17	0.19	
COV regions DE		0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08
COV regions ES	0.18	0.22	0.22	0.22	0.21	0.20	0.23	0.23	0.27
COV regions IT	0.19	0.19	0.18	0.17	0.16	0.16	0.15	0.17	0.18
COV all regions	0.19	0.20	0.20	0.19	0.17	0.17	0.18	0.19	0.21

The left graph in Figure 3-7 helps us to provide an overall description of the trends in the multidimensional phenomenon of Inclusion at country level, according to the data-driven model. Differences between countries appear rather limited until 2008. Italy reports the highest levels of Inclusion, followed by Germany, Belgium and by Spain. There is a general increase in the index for all countries until 2008. Starting from that year, the Spanish performance declines and leads the country back to its 2004 levels of Inclusion. Italy's index is slightly affected by the economic crisis (roughly, from 2010 onward): its aggregate Inclusion ceases to improve and starts to decline, reaching in 2012 the same levels of 2006. Belgium and Germany show a general continuous increase in their levels of Inclusion (the former does not report data for 2012, the latter lacks data for poverty-rate for 2004, thereby their respective aggregate indexes are not available in these years). In particular, since 2011 Italy and Germany switch positions, with the latter becoming the country with the highest index among the four. Overall, the situation in 2012 appear to be more heterogeneous than it was in the early years in our sample: Italy and Spain show a negative trend (increasing exclusion),

while Belgium and Germany continue to improve their aggregate performance. The coefficients of variation in Table 3-13 highlight that the Spanish regional picture is the most heterogeneous one, with Italy and Belgium following closely, and Germany being the country with less territorial variation. Moreover, a look at Table 3-18 and Table 3-19 allows us to recognize that, while many Italian regions score very well, some others are consistent bad performers. Most of the top-10 regions between 2004 and 2012 are Italians, but Campania and Sicilia constantly ranks at the very bottom of the tables. With this regard, the Social Inclusion index emphasizes the well known dichotomous socio-economic picture of Italy as well as the contradictions of Belgium where important differences exist between the Flemish region, the Bruxelles region and Wallonia.

Figure 3-7, baseline models of Social Inclusion with different normalizations



Note: country indices are population-weighted aggregation of regional indices

The alternative specification in (3.12) implements the min-max normalization function where benchmarks are elicited through a survey on a panel of professors in Economics and Management (see Section 3.5). The aggregation framework is maintained linear, with equal weights attached to the rescaled variables. Recall that, in the survey-based models, Social Inclusion must be intended on a scale of "desirability", where a value of zero represent a certainly undesirable condition, while a value of 100 represents a fully desirable one. This comes from the fact that each original variable is rescaled (paragraph 3.5.1) through a value function which assigns value of 0 to any observed performance equal or worse than an expert-elicited "certainly undesirable" threshold, while 100 is assigned to those which are equal or better than an expert-elicited "certainly desirable" level. As already discussed, this implies that the normalization functions are weakly monotonic rather than strongly monotonic (as it is under the data-driven approach).

The results for this survey-based measure of Social Inclusion are summarized in Table 3-14 (aggregated at countries' level), while the right graph in Figure 3-7 provides a graphical illustration. Full results for levels (Table 3-20) and rankings (Table 3-21, Table 3-22) are reported in the Appendix 3.9.4. At country levels, trends are confirmed but made more evident, with respect to the results of the baseline specification. Social Inclusion increases in both Belgium and Germany, while Italy and Spain experience a continuous decline which starts since the early years of the economic

crisis. That being, said, the overall picture is quite different from the one commented before, for at least three reasons. First, Social Inclusion in levels is very different, with Italy being well below both Belgium and Germany for all the time-interval. In particular, Italy (blue circle markers) and Germany (green triangle markers) show similar levels of Inclusion in 2006. After that, the index continues to increase for Germany while it remains constant (and then declines) in Italy. Thus, there is a clear phenomenon of rank reversal between the two models: in terms of "desirability" (as defined by the expert-panel in Ca' Foscari University), the aggregated Italian picture is worse than the German one.

Table 3-14, Social Inclusion measure and coefficients of variation, survey-based normalization

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	63.5	62.2	64.4	66.1	66.7	69.4	68.5	70.1	
Germany		58.6	60.5	65.4	69.3	71.9	71.9	73.4	76.3
Spain	48.2	50.3	53.6	53.5	52.8	49.0	38.0	34.2	32.0
Italy	51.6	52.2	56.7	59.7	59.0	59.2	59.4	58.3	55.9
COV regions BE	0.37	0.43	0.43	0.42	0.43	0.34	0.39	0.39	
COV regions DE		0.28	0.26	0.24	0.22	0.19	0.17	0.16	0.13
COV regions ES	0.25	0.26	0.27	0.28	0.23	0.31	0.46	0.50	0.50
COV regions IT	0.39	0.34	0.30	0.31	0.31	0.32	0.32	0.38	0.34
COV all regions		0.20	0.22	0.22	0.28	0.21	0.32	0.34	

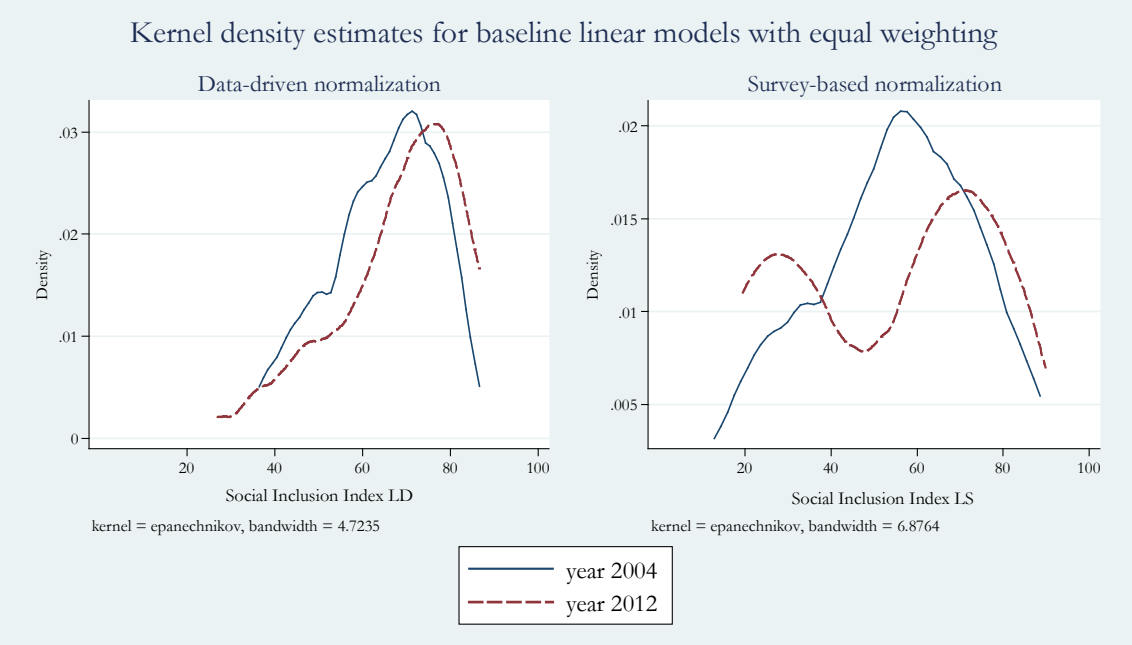
A look at Table 3-21 and the following one, in the Appendix 3.9.4, highlights how German regions, together with Belgium's Flanders, achieve more top-10 rankings than they were under the previous specification, especially after 2007. Second, Spain exhibits an increase in Social Exclusion (a decline in Inclusion) which is much more dramatic than it appeared before. The negative trend starts after 2006 but the drop in performance is substantial after 2008, leading to levels of Inclusion much lower in 2012 than they were in 2004. Again, we stress the fact that, albeit the negative trend for Spain was already visible from the baseline data-driven model, this picture conveys a much stronger need for intervention. Third, the heterogeneity within each country is much higher, as noticeable from the coefficients of variation in Table 3-14. Spain, Italy and Belgium still report the highest coefficients, but heterogeneities are rather constant in the latter country while they are increasing in Italy and especially in Spain. An opposite trend appears in Germany, where convergence of Social Inclusion between regions seems to occur. It is important to recall, at this point, that none of these differences are due to changes in the core parameters of the aggregation function (the β, or the weights w_j), but rather to the new re-scaling characterization, which has now an explicit interpretation in terms of desirability.

Further evidence on the differences in the results can be gained by plotting a kernel-density estimation for the distribution of the two aggregate indices LD (linear, data-driven) and LS (linear, survey-based) at the starting and final years considered in this analysis.[223] Although this does not constitute a proper convergence analysis, it can help in spotting major changes in the distribution and the evolution of the phenomenon at study. Indeed, the left graph in Figure 3-8 highlights how the distribution moved to the right (higher inclusion) between the starting and the final period, and became less disperse and more uni-modal. Conversely, the graph on the right reports a more heterogeneous

[223] The starting year for Germany is 2005, while the final year for Belgium is 2011, due to partial data-unavailability.

starting distribution, which becomes clearly bi-modal in the final period of the analysis, providing another view on the trends already conveyed from Figure 3-7.

Figure 3-8, distributions of Inclusion Indices



Finally, in order to test whether the two specifications convey similar rankings, we perform a Kendall's tau[224] tests between the ranking of the data-driven model and the one coming from the survey-driven model, for each year. A resulting test-value of zero would indicate that no correlation exist between the two rankings, while a value of 1 would indicate perfect correlation. Conversely, negative values (down to a minimum of -1) would indicate that rankings are inverted. Results are reported in Table 3-15. All the coefficients are statistically significant at 99% and allow us to reject the null-hypothesis of no correlation between the models' rankings. Nevertheless, the coefficients are lower than those found in similar analyses, as Carrino (2013). A reason for this is that the latter study was limited to Italian regional data. As we will discuss later, Italy present a rather consolidated pattern of dominance between regions, so that the rankings are less affected by changes in model design. To sum up, rankings are consistent between the two models' results but, as we just described, the trends and the differences in levels are non-negligible and could lead to very different conclusions in terms of appropriate policies of intervention to assuage and prevent Social Exclusion.

Table 3-15, Kendall's τ correlation coefficients

	2005	2006	2007	2008	2009	2010	2011	2012	Average
Kendall's τ	0.78	0.80	0.78	0.75	0.73	0.73	0.78	0.78	0.76

3.6.1 Germany vs Italy: where's the rub?

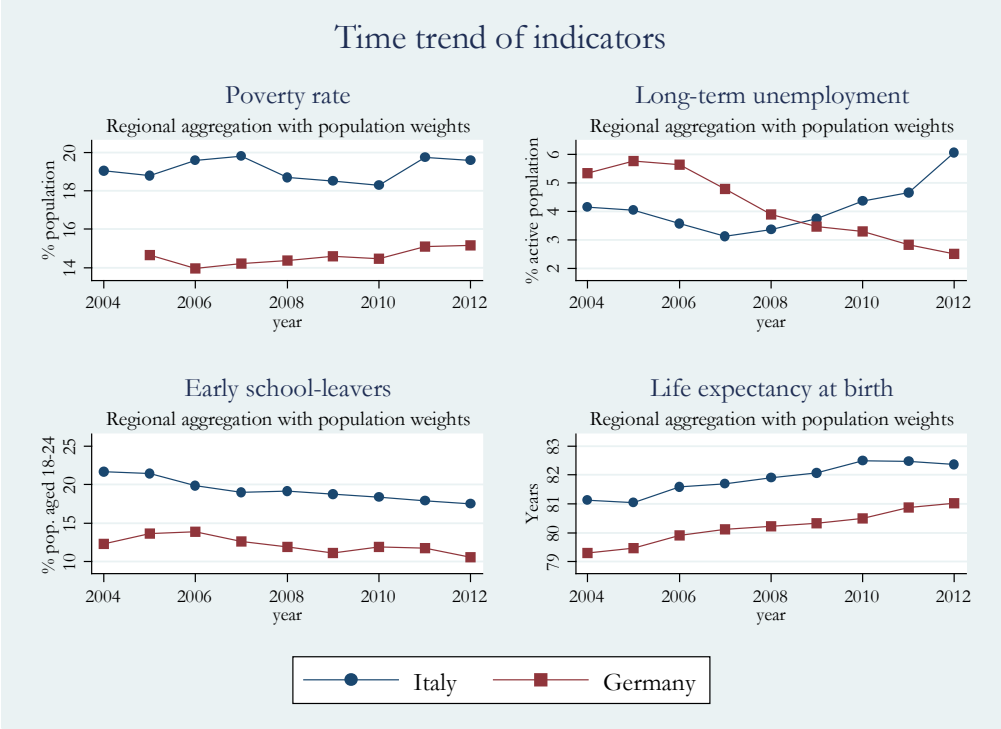
Arbitrariness in multidimensional measurement is wide, ranging from the choice of the indicators, to the specification of the aggregation model, to the choice of the normalization strategy and the weights. The results just described

[224] The Kendall-τ test is a non parametric method that allows to measure the degree of correspondence between two rankings. In particular, the Kendall-τ b allows for the possibility of ties in the rankings. Command in STATA: ktau.

highlight how arbitrariness might lead to very different pictures of the same conceptual phenomenon, measured on the same data. Nevertheless, it is straightforward to identify which is the driver of these differences, in our case, i.e., the normalization function, which is the only factor that differentiates between the two specifications (3.18) and (3.12). It is less intuitive, indeed, to spot what are the economic factors that cause the discrepancies, through the normalization function.

Let us consider the most striking difference from the two results just presented, i.e., the rank reversal between Germany and Italy. Figure 3-9 depicts the time trend of the four (original, non-normalized) indicators included in the Social Inclusion models. It is visible from the graphs, that the two countries share common trends in early school-leaving, life-expectancy at birth and poverty rate. Nevertheless, the levels of these variables are quite different: there are much more school-dropouts and poverty rates in Italy, which also presents substantially higher longevity. When it comes to long-term unemployment, however, the country-trends are crossing: Italy experienced a consistent decline in its labour market performance after the crisis, with a lot of individuals losing their job and/or exiting from the active population, while Germany saw a constant improvement in long-term unemployment (according to many observers, a consequence of the Hartz Reforms) way before the financial crisis erupted.

Figure 3-9, Time trends in Germany and Italy



In order to come to an aggregate measure, these variable must be normalized. Figure 3-10 reports the values of the four indicators normalized according to the data-driven min-max function (3.5), (3.6) with benchmarks as of Table 3-5. Conversely, Figure 3-11 illustrates the normalized variables obtained following the survey-elicited min-max function (3.10) (3.11) with benchmarks as of Table 3-9. Differences are evident, but let us start with the analysis of what does not change much between the two methods. Both in Germany and in Italy, the normalized poverty-rate is quite flat according to both normalizations strategies. Nevertheless, the survey-based transformed values are much lower than the data-driven ones, because of the narrower normalization range (see paragraph 3.5.1).

Figure 3-10 data-drivem normalized time trends in Germany and Italy

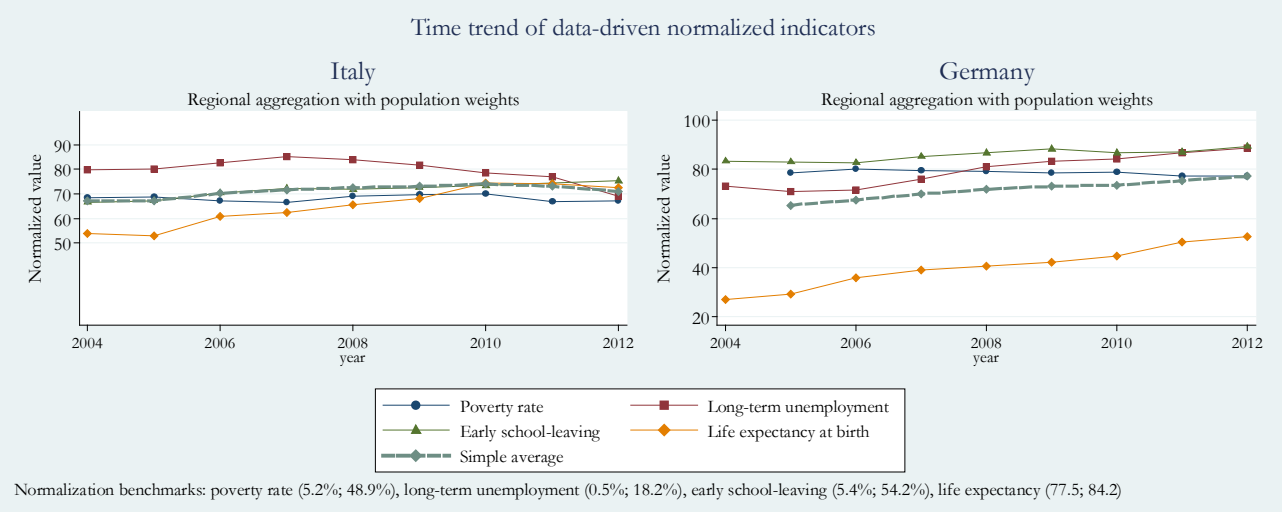
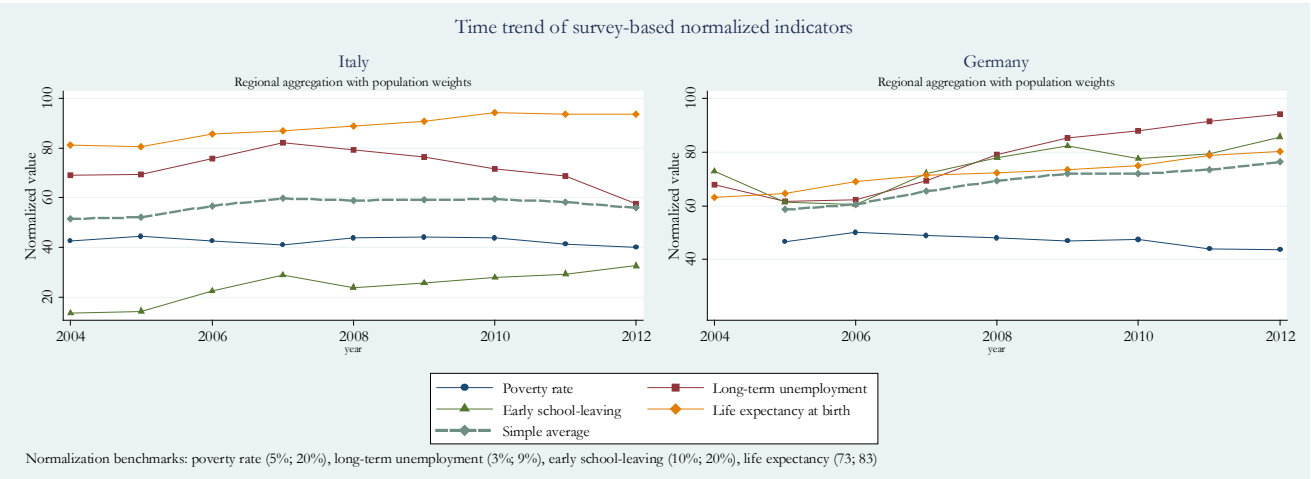


Figure 3-11 survey-driven normalized time trends in Germany and Italy



The dashed thick lines in both Figures denote the aggregate measure of the normalized dimensions of social exclusion (i.e., with equal weighting $w_j=0.25$). We can see on the left graph of Figure 3-10 that the increase in normalized life-expectancy more than counterbalances the worsening conditions in the labour market up to 2010, therefore allowing the overall measure to increase slightly, or remain constant. Recall that life expectancy's marginal effects are extremely high in the data-driven model (Table 3-7). Almost no role is played by early school-leaving (the triangle-marked line). In Germany, all the dimensions improve, thus leading to a regular increase in the composite measure. However, note that the Inclusion index is lower for Germany, because of the high weight given to life-expectancy (this is, as already mentioned, an entirely unsought consequence of the data-driven normalization, see Table 3-7).

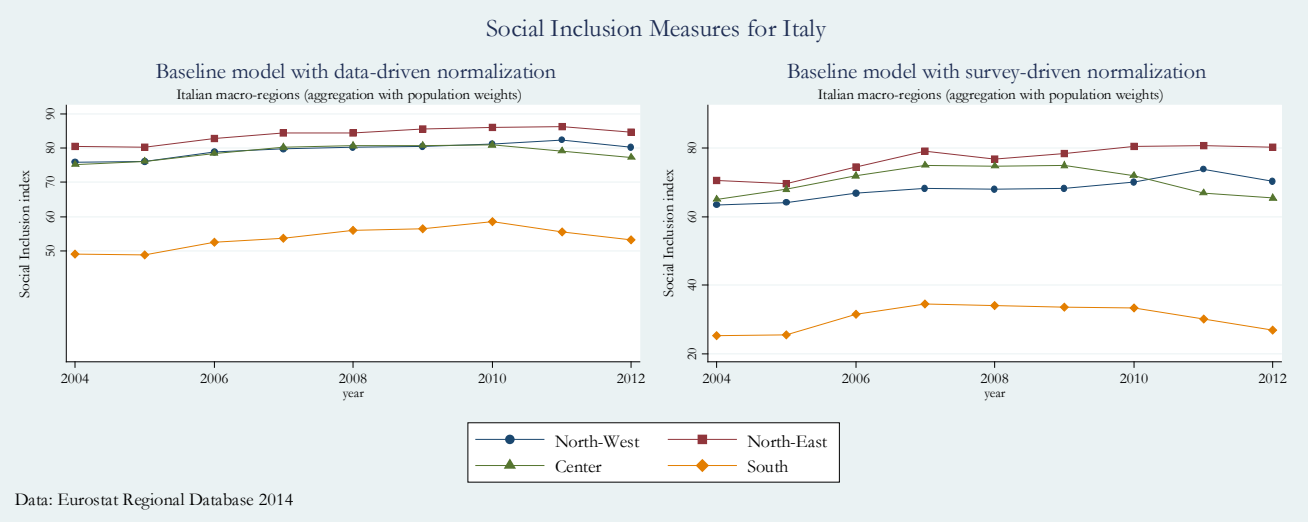
When the elicited benchmarks are implemented (Figure 3-11), life expectancy becomes the stronger pillar of the Italian Inclusion model, while early school-leaving is heavily penalized and shows a slow improve across the years. However, normalized-longevity is now much higher than before in Germany, and early school leaving has now a much higher value than in Italy, with a substantial positive trend too. Finally, although starting at similar normalized values in 2004, Italy's and Germany's differences in their long-term unemployment paths are much more evident now. Poverty rates continue to play a marginal role in both countries. If we recall that, additionally, longevity has a much reduced actual

weight in determining Social Inclusion in the survey-based model (Table 3-11), whereas long-term unemployment has the highest marginal effects, we can see why the German index is (1) higher than Italy, while it was lower in the previous specification; and (2) increasing at a higher rate. In other words, under the explicit value judgments of Ca'Foscari Alumni in Economics and Management, the conditions of Social Inclusion in Italy are much less desirable (and they are worsening) than those in Germany (which are improving).

A similar reasoning could be followed to explain the dramatic drop in the Spanish Social Inclusion in the survey-based model (Figure 3-7). The main drivers are the same: life-expectancy in Spain is increasing, but it counts much less in the survey-based model while it was by and large the strongest determinant in the data-driven model. Conversely, long-term unemployment, which is continuously rising in Spain, has a much higher marginal effect in the survey-based model. These two effects together explain the differences in the results.

However, although important differences characterize the two aggregation models in terms of marginal effects and trade-offs between dimensions, rank reversal is not always a necessary consequence of changes in normalization functions. When the socio-economic phenomena are highly crystalized in a given territorial context (i.e., there is clear dominance in performances, see Carrino (2013)), changes in parameters do not lead to a much different picture. As an example, Figure 3-12 depicts the Italian regional framework in 4 macro-regions, North-West, North-East, Center, South, built by aggregating regional indexes with population weights.[225] Although the graph on the right (survey-based model) shows higher variance between macro-regions, the trends are all confirmed. It is interesting to notice that, as in Spain, the South of Italy is shown to have suffered more for the crisis under the survey-based model. Also, the drop in Social Inclusion of the Center-Region (mainly due to worsened labour-market conditions, which get closer to the "certainly undesirable" level of 9%) is emphasized.

Figure 3-12, Italian macro-regions



[225] North-West: Piemonte, Valle d'Aosta, Lombardia, Liguria; North-East: Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Emilia Romagna. Center: Toscana, Umbria, Marche, Lazio. South: Abruzzo, Molise Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna.

3.7 RELAXING THE ASSUMPTION OF PERFECT SUBSTITUTABILITY

In the baseline specifications described in paragraphs 3.4.2 and 3.5.2 the substitutability parameter β in the (3.1) was fixed to unity. As already discussed in Section 3.3, the β affects the shape of the indifference curves between any normalized indicator $v(x_j)$ $v(x_k)$. With $\beta=1$, indifference curves are linear, which implies perfect substitutability. Note that, since the min-max normalization function previously adopted (3.5), (3.6), (3.10), (3.11) are linear in their arguments (regardless on the choices of the extreme benchmarks), this implies that also the core indicators x_j, x_k are assumed to be perfect substitutes.[226]

What are the implications of setting a β different from unity, in terms of relevance of the single indicator, as well as of the trade-offs between indicators? The "relevance" of a core variable x_j on the aggregate measure (i.e., the derivative of the aggregate measure with respect to x_j) is driven by the normalization function, the weights, and the value of β, as denoted by equation (3.3). In particular, when β is lower than one, the marginal contribution of x_j (i.e.,) $\partial F(v(\mathbf{x}))/\partial x_j$ is not anymore constant, but it depends on the observed performance in $v(x_j)$ as well as in the other normalized variables which enter the aggregation function (the last fraction in the last right-hand side term in (3.18), which is neutralized when $\beta=1$). For a generic attribute j (regional and time subscripts are dropped):

$$\frac{\partial F(v(\mathbf{x}))}{\partial x_j} = w_j v_j'(x_j)\left(\frac{\left[w_1 v_1(x_1)^{\beta} + \cdots + w_m v_m(x_m)^{\beta}\right]^{1/\beta}}{v_j(x_j)}\right)^{1-\beta} = w_j v_j'(x_j)\left(\frac{F(v(\mathbf{x}))}{v_j(x_j)}\right)^{1-\beta} \tag{3.13}$$

Indeed, the worse is the performance in $v(x_j)$, with respect to the other variables in the index, the higher will be its relevance to the synthetic measure. When holding $v(x_j)$ constant, the lower the β, the higher will be the marginal contribution of relatively bad performances in x_j (i.e., when $v(x_j)<F(v(\mathbf{x}))$). Stated differently, a lower β implies that the performances of the included dimensions *jointly* contribute to the aggregate index. A lower β results in a higher penalization of those territories in which some dimensions suffer from relatively bad performances, since these cannot be fully compensated by particularly good performances in other dimensions (as it would be with $\beta=1$).[227] The effect of assuming a $\beta<1$ on the derivative is, therefore, theoretically ambiguous, and will vary across regions and years. Besides depending on the data, it will depend on the benchmarks adopted for the normalization. Indeed, we are particularly interested in how different normalization functions can affect the results of the model in (3.1) when β is fixed at some value less than unity. In terms of dimensions' relevance, equation (3.13) highlights that, when $\beta<1$, the normalization function (through the choice of its benchmarks *minimum* and *maximum*) plays a double role: first, through its steepness v' and, second, through $v(x_j)$ at the denominator in the last factor of the last term.

The marginal rate of substitution between two original indicators j and h will be:

$$MRS_{x_k,x_j} = \frac{w_k}{w_j}\frac{v_k'(x_k)}{v_j'(x_j)}\left(\frac{v_j(x_j)}{v_k(x_k)}\right)^{1-\beta} \tag{3.14}$$

[226] This would not be the case if the normalization function were, e.g., $v(x_j) = log(x_j)$, as it happens in the Human Development Index with respect to the "income" variable (UNDP (2014)).

[227] Ravallion (2012b) discusses the potentially undesirable (or unjustifiable) trade-offs implicit in the geometric HDI.

That is, the reduction in x_j needed to compensate for a one-unit increase in x_h while keeping the Social Inclusion Index constant in a given territory depends on the ratio of weights w_h/w_j , on the ratio between the steepness of the normalization functions but also on the relative performance in the normalized dimensions v_h and v_j. In those cases where the performance of an observed indicator lies outside the boundaries of the normalization functions (which, as we discussed in the previous Sections, happens when the survey-based normalization is adopted), the MRS is, in principle, either zero or un-defined.

From all these considerations, we expect that changes in the normalization functions adopted (i.e., switching from *data-driven* to *survey-driven* normalizations) will have even stronger effects in a geometric aggregation framework, than those discussed in Section 3.6, when the models were linear. For a comprehensive discussion on the implication of adopting an aggregation function with $\beta<1$ rather than a linear one with $\beta=1$, we refer the reader to Klugman *et al.* (2011a) and Ravallion (2012b).

The parameter β, like the set of weights w and the normalization function v, can be arbitrarily chosen by the researcher, or be the result of an expert consultation. As we said, the lower is β, the less compensative the aggregation framework is, the more penalized are the territories with strong imbalances in rescaled dimensions' performances. In this Section, we opt for two specifications lying between the extremes of perfect substitutability ($\beta=1$) and perfect complementarity ($\beta=-infinity$). We first set $\beta=0$, a frequent choice for a non-compensative index (a recent example being, e.g., Silva and Ferreira-Lopes (2013)). Indeed, this was the road recently taken by the Human Development Index, which switched from a linear aggregation ($\beta=1$) to a geometric one in 2010 (UNDP, 2010). As a further variation, we also consider a switch to $\beta=-1$ which, as shown in (3.2), correspond to a harmonic mean of the rescaled dimensions (and therefore also of the original variables, given that the normalization step is unchanged). That is, we are going to build a geometric and a harmonic index of Social Inclusion. As for the normalization step, we are going to apply both the data-driven and the survey-driven transformations already described (paragraphs 3.4.1 and 3.5.1).

When the data-driven normalization is adopted, the resulting indices will be a Geometric Data-driven (GD) and a Harmonic Data-Driven (HD), defined as follows:

$$\begin{aligned} GD^i(\tau(\mathbf{x}^i)) &= \tau_1(x_1^i)^w * \cdots * \tau_m(x_m^i)^w \\ HD^i(\tau(\mathbf{x}^i)) &= \left[w\frac{1}{\tau_1(x_1^i)} + \cdots + w\frac{1}{\tau_m(x_m^i)}\right]^{-1} \end{aligned} \tag{3.15}$$

where the normalization function $\tau^{i,t}\left(\mathbf{x}^{i,t}\right)$ adopts the thresholds as of Table 3-5 and the weights w are all set equal to 0.25, as in the previous Sections.

When the survey-driven normalization is adopted, the result will be a Geometric Survey-driven (GS) and a Harmonic Survey-Driven (HS) indices, defined as follows:

$$\begin{aligned} GS^i(\varsigma(\mathbf{x}^i)) &= \varsigma_1(x_1^i)^w * \cdots * \varsigma_m(x_m^i)^w \\ AS^i(\varsigma(\mathbf{x}^i)) &= \left[w\frac{1}{\varsigma_1(x_1^i)} + \cdots + w\frac{1}{\varsigma_m(x_m^i)}\right]^{-1} \end{aligned} \tag{3.16}$$

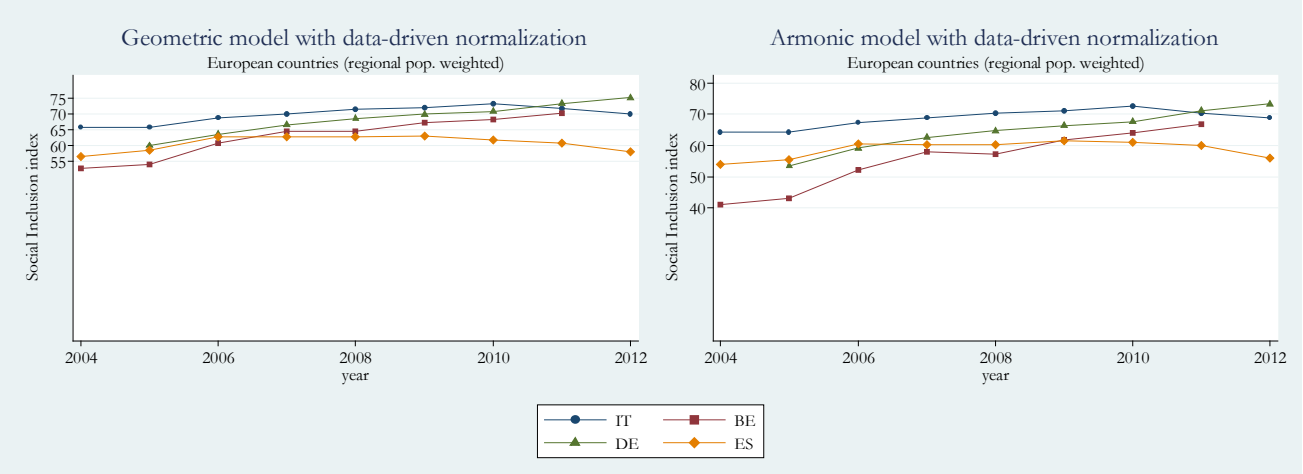
where the normalization function $\varsigma^{i,t}\left(\mathbf{x}^{i,t}\right)$ adopts the thresholds as of Table 3-9 and the weights w are all set equal to 0.25.

It is immediate to notice that, under (3.15), if any of the rescaled components of the geometric mean is at the minimum (i.e., at zero), the whole index collapses to zero, so that other components become irrelevant. A similar outcome results

from the harmonic mean, whose limit is zero when any of its component is zero. Klugman *et al.* (2011a) notes that "this is a general characteristic of indices characterized by some level of complementarity".

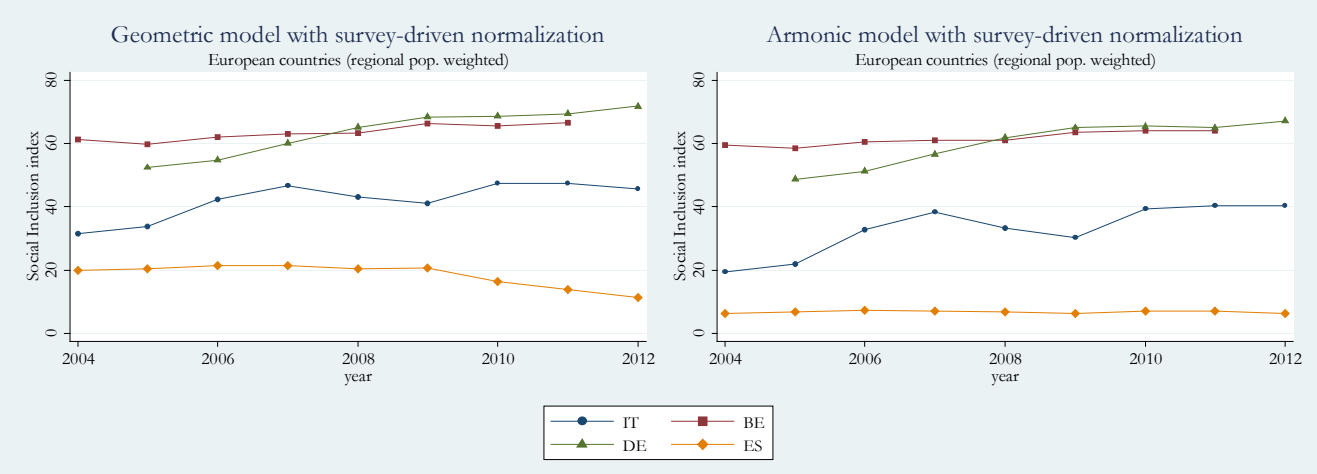
Results are shown (aggregated at country level, with regional population weights) in Figure 3-13, Figure 3-14 and in the Appendix 3.9.6. Results at regional level are available upon request. The lower degree of substitutability inherent in both the geometric and the harmonic specification leads us to expect a reduction in the Social Inclusion Indices with respect to the linear case (Figure 3-7). Indeed, the extent of this reduction depends on the adopted normalization. The two graphs in Figure 3-13 show lower levels of Inclusion with respect to Figure 3-7, but relatively consistent trends for Italy, Germany and Spain, with the latter being now closer to the former two countries. Conversely, the aggregate index for Belgium is lower than the Spanish one in both the geometric and the harmonic models in the early years of our time interval.

Figure 3-13, geometric and harmonic models, data-driven



When the survey-driven normalization is adopted, results change drastically. Figure 3-14 shows highly heterogeneous countries' performances. While Belgium and Germany keep similar levels and trends with respect to the data-driven geometric and harmonic models, Italy and Spain score much lower levels of Inclusion. Spain, in particular, shows almost no improvements in Inclusion even before the crisis years.

Figure 3-14 eometric and harmonic models, survey-driven



These results must be commented under two perspectives: first, the difference between a linear and a non-linear specification (we will mainly discuss the geometric model, for convenience) and, second, the role of different normalization functions. From equation (3.1) and Figure 3-2, we know that lowering the substitutability coefficient β will lead to lower levels of the aggregate index. Values of β lower than unity lead to a higher severity in evaluating imbalances between dimensions. In other words, although the index remains (weakly) increasing and concave in each dimension, a low (normalized) performance in one indicator can (even completely) wipe out good performances in other variables.[228] Indeed, from a mathematical point of view, both the geometric and the harmonic models must convey lower or equal levels of Inclusion than the arithmetic mean. The reason why this drop is much more evident (for Italy and Spain) in Figure 3-14 relies on the higher occurrences of zero normalized-values in at least one dimension, and in the new weights implied by the new rescaling function (survey-based). In particular, both long-term unemployment and early school leavers have very low normalized values in Spain (and, to a lesser extent, in Italy), according to the survey-based normalization. Since it is the "normalized" dimensions who are aggregated, a very low normalized performance in these two (or even in one) attributes drags down the aggregate measure.[229]

Even though our attention is mainly focused on the Indices' levels, which provide us with insights on the distances between regional performances and on how they evolve in time, it is useful to compare rankings of Social Inclusion generated by various methodologies, to get a broad sense of the differences in the underlying mechanisms embedded in each characterization. Table 3-16 reports average Kendall's τ coefficients (already described in the context of Table 3-15) between the rankings generated by the data-driven and the survey-driven specifications adopted so far.

Table 3-16, Average Kendall's τ correlation coefficients between Linear, Geometric and Harmonic specifications: data-driven vs survey- normalization

	Linear survey-driven	Geometric survey-driven	Harmonic survey-driven
Linear data-driven	0.76	0.56	0.53
Geometric data-driven	0.70	0.51	0.48
Harmonic data-driven	0.63	0.45	0.42

Results confirm the findings already commented. In general, all coefficients allow to significantly reject (at 99%) the null hypothesis of independence in rankings. As expected, the coefficients corresponding to comparisons involving any geometric or harmonic model are lower than those involving linear models: as an example, comparing the third coefficient in the third column (harmonic data-driven vs geometric survey-driven) is 0.45, while the first coefficient in the third colum (where the linear data-driven is compared to the geometric survey-driven) is 0.56. Furthermore, when moving from a full substitutability model to a less compensative one *within* the data-driven framework, the rankings do not change much (this is visible when one compares the Kendall's coefficients by reading the table column-wise, e.g. from top to bottom).[230] Conversely, when the survey-based normalization is kept constant and the model switches

[228] Whether this is a desirable characteristic for an aggregate measure of wellbeing is debatable (again, we refer to the comprehensive discussion in Klugman *et al.* (2011a) and Ravallion (2012b)).
[229] Although the early school-leaving rates are recently improving (i.e., lowering) in Spain, most of the regions still exhibit levels higher that 20% which is the extreme bound fixed by the experts evaluation described in Section 3.5, and defined as a condition of school-dropouts which is certainly undesirable and detrimental. In other words, the "value" function of the early-school leaving is not strictly decreasing in school-dropouts rates, therefore determining a non-linearity effect: no improvement in the normalized variable for regions above 20%, regardless of their performance. A similar reasoning is valid, albeit to a lesser extent, for Italy.
[230] This result is discussed in Carrino (2013) (in Italian).

from linear to geometric and harmonic, the rankings differ more substantially, compared to any of the data-driven models (this interpretation requires to read the table row-wise, from left to right, for each row).

In paragraphs 3.5.2 and 3.6.1, we discussed how the normalization parameters (the benchmarks *minimum* and *maximum*) affect the variable relevance in a linear specification. In the survey-normalization, the relevance of life-expectancy is reduced while the one for long-term unemployment is increased. The same reasoning apply here, but with an additional effect due to the imperfect compensatory nature of both the geometric and the harmonic frameworks. In the linear model, the relevance of a dimension to the aggregate Index is independent from the other dimensions' performance, but this does not hold anymore when β is less than one.

Let us consider the geometric aggregation framework with $\beta=0$ (the following considerations hold, even magnified, for the harmonic aggregation). If we take a generic variable *j*, its "relevance" with respect to the aggregate measure is $\partial GD(\tau(\mathbf{x}))/\partial x_j$, when the normalization is data-driven, and $\partial GS(\varsigma(\mathbf{x}))/\partial x_j$, when the normalization is survey-driven. A quick look at equation (3.13) allows us to see that, when $\beta=1$, the last factor is neutralized. Therefore, the difference between the relevance of indicator *j* between the linear and the geometric specifications will entirely depend, holding the weights and the normalization function unchanged, on the ratio between the aggregate measure and the normalized performance $v_j(x_j)$. That is, using the notation referred to our two normalization strategies (Data-driven and Survey-driven):

$$\frac{\partial GD(\tau(\mathbf{x}))}{\partial x_j} > \frac{\partial LD(\tau(\mathbf{x}))}{\partial x_j} \text{ if } \frac{GD(\tau(\mathbf{x}))}{\tau_j(x_j)} \geq 1$$
$$\frac{\partial GS(\varsigma(\mathbf{x}))}{\partial x_j} > \frac{\partial LS(\varsigma(\mathbf{x}))}{\partial x_j} \text{ if } \frac{GS(\varsigma(\mathbf{x}))}{\varsigma_j(x_j)} \geq 1 \quad (3.17)$$

when $\tau_j(x_j)$ and $\varsigma_j(x_j)$ are greater than zero.

Consider longevity in a given region at a given year: if the normalized value of longevity is lower than the overall Index for that region in that year, then its relevance will be higher in the geometric aggregation than it was in the linear one. In other words, the geometric aggregation gives more "importance" to the longevity variable, when its normalized values lie below the aggregate measure, thus denoting a shortcoming in this specific dimension.

As highlighted by Ravallion (2012b) with respect to the Human Development Index, the geometric aggregation implicitly assign variable marginal rates of substitution between pairs of dimensions (the MRS was constant in the linear specification, when β=0, since the last factor in equation (3.14) is neutralized). It is interesting to briefly show the MRS between longevity and long-term unemployment whose formalization is:

$$MRS^{GD}\left(x_{longevity}, x_{l.t.unemplyment}\right) = \frac{\partial GD(\tau(\mathbf{x}))}{\partial x_{longevity}} \Big/ \frac{\partial GD(\tau(\mathbf{x}))}{\partial x_{l.t.unempl.}} = \frac{\mathrm{d}\max\left(x_{l.t.unempl.}\right) - x_{l.t.unempl.}}{x_{longevity} - \mathrm{d}\min\left(x_{longevity}\right)}$$
$$MRS^{GS}\left(x_{longevity}, x_{l.t.unemplyment}\right) = \frac{\partial GS(\varsigma(\mathbf{x}))}{\partial x_{longevity}} \Big/ \frac{\partial GS(\varsigma(\mathbf{x}))}{\partial x_{l.t.unempl.}} = \frac{\mathrm{e}\max\left(x_{l.t.unempl.}\right) - x_{l.t.unempl.}}{x_{longevity} - \mathrm{e}\min\left(x_{longevity}\right)} \quad (3.18)$$

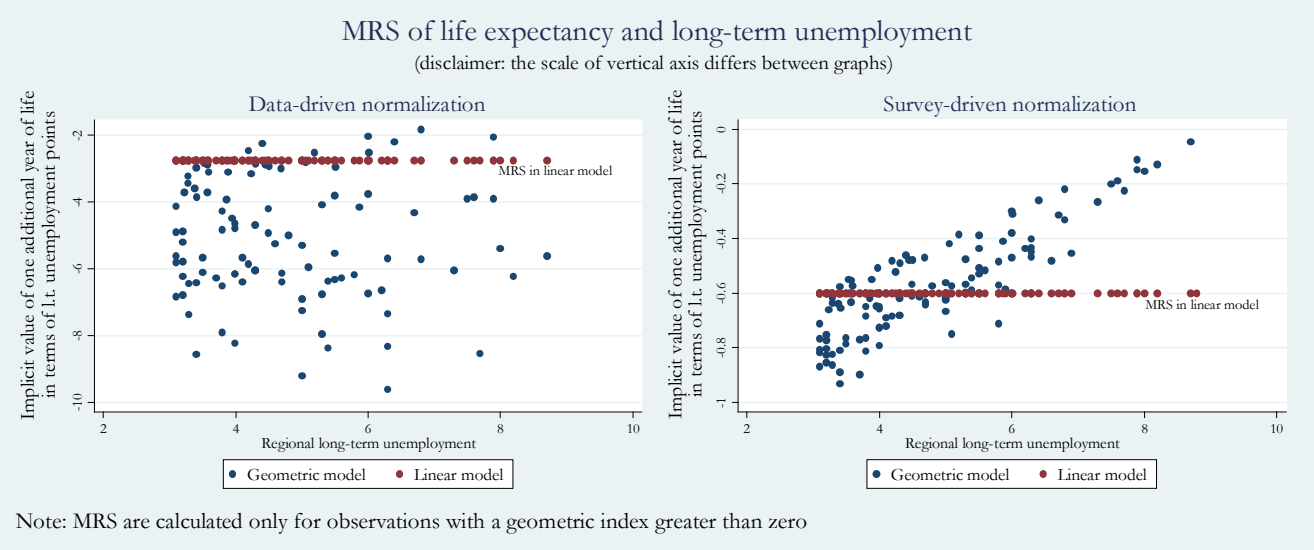
It is visible that the MRS now depends on the observed variables $x_{long\text{-}term\ unemployment}$ as well as $x_{longevity}$. The MRS represents the implicit valuation of a change of one year in longevity, in terms of long-term unemployment percentage points, i.e., the change (increase) in unemployment that is needed to compensate for an additional year in life expectancy. In the geometric survey-driven model, the MRS has a meaning only when longevity and long-term unemployment lie

within their respective boundaries *emax* and *emin*. In order to perform a proper comparison, we will compute the data-driven MRS only for those observation with normalized longevity and unemployment greater than 0 and lower than 100 (that is, longevity between 73 and 83 and unemployment between 3 and 9, excluding the extremes).

Figure 3-15 plots the MRS between these two dimensions over the levels of regional long-term unemployment, under both normalization (a disclaimer: the two graphs have different measurement units on the y-axis), for administrative regions in our sample (from 2004 to 2012). Under the linear models, the MRS is constant (and negative), by construction. When switching to the survey-based normalization, the "linear" MRS drops below unity (at -0.6) while it lies at -2.6 under data-driven normalization (see also Table 3-8 and Table 3-12). Under the geometric models, the MRS is much more variable, as expected. In particular, with survey-based normalization, the value of an additional year in longevity (in terms of long-term unemployment points) is approaching zero as unemployment increases. That is, for territories where unemployment is higher, the index gives less value to an additional year of life in terms of unemployment. Alternatively stated, the effects that would have a reduction of 1 percentage point in unemployment on the Social Inclusion measure are much higher than those deriving from an increase of 1 year in life-expectancy-at-birth. This effect appears in the right-hand side graph because, as already discussed, survey-based normalization has relatively devalued longevity while it has increased the impact of a change in unemployment. In other words, the same longevity levels are valued as relatively "more desirable" under survey-driven normalization, while long-term unemployment is valued relatively worse (Figure 3-6). As a consequence, there are more regions with normalized values of unemployment lower than longevity, and this increases the relevance of the former on the aggregate measure, while decreasing the relevance of the latter. Finally, as already noted, when the long-term unemployment rate is above 9% or below 3%, its relevance (marginal effect) is zero under the survey-driven normalization, and the MRS between longevity and unemployment does not make sense anymore.

Again, we can see that the choice of normalization benchmarks, this time combined with the nature of the data and the choice of the geometric aggregation, always hide trade-offs which can be partially unwanted. In a similar fashion, Ravallion (2012b) highlights how the HDI puts a higher value to an extra year of life for people in rich countries than poor ones. Paraphrasing a comment from the author, we might find reasonable that, across individuals, the value attached to extra longevity is higher when the labour market conditions are better (i.e., lower long-term unemployment). Higher job security can surely guarantee higher consumption in the extra years of life, thus raising expected utility, and causing people to be willing to pay more for an additional year of life. However, especially in the context of a social value as the "Social Inclusion", as intended by the European Council, the implementation of an intrinsic steep trade-off into the valuation of longevity, although inevitable (Klugman *et al.*, 2011b), should be made transparent to the reader.

Figure 3-15 MRS between longevity and unemployment



Note: MRS are calculated only for observations with a geometric index greater than zero

3.8 IN PLACE OF A CONCLUSION

As frequently remarked throughout this paper, no *golden rule* is likely to exists for building a *definitive* aggregate index of well-being. The inherent subjectivity of such measures are the main cause of controversies in this field of economic analysis. In the previous Sections we tried to argue that the lack of transparency on the consequences of arbitrary methodological choices is more troublesome than subjectivity per se, which is most likely unavoidable. The act of synthesizing a composite latent phenomenon encompasses methodological issues that have economic, philosophical (as well as psychological) and political connotations. Indeed, these issues arise from a fundamental mismatch between the kind of multiplicity inherent in the latent concept and the multiplicity characterizing the forged measure (the result of the researcher's work). In a sense, the latent multidimensional concept (e.g., well-being or social inclusion) is an un-synthesized multiplicity, in that it is composite by nature and perceived as a whole by the human sensibility. Since the phenomenon is unmeasurable per se, the researcher is forced to operationally separate it in numerous measurable components, in order to aggregate them back to provide a proxy of the latent phenomenon. In other words, building a synthetic index of well-being requires that the indeterminate nature of multiplicity is made determinate through a specification of its contents, and of their relationship.[231]

Although there may be no "absolute cure" for multidimensional evaluations, a good practice could consist in enhancing transparency in the adopted methodology. Paraphrasing Jean-Paul Sartre's *existentialist* argument in the context of multidimensional measurement, "choice is possible, but what is not possible is not to choose. I can always choose, but I must know that if I do not choose, that is still a choice" (Sartre, 2002). This implies taking full responsibility for methodological choices, as well as acknowledging the theoretical (economic or sociological) foundations for such choices, or the lack of them.

[231] We find particularly interesting to match the theoretical issues behind the construction of multidimensional indices with the modern philosophical debate on multiplicity and synthesis, e.g., the Husserlian arguments on "active" and "passive" synthesis and multiplicity (Husserl and Cairns (1960), Moran (2005)), or the works of Henri Bergson (the "quantitative" and "qualitative" multiplicities) as well as those of Gilles Deleuze.

By adopting the European Union's theoretical framework developed by Atkinson *et al.* (2002), we aimed at building a synthetic Index of Social Inclusion for 58 administrative regions in Belgium, Germany, Italy and Spain between 2004 and 2012. We stressed the importance of the normalization step, which rescales raw data through a "value function" which attach specific "hidden" weights and marginal rates of substitution between the dimensions included in the Index. Our baseline framework is a standard linear aggregation model, where equal weights are given to the rescaled dimensions. For normalization, we choose the *min-max* function, which transforms data on the scale 0-100.

In the data-driven normalization, the rescaling is performed by using observed maximum and minimum performances as benchmarks, thus grounding solely on the statistical characteristics of the data. Indeed, the data-driven benchmarks do not correspond necessarily to "best" or "worst" possible values of an indicator in absolute terms, nor do they necessarily represent some policy target to be achieved or avoided. In sum, they are not based on economic-judgments. If such a data-driven index is to be adopted under a normative perspective, in order to prioritize policy interventions across European regions, the lack of economic justification for the index's intrinsic trade-offs should be made transparent to the readers. Otherwise, one could try to extrapolate economic and policy implications from a synthetic measure, tacitly accepting its founding trade-offs which might be hardly defensible from an economic perspective.

As an alternative, we propose the adoption of fixed normalization thresholds, which are based on median responses of an expert panel of 90 professors in Economics and Management at the Ca' Foscari University of Venice. The resulting normalization functions are to be interpreted more as "social value-functions", in that each variable is rescaled according to how much it fulfills a given degree of "desirability". As a result, the normalization function may become weakly monotonic (instead of being *strongly monotonic*), when the elicited constraints are binding for some observed variable. The *non-satiation* hypothesis is maintained only in a weaker form: more of a "good" is simply *non ill-favored* with respect to less of it, after a certain performance is reached (and, conversely, more of a "bad" is *non-preferred* to less), in a rough realisation of a diminishing sensitivity hypothesis.

To the extent to which rescaling is a requirement for composite measures, what is actually aggregated are always the transformed variables and not the observed performances. There is an unavoidable and intrinsic difference between the interpretation of original and normalized performances. The common unit of measurement (e.g., between zero and 100) can be interpreted as a sort of degree of fulfilment of some criterion. Whether this criterion should be purely statistical, or whether it should encompass some informed value judgements related to the topic at hand, relies on the researcher's choice. In the former case (*data-driven*), standard properties as strong non-satiation and continuity of the normalization function are guaranteed, yet trade-offs might be hard to interpret in economic terms and debatable from a social desirability perspective (e.g., assigning equal normalized scores to a 10% long-term unemployment rate, a 30% of school dropouts and a life expectancy at birth of 81 years old). In the latter case (*survey-driven*), the normalization and its implied trade-offs are independent from the data chosen (in terms of time-span and geographic coverage); nonetheless, we face issues like the aforementioned discontinuities, as a result of the intersection between explicit value judgements and the observed data.

As discussed at the beginning of this Section, neither method is neutral. Data-driven normalization does not allow for any judgment evaluation, other than the arbitrary *agnostic* choice of "letting the data talk", thus resulting in trade-offs which have weak economic justifications. The elicitation method suffers from the arbitrariness of any survey exercise (choice of the population, bias in the framing of questions), and internalize the subjective judgments of the respondents.

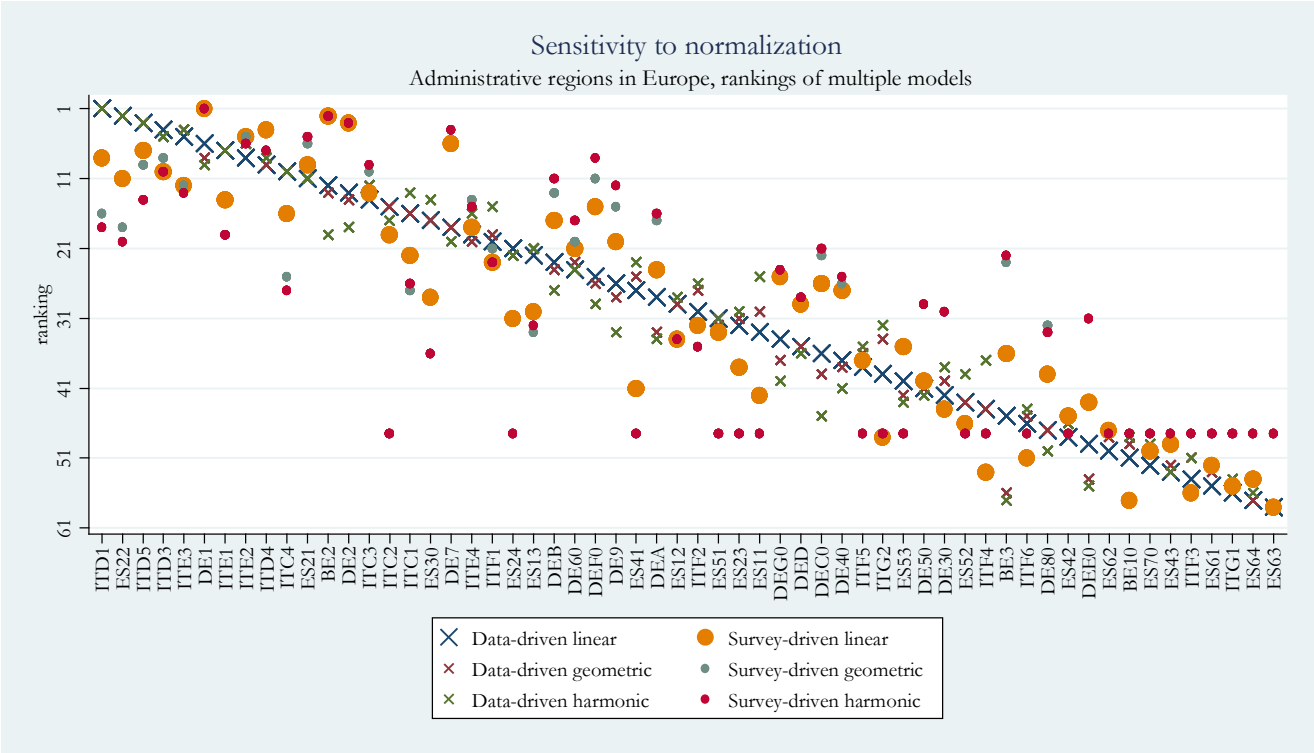
We argue that, with elicited preferences, this unavoidable subjectivity is made explicit, transparent and, possibly, slightly more anchored to economic sensibility.

In terms of results, we find that data-driven normalization softens the aftermaths of the recent economic crisis in the linear model. Conversely, the survey-driven linear model emphasizes the worsening trends in long-term unemployment and the relevance of early school-leaving. As a result, Italy exhibits lower aggregate performances than Germany (while they were higher in the data-driven model), with Spain showing a substantial drop after 2008. These important differences are due to the changes in the implicit relevance of the four dimensions, thereby also in their implicit marginal rates of substitution. Huge relevance is given to longevity in the data-driven linear model. The reason for this relies in its relatively narrower distribution in the observed data with respect to the other variables, which show much more variation between minimum and maximum performance. A lower relevance is attributed to unemployment, and an even lower one to school-dropouts and poverty-rate. When considering that longevity is almost always increasing, this counterbalances the effects of the crisis on unemployment for those regions (mostly Italian and Spanish) which suffered most on labour-market issues after 2008. Similarly, these countries' substantial worse performances in school-dropouts are softened. Switching to survey-based normalization leads to a higher relevance for unemployment, with respect to early school-leaving and longevity (which now have equal relevance), and relative-poverty. The resulting aggregate Index internalizes these new weights and produces a very different overall picture of Social Inclusion.

The choice of survey-based boundaries for normalization (as well as any fixed thresholds like those of the HDI prior to 2010), has important consequences when geometric (or harmonic) aggregation is assumed. In our panel, many regions exhibit observed performances at, or below, the minimum thresholds (or the maximum, in case of dimensions negatively correlated to the latent phenomenon). As a consequence, the value of their Inclusion Index collapses to zero. This implies that other indicators are irrelevant to the synthetic Index, and that the marginal rates of substitution have no meaning (Klugman *et al.*, 2011a). These extreme situations could be avoided by imposing (again, arbitrarily!) a suitable shape to the normalization functions in order to preserve strict monotonicity and full differentiability.

Changing the normalization strategy can sensibly alter the levels of the aggregate measure, as well as its rankings. Although Kendall's τ coefficients highlighted that dependencies still exist between rankings resulting from different specifications, we offer a brief follow-up in the analysis through the next two graphs, in Figure 3-16 and Figure 3-17. The former graph draws the rankings obtained for each administrative region, sorted by the ranking in the linear data-driven model (detailed in Section 3.4). At first sight, the graph appears rather chaotic, and this already gives a hint on the relative instability caused by changes in model specifications. We made a graphical distinction between data-driven and survey-driven rankings: the former are characterized by "x" symbols, the latter by "circle" symbols. Both the categories appear in markers of different size, depending on the degree of substitutability implied in the models. At first, we suggest the reader to concentrate the attention to the biggest "x" and "circle" symbols, which represent, respectively, the data-driven and survey-driven *linear* models.

Figure 3-16, rankings' sensitivity



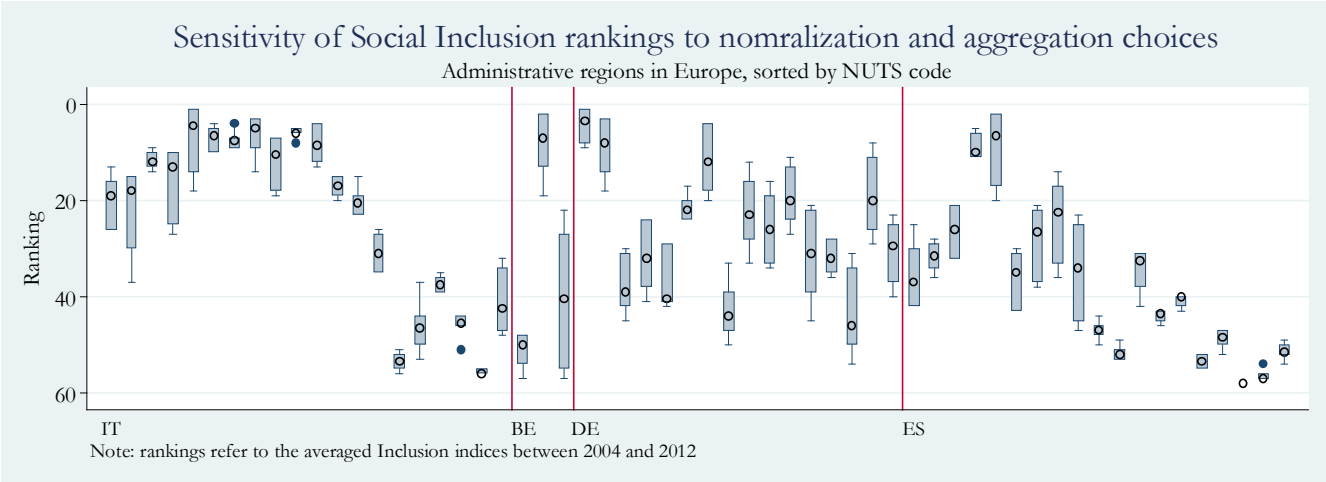
The graph clearly highlights how the two rankings are quite heterogeneous: several regions are "penalized" by the data-driven normalization (the "x" symbol lies below the "circle" one), while others are "penalized" by the other strategy (the "x" symbol lies above the "circle" one). Another feature is worth noting, to stress graphically something that was already discussed: when changing the substitutability degree *within* the data-driven framework (i.e., when switching from the biggest "x" to the smaller ones), rankings are not much affected. Conversely, the distances between the big "circle" and the smaller ones are visibly higher, even in the regions in the first half of the ranking. Note also that, in many occasions, the switch to complementarity (either geometric or harmonic) causes rankings to change in opposite directions, depending on which normalization is adopted (e.g., the 6th, the 12th and 13th observations from the left). This, again, goes to show how the choice of a normalization, and the economic justification of its implied trade-offs, should be held in high consideration when commenting the resulting Indices. Finally, note that, for many low-ranking regions (at the extreme right of the graph), the small "circle" symbols are all fixed at a constant value, which symbolizes that these territories are all at the bottom of the table under geometric or harmonic specifications (they have at least one zero-valued normalized dimension).

Although heterogeneities are evident from the previous graph, it is easy to show that they are not randomly occurring across regions. The following Figure plots the average rankings' distribution for each administrative region, sorted by NUTS codes.[232] There are visible groups of "highly ranked" and "badly ranked" territories, which do not vary much regardless of the aggregation and normalization choices. The former are concentrated in the North-East and Center of Italy, the Flemish Belgian region, the Baden-Württemberg and Bayern in Germany, the País Vasco and Comunidad

[232] Italian NUTS are sorted from North to Nouth, while Belgium's regions are Bruxelles, Flanders and Wallonia, German Länders (NUTS 1) are sorted alphabetically while the Spanish Comunidades are – roughly - sorted from North-West to South, to Islands.

Foral de Navarra in Spain. Among the latter we find most of the Southern Italian and Spanish regions (including the islands), as well as the Belgian Bruxelles region of Belgium.

Figure 3-17, rankings' sensitivity, sorted by geographical location



Further work is needed in order to test the reliability of our analysis and enhance transparency. A first step would be, as already mentioned, to "smooth" the normalization function in order for it to be strictly monotonous and avoid the discontinuities which typically occur when thresholds are fixed (as in our survey-based example) and are especially troublesome when complementarity is embedded in the CES framework. A next step will involve relaxing the hypothesis of fixed weights w_j and of the pre-determined substitutability parameter β, e.g., through the elicitation of informed-preferences among decision makers with relevant positions in the field of national and/or regional Departments for Social Policies. Furthermore, other aggregation strategies (different from the CES-based ones) as the linear programming Data Envelopment Analysis will be implemented, in order to discuss the consequences of relaxing the hypothesis of a fixed set of weights across regions (the "benefit of the doubt" approach of Cherchye, Moesen, *et al.* (2007)).

3.9 APPENDICES

3.9.1 Elasticity of substitution in the CES function

The elasticity of substitution between two normalized arguments of the aggregation function F described as of (3.1) is obtained as follows (making use of (3.20) for the MRS):

$$\varepsilon_{v_j,v_k} = \frac{\frac{d\left(v_j/v_k\right)}{v_j/v_k}}{\frac{d\left(dv_j/dv_k\right)}{dv_j/dv_k}} = \frac{\frac{d\left(v_j/v_k\right)}{v_j/v_k}}{\frac{d\left(MRS_{k,j}\right)}{MRS_{k.j}}} = \frac{d\left(\frac{v_j}{v_k}\right)}{\frac{v_j}{v_k}} \cdot \frac{MRS_{v_k,v_j}}{d\left(MRS_{v_k,v_j}\right)} \triangle ABC$$

(3.19)

$$\varepsilon_{v_j,v_k} = \frac{d\left(\frac{v_j}{v_k}\right)}{d\left[\frac{w_k}{w_j}\left(\frac{v_j}{v_k}\right)^{1-\beta}\right]} \cdot \frac{w_k}{w_j}\left(\frac{v_j}{v_k}\right)^{-\beta} = \frac{w_k}{w_j}\left(\frac{v_j}{v_k}\right)^{-\beta} \cdot \frac{1}{(1-\beta)\frac{w_k}{w_j}\left(\frac{v_j}{v_k}\right)^{-\beta}} = \frac{1}{1-\beta}$$

where we used the following to determine the *MRS*:

(3.20)

$$MRS_{v_k,v_j} = \frac{F_{v_k}}{F_{v_j}} = \frac{w_k \frac{1}{v_k^{1-\beta}}(\ldots)^{\frac{1-\beta}{\beta}}}{w_j \frac{1}{v_j^{1-\beta}}(\ldots)^{\frac{1-\beta}{\beta}}} = \frac{w_k}{w_j}\left(\frac{v_j}{v_k}\right)^{1-\beta}$$

3.9.2 Social Inclusion Measure, Baseline model with data-driven normalization

The following coefficients are obtained by implementing the LD model (3.18)

Table 3-17, Aggregate measure of Social Inclusion, baseline model with data-driven normalization

nation	region	2004	2005	2006	2007	2008	2009	2010	2011	2012
BE	Bruxelles	51.3	47.7	49.5	50.8	51.8	55.1	52.6	51.3	.
BE	Vlaams Gewest	75.1	75.2	77.6	80.0	81.2	81.7	81.6	83.9	.
BE	Région wallonne	56.1	55.1	56.8	58.2	58.0	59.9	60.4	61.6	.
DE	Baden-Württemberg	.	76.4	79.6	81.2	82.9	83.0	83.0	85.3	86.5
DE	Bayern	.	73.4	74.4	77.4	79.3	80.4	81.2	82.1	84.1
DE	Berlin	.	52.3	53.7	59.4	59.1	62.9	63.4	66.9	67.9
DE	Brandenburg	.	55.0	56.9	60.9	65.5	66.8	68.7	70.2	70.4
DE	Bremen	.	51.3	57.6	59.8	61.4	64.3	65.5	65.0	68.2
DE	Hamburg	.	63.2	67.3	68.1	72.7	74.2	75.2	75.4	77.5
DE	Hessen	.	70.3	72.7	74.0	75.4	77.2	78.9	80.5	81.2
DE	Mecklenburg-Vorpommern	.	45.4	50.6	52.7	58.0	59.5	61.5	63.8	64.0
DE	Niedersachsen	.	63.9	65.7	68.5	69.5	71.0	71.6	72.6	74.9
DE	Nordrhein-Westfalen	.	63.6	65.3	67.2	68.8	69.8	69.6	71.5	72.4
DE	Rheinland-Pfalz	.	66.0	68.9	71.0	73.3	72.8	73.0	75.0	76.7
DE	Saarland	.	57.3	58.5	65.2	65.9	66.8	69.7	68.6	71.9
DE	Sachsen	.	58.1	61.1	62.9	67.1	68.0	66.2	71.2	73.0
DE	Sachsen-Anhalt	.	47.5	51.1	54.1	54.5	57.7	61.0	61.6	
DE	Schleswig-Holstein	.	66.3	68.7	70.9	71.3	72.8	72.6	74.8	75.8
DE	Thüringen	.	58.7	59.0	61.2	65.8	68.8	71.1	71.9	73.1

ES	Galicia	60.9	65.7	65.8	68.3	68.8	67.9	69.0	68.0	66.0
ES	Principado de Asturias	62.5	65.4	68.5	70.6	72.5	70.5	68.5	69.3	64.7
ES	Cantabria	66.4	72.4	73.6	73.3	77.4	75.5	69.5	70.8	74.6
ES	País Vasco	75.9	78.5	81.4	80.1	82.5	82.1	82.6	81.1	80.4
ES	Comunidad Foral de Navarra	77.7	81.0	85.7	87.2	85.9	86.1	88.4	87.5	85.2
ES	La Rioja		64.9	70.2	68.7	65.1	69.1	69.4	64.2	68.4
ES	Aragón	72.7	70.6	74.7	72.5	74.9	76.6	72.0	70.2	69.6
ES	Comunidad de Madrid	74.6	74.6	78.2	77.9	77.3	76.5	77.5	77.7	74.9
ES	Castilla y León	64.8	65.7	70.0	70.9	70.2	71.5	71.0	68.7	71.3
ES	Castilla-la Mancha	54.9	55.3	59.1	58.7	58.7	60.0	57.9	54.1	52.2
ES	Extremadura	42.5	44.2	48.7	47.8	51.4	50.9	46.4	52.3	42.3
ES	Cataluña	63.8	66.3	72.5	70.7	71.0	68.0	65.8	65.8	64.1
ES	Comunidad Valenciana	56.5	58.2	63.6	64.8	62.3	62.3	57.2	58.0	53.9
ES	Illes Balears	61.2	61.9	67.8	64.6	64.1	60.6	58.8	62.1	56.8
ES	Andalucía	41.6	47.1	48.8	51.0	49.6	48.5	45.9	43.1	41.8
ES	Región de Murcia	50.4	53.3	55.2	55.3	54.7	52.4	51.1	53.0	50.5
ES	Ciudad Autónoma de Ceuta	.	21.0	23.9	24.9	29.3	33.3	30.0	34.5	26.9
ES	Ciudad Autónoma de Melilla	.	.	42.7	41.1	.	.	48.4	42.2	30.1
ES	Canarias	52.1	52.9	53.5	54.3	53.7	53.1	46.9	42.6	43.0
IT	Piemonte	72.4	74.2	76.0	78.9	77.3	77.5	78.4	78.2	76.6
IT	VDA	74.9	74.0	79.7	74.3	76.3	79.6	80.5	81.1	81.6
IT	Liguria	76.7	74.6	77.8	78.5	80.7	83.0	81.6	81.0	77.3
IT	Lombardia	77.3	77.3	80.4	80.5	81.5	81.3	82.4	84.5	82.5
IT	TAA	79.4	81.7	84.4	87.2	87.9	89.2	89.8	90.7	86.5
IT	Veneto	80.6	79.9	83.3	84.1	83.9	85.5	85.0	84.8	84.8
IT	FVG	80.7	79.0	78.5	84.8	81.6	83.3	83.6	83.9	81.8
IT	ER	80.5	80.7	83.0	84.2	84.8	85.7	86.7	87.4	84.9
IT	Toscana	79.1	81.4	83.2	82.2	83.0	83.7	82.6	82.2	80.6
IT	Umbria	80.6	76.6	80.2	83.0	81.0	84.4	84.5	85.9	81.4
IT	Marche	81.9	79.5	81.6	85.0	84.7	84.7	87.0	85.4	81.5
IT	Lazio	70.1	71.7	74.3	77.1	77.9	77.3	77.6	74.3	73.5
IT	Abruzzo	73.1	73.5	76.4	74.7	76.5	73.5	76.0	75.5	73.4
IT	Molise	64.5	64.7	63.6	67.8	66.2	67.5	73.6	71.8	71.3
IT	Campania	44.0	43.9	47.1	46.2	47.7	50.5	50.2	47.7	45.0
IT	Puglia	50.9	51.0	52.2	56.9	62.4	63.0	64.7	62.6	62.1
IT	Basilicata	59.9	58.0	64.6	66.5	65.0	65.5	68.7	64.6	63.5
IT	Calabria	50.9	50.9	55.5	57.1	58.4	60.3	63.6	61.1	55.9
IT	Sicilia	41.1	40.9	45.6	46.0	49.7	46.9	50.2	46.4	43.8
IT	Sardegna	57.3	54.8	62.4	67.3	64.5	65.1	70.4	64.1	62.2
	BELGIUM	**66.5**	**65.8**	**68.0**	**69.9**	**70.6**	**71.9**	**71.8**	**73.3**	**.**
	GERMANY	**.**	**65.4**	**67.5**	**69.9**	**71.8**	**73.1**	**73.6**	**75.4**	**77.1**
	SPAIN	**59.5**	**61.8**	**65.3**	**65.5**	**65.3**	**64.4**	**62.4**	**61.6**	**59.7**

ITALY	**70.2**	**70.3**	**73.2**	**74.6**	**75.3**	**75.8**	**76.6**	**75.8**	**73.9**

3.9.3 Ranking of Social Inclusion Measure, Baseline model with data-driven normalization

A look at the

Table 3-18 Ranking of Social Inclusion Measure, Baseline model with data-driven normalization, years 2004-2008

	region	2004	region	2005	region	2006	region	2007	region	2008
1	Marche	81.9	TAA	81.7	Navarra	85.7	TAA	87.2	TAA	87.9
2	FVG	80.7	Toscana	81.4	TAA	84.4	Navarra	87.2	Navarra	85.9
3	Veneto	80.6	Navarra	81.0	Veneto	83.3	Marche	85.0	ER	84.8
4	Umbria	80.6	ER	80.7	Toscana	83.2	FVG	84.8	Marche	84.7
5	ER	80.5	Veneto	79.9	ER	83.0	ER	84.2	Veneto	83.9
6	TAA	79.4	Marche	79.5	Marche	81.6	Veneto	84.1	Toscana	83.0
7	Toscana	79.1	FVG	79.0	País Vasco	81.4	Umbria	83.0	Baden-W.	82.9
8	Navarra	77.7	País Vasco	78.5	Lombardia	80.4	Toscana	82.2	País Vasco	82.5
9	Lombardia	77.3	Lombardia	77.3	Umbria	80.2	Baden-W.	81.2	FVG	81.6
10	Liguria	76.7	Umbria	76.6	VDA	79.7	Lombardia	80.5	Lombardia	81.5
11	País Vasco	75.9	Baden-W.	76.4	Baden-W.	79.6	País Vasco	80.1	Vlaams G.	81.2
12	Vlaams G.	75.1	Vlaams G.	75.2	FVG	78.5	Vlaams G.	80.0	Umbria	81.0
13	VDA	74.9	Liguria	74.6	Madrid	78.2	Piemonte	78.9	Liguria	80.7
14	Madrid	74.6	Madrid	74.6	Liguria	77.8	Liguria	78.5	Bayern	79.3
15	Abruzzo	73.1	Piemonte	74.2	Vlaams G.	77.6	Madrid	77.9	Lazio	77.9
16	Aragón	72.7	VDA	74.0	Abruzzo	76.4	Bayern	77.4	Cantabria	77.4
17	Piemonte	72.4	Abruzzo	73.5	Piemonte	76.0	Lazio	77.1	Piemonte	77.3
18	Lazio	70.1	Bayern	73.4	Aragón	74.7	Abruzzo	74.7	Madrid	77.3
19	Cantabria	66.4	Cantabria	72.4	Bayern	74.4	VDA	74.3	Abruzzo	76.5
20	Castilla L.	64.8	Lazio	71.7	Lazio	74.3	Hessen	74.0	VDA	76.3
21	Molise	64.5	Aragón	70.6	Cantabria	73.6	Cantabria	73.3	Hessen	75.4
22	Cataluña	63.8	Hessen	70.3	Hessen	72.7	Aragón	72.5	Aragón	74.9
23	Asturias	62.5	Schleswig	66.3	Cataluña	72.5	Rheinland	71.0	Rheinland	73.3
24	Balears	61.2	Cataluña	66.3	La Rioja	70.2	Castilla L.	70.9	Hamburg	72.7
25	Galicia	60.9	Rheinland	66.0	Castilla L.	70.0	Schleswig	70.9	Asturias	72.5
26	Basilicata	59.9	Galicia	65.7	Rheinland	68.9	Cataluña	70.7	Schleswig	71.3
27	Sardegna	57.3	Castilla L.	65.7	Schleswig	68.7	Asturias	70.6	Cataluña	71.0
28	Valenciana	56.5	Asturias	65.4	Asturias	68.5	La Rioja	68.7	Castilla L.	70.2
29	Wallonia	56.1	La Rioja	64.9	Balears	67.8	Nieders.	68.5	Nieders.	69.5
30	Castilla M.	54.9	Molise	64.7	Hamburg	67.3	Galicia	68.3	Nordr.-W.	68.8
31	Canarias	52.1	Nieders.	63.9	Galicia	65.8	Hamburg	68.1	Galicia	68.8
32	Bruxelles	51.3	Nordr.-W.	63.6	Nieders.	65.7	Molise	67.8	Sachsen	67.1
33	Puglia	50.9	Hamburg	63.2	Nordr.-W.	65.3	Sardegna	67.3	Molise	66.2
34	Calabria	50.9	Balears	61.9	Basilicata	64.6	Nordr.-W.	67.2	Saarland	65.9
35	Murcia	50.4	Thüringen	58.7	Molise	63.6	Basilicata	66.5	Thüringen	65.8
36	Campania	44.0	Valenciana	58.2	Valenciana	63.6	Saarland	65.2	Br'burg	65.5
37	Extremad.	42.5	Sachsen	58.1	Sardegna	62.4	Valenciana	64.8	La Rioja	65.1

38	Andalucía	41.6	Basilicata	58.0	Sachsen	61.1	Balears	64.6	Basilicata	65.0
39	Sicilia	41.1	Saarland	57.3	Castilla M.	59.1	Sachsen	62.9	Sardegna	64.5
40	Baden-W.	.	Castilla M.	55.3	Thüringen	59.0	Thüringen	61.2	Balears	64.1
41	Bayern	.	Wallonia	55.1	Saarland	58.5	Br'burg	60.9	Puglia	62.4
42	Berlin	.	Br'burg	55.0	Bremen	57.6	Bremen	59.8	Valenciana	62.3
43	Br'burg	.	Sardegna	54.8	Br'burg	56.9	Berlin	59.4	Bremen	61.4
44	Bremen	.	Murcia	53.3	Wallonia	56.8	Castilla M.	58.7	Berlin	59.1
45	Hamburg	.	Canarias	52.9	Calabria	55.5	Wallonia	58.2	Castilla M.	58.7
46	Hessen	.	Berlin	52.3	Murcia	55.2	Calabria	57.1	Calabria	58.4
47	Meck'burg	.	Bremen	51.3	Berlin	53.7	Puglia	56.9	Wallonia	58.0
48	Nieders.	.	Puglia	51.0	Canarias	53.5	Murcia	55.3	Meck'burg	58.0
49	Nordr.-W.	.	Calabria	50.9	Puglia	52.2	Canarias	54.3	Murcia	54.7
50	Rheinland	.	Bruxelles	47.7	Sachsen-A.	51.1	Sachsen-A.	54.1	Sachsen-A.	54.5
51	Saarland	.	Sachsen-A.	47.5	Meck'burg	50.6	Meck'burg	52.7	Canarias	53.7
52	Sachsen	.	Andalucía	47.1	Bruxelles	49.5	Andalucía	51.0	Bruxelles	51.8
53	Sachsen-A.	.	Meck'burg	45.4	Andalucía	48.8	Bruxelles	50.8	Extremad.	51.4
54	Schleswig	.	Extremad.	44.2	Extremad.	48.7	Extremad.	47.8	Sicilia	49.7
55	Thüringen	.	Campania	43.9	Campania	47.1	Campania	46.2	Andalucía	49.6
56	La Rioja	.	Sicilia	40.9	Sicilia	45.6	Sicilia	46.0	Campania	47.7
57	Ceuta	.	Ceuta	21.0	Melilla	42.7	Melilla	41.1	Ceuta	29.3
58	Melilla	.	Melilla	.	Ceuta	23.9	Ceuta	24.9	Melilla	.

Table 3-19, Ranking of Social Inclusion Measure, Baseline model with data-driven normalization, years 2009-2012

	region	**2009**	**region**	**2010**	**region**	**2011**	**region**	**2012**
1	TAA	89.2	TAA	89.8	TAA	90.7	TAA	86.5
2	Navarra	86.1	Navarra	88.4	Navarra	87.5	Baden-W.	86.5
3	ER	85.7	Marche	87.0	ER	87.4	Navarra	85.2
4	Veneto	85.5	ER	86.7	Umbria	85.9	ER	84.9
5	Marche	84.7	Veneto	85.0	Marche	85.4	Veneto	84.8
6	Umbria	84.4	Umbria	84.5	Baden-W.	85.3	Bayern	84.1
7	Toscana	83.7	FVG	83.6	Veneto	84.8	Lombardia	82.5
8	FVG	83.3	Baden-W.	83.0	Lombardia	84.5	FVG	81.8
9	Baden-W.	83.0	País Vasco	82.6	FVG	83.9	VDA	81.6
10	Liguria	83.0	Toscana	82.6	Vlaams G.	83.9	Marche	81.5
11	País Vasco	82.1	Lombardia	82.4	Toscana	82.2	Umbria	81.4
12	Vlaams G.	81.7	Vlaams G.	81.6	Bayern	82.1	Hessen	81.2
13	Lombardia	81.3	Liguria	81.6	VDA	81.1	Toscana	80.6
14	Bayern	80.4	Bayern	81.2	País Vasco	81.1	País Vasco	80.4
15	VDA	79.6	VDA	80.5	Liguria	81.0	Hamburg	77.5
16	Piemonte	77.5	Hessen	78.9	Hessen	80.5	Liguria	77.3
17	Lazio	77.3	Piemonte	78.4	Piemonte	78.2	Rheinland	76.7
18	Hessen	77.2	Lazio	77.6	Madrid	77.7	Piemonte	76.6
19	Aragón	76.6	Madrid	77.5	Abruzzo	75.5	Schleswig	75.8

20	Madrid	76.5	Abruzzo	76.0	Hamburg	75.4	Madrid	74.9
21	Cantabria	75.5	Hamburg	75.2	Rheinland	75.0	Nieders.	74.9
22	Hamburg	74.2	Molise	73.6	Schleswig	74.8	Cantabria	74.6
23	Abruzzo	73.5	Rheinland	73.0	Lazio	74.3	Lazio	73.5
24	Schleswig	72.8	Schleswig	72.6	Nieders.	72.6	Abruzzo	73.4
25	Rheinland	72.8	Aragón	72.0	Thüringen	71.9	Thüringen	73.1
26	Castilla L.	71.5	Nieders.	71.6	Molise	71.8	Sachsen	73.0
27	Nieders.	71.0	Thüringen	71.1	Nordr.-W.	71.5	Nordr.-W.	72.4
28	Asturias	70.5	Castilla L.	71.0	Sachsen	71.2	Saarland	71.9
29	Nordr.-W.	69.8	Sardegna	70.4	Cantabria	70.8	Castilla L.	71.3
30	La Rioja	69.1	Saarland	69.7	Aragón	70.2	Molise	71.3
31	Thüringen	68.8	Nordr.-W.	69.6	Br'burg	70.2	Br'burg	70.4
32	Sachsen	68.0	Cantabria	69.5	Asturias	69.3	Aragón	69.6
33	Cataluña	68.0	La Rioja	69.4	Castilla L.	68.7	La Rioja	68.4
34	Galicia	67.9	Galicia	69.0	Saarland	68.6	Bremen	68.2
35	Molise	67.5	Basilicata	68.7	Galicia	68.0	Berlin	67.9
36	Saarland	66.8	Br'burg	68.7	Berlin	66.9	Galicia	66.0
37	Br'burg	66.8	Asturias	68.5	Cataluña	65.8	Asturias	64.7
38	Basilicata	65.5	Sachsen	66.2	Bremen	65.0	Cataluña	64.1
39	Sardegna	65.1	Cataluña	65.8	Basilicata	64.6	Meck'burg	64.0
40	Bremen	64.3	Bremen	65.5	La Rioja	64.2	Basilicata	63.5
41	Puglia	63.0	Puglia	64.7	Sardegna	64.1	Sardegna	62.2
42	Berlin	62.9	Calabria	63.6	Meck'burg	63.8	Puglia	62.1
43	Valenciana	62.3	Berlin	63.4	Puglia	62.6	Balears	56.8
44	Balears	60.6	Meck'burg	61.5	Balears	62.1	Calabria	55.9
45	Calabria	60.3	Sachsen-A.	61.0	Wallonia	61.6	Valenciana	53.9
46	Castilla M.	60.0	Wallonia	60.4	Sachsen-A.	61.6	Castilla M.	52.2
47	Wallonia	59.9	Balears	58.8	Calabria	61.1	Murcia	50.5
48	Meck'burg	59.5	Castilla M.	57.9	Valenciana	58.0	Campania	45.0
49	Sachsen-A.	57.7	Valenciana	57.2	Castilla M.	54.1	Sicilia	43.8
50	Bruxelles	55.1	Bruxelles	52.6	Murcia	53.0	Canarias	43.0
51	Canarias	53.1	Murcia	51.1	Extremad.	52.3	Extremad.	42.3
52	Murcia	52.4	Sicilia	50.2	Bruxelles	51.3	Andalucía	41.8
53	Extremad.	50.9	Campania	50.2	Campania	47.7	Melilla	30.1
54	Campania	50.5	Melilla	48.4	Sicilia	46.4	Ceuta	26.9
55	Andalucía	48.5	Canarias	46.9	Andalucía	43.1	Bruxelles	
56	Sicilia	46.9	Extremad.	46.4	Canarias	42.6	Vlaams G.	
57	Ceuta	33.3	Andalucía	45.9	Melilla	42.2	Wallonia	
58	Melilla		Ceuta	30.0	Ceuta	34.5	Sachsen-A.	

3.9.4 Social Inclusion Measure, Baseline model with survey-based normalization

The following coefficients are obtained by implementing the LS model (3.12)

Table 3-20, Social Inclusion Measure, Baseline model with survey-based normalization

nation	region	2004	2005	2006	2007	2008	2009	2010	2011	2012
BE	Bruxelles	24.9	17.0	17.7	18.3	17.4	31.4	22.5	22.8	.
BE	Vlaams Gewest	81.2	81.8	84.6	86.1	87.3	87.7	88.0	89.8	.
BE	Région wallonne	44.7	42.1	43.7	46.3	46.0	49.2	48.9	50.2	.
DE	Baden-Württemberg	.	79.4	84.5	85.8	88.8	88.3	88.4	89.1	89.5
DE	Bayern	.	79.7	77.6	84.2	85.9	86.0	86.9	86.7	87.4
DE	Berlin	.	28.1	29.1	37.6	34.5	43.1	43.5	51.4	53.6
DE	Brandenburg	.	43.0	44.4	49.2	59.3	61.7	67.6	69.1	68.8
DE	Bremen	.	21.2	32.0	41.0	45.5	55.4	55.5	49.0	60.5
DE	Hamburg	.	44.0	54.3	53.9	67.7	76.0	75.2	73.5	75.9
DE	Hessen	.	66.1	67.4	73.1	77.4	81.0	81.4	83.6	84.9
DE	Mecklenburg-Vorpommern	.	32.0	35.4	38.5	44.8	47.6	52.6	57.2	54.5
DE	Niedersachsen	.	53.8	56.7	63.0	66.8	70.9	68.8	68.1	73.7
DE	Nordrhein-Westfalen	.	52.9	53.8	59.6	63.7	66.9	64.5	67.1	69.6
DE	Rheinland-Pfalz	.	57.6	62.8	67.4	73.8	71.0	66.6	71.2	74.7
DE	Saarland	.	37.9	40.2	62.9	62.8	62.8	69.3	62.4	70.0
DE	Sachsen	.	46.5	48.8	47.5	54.9	57.7	59.8	64.6	69.2
DE	Sachsen-Anhalt	.	35.8	36.4	36.3	35.5	44.8	51.4	48.6	
DE	Schleswig-Holstein	.	58.9	61.7	69.7	70.8	75.0	73.2	74.0	75.0
DE	Thüringen	.	44.1	45.8	47.7	59.8	64.7	69.3	71.9	74.4
ES	Galicia	34.9	48.7	47.1	50.3	48.8	51.8	45.5	36.8	32.9
ES	Principado de Asturias	48.1	48.2	57.4	60.1	58.7	54.7	48.2	46.6	32.2
ES	Cantabria	50.5	57.6	61.1	60.9	63.4	61.5	46.0	42.3	55.3
ES	País Vasco	74.6	76.1	78.3	75.3	78.3	78.3	81.1	74.1	71.5
ES	Comunidad Foral de Navarra	61.6	68.8	82.1	80.6	74.7	71.9	79.3	82.8	74.9
ES	La Rioja	.	46.4	48.7	51.0	50.0	53.5	45.0	34.7	34.8
ES	Aragón	60.5	52.8	60.2	54.9	58.3	63.8	50.5	43.0	35.1
ES	Comunidad de Madrid	65.3	61.3	64.4	63.2	61.1	60.4	51.2	45.1	38.9
ES	Castilla y León	43.1	46.8	48.5	48.3	49.0	52.4	43.6	37.8	35.7
ES	Castilla-la Mancha	45.8	45.5	47.8	46.8	47.8	44.3	33.4	25.8	25.8
ES	Extremadura	35.5	36.4	43.1	43.3	43.9	37.2	26.3	23.3	22.5
ES	Cataluña	55.9	57.9	60.1	59.5	60.8	54.8	40.1	32.8	33.6
ES	Comunidad Valenciana	45.3	44.6	49.0	52.0	46.2	46.1	23.7	26.3	23.5
ES	Illes Balears	56.6	52.6	59.5	56.9	58.2	53.9	38.5	35.5	23.5
ES	Andalucía	30.5	38.4	42.5	42.5	41.2	30.5	20.5	21.0	21.0
ES	Región de Murcia	42.2	42.5	44.3	44.3	44.5	40.8	25.7	23.3	23.0
ES	Ciudad Autónoma de Ceuta	.	15.0	19.9	14.8	26.0	16.6	15.8	17.5	20.0
ES	Ciudad Autónoma de Melilla	.	.	30.6	25.8	.	.	24.5	19.0	19.5
ES	Canarias	39.2	41.6	43.5	43.8	42.1	28.8	23.3	22.5	22.8
IT	Piemonte	59.0	61.7	62.1	69.9	65.8	64.8	66.4	68.2	62.2
IT	VDA	62.3	66.0	70.5	64.9	65.2	66.2	67.7	69.5	70.5

IT	Liguria	71.2	63.8	69.2	67.7	78.3	84.8	75.4	75.5	67.4
IT	Lombardia	64.2	65.0	68.4	67.7	67.2	67.1	70.9	75.9	74.3
IT	TAA	65.8	68.8	76.4	79.6	80.7	79.7	78.9	83.4	75.1
IT	Veneto	70.7	69.2	78.1	81.6	76.6	76.0	77.4	74.9	81.2
IT	FVG	81.7	74.8	64.8	84.4	75.8	79.0	83.7	82.3	79.1
IT	ER	68.2	68.7	72.5	74.6	76.6	80.8	83.2	85.8	81.0
IT	Toscana	66.0	74.1	76.6	71.3	75.8	75.2	71.8	69.1	68.4
IT	Umbria	78.8	70.7	71.6	80.4	72.6	81.1	81.6	84.2	75.0
IT	Marche	72.5	64.1	67.3	75.5	78.0	76.7	78.2	79.8	68.3
IT	Lazio	60.2	64.5	70.0	76.5	73.6	73.2	68.8	59.2	61.1
IT	Abruzzo	61.0	61.5	68.3	63.3	65.7	62.2	64.2	63.3	57.4
IT	Molise	46.1	48.7	45.8	53.5	49.1	50.9	60.5	56.2	60.1
IT	Campania	20.6	18.4	25.4	30.4	27.3	26.2	23.3	20.0	20.3
IT	Puglia	21.7	26.1	30.0	35.0	36.5	36.3	33.4	32.7	26.3
IT	Basilicata	36.7	35.6	46.1	53.2	50.4	55.4	43.8	45.1	43.4
IT	Calabria	24.7	26.6	30.4	33.3	37.3	41.6	44.1	34.4	29.8
IT	Sicilia	19.8	19.0	25.2	26.1	26.2	24.3	25.4	25.3	21.8
IT	Sardegna	30.3	29.0	39.2	42.0	35.5	36.9	45.2	32.1	27.4
	BELGIUM	63.5	62.2	64.4	66.1	66.7	69.4	68.5	70.1	.
	GERMANY	.	58.6	60.5	65.4	69.3	71.9	71.9	73.4	76.3
	SPAIN	48.2	50.3	53.6	53.5	52.8	49.0	38.0	34.2	32.0
	ITALY	56.1	56.7	61.1	64.2	63.4	63.8	63.9	62.8	60.7

3.9.5 Ranking of Social Inclusion Measure, Baseline model with survey-based normalization

Table 3-21, Ranking of Social Inclusion Measure, Baseline model with survey-based normalization, years 2004-2008

	region	**2004**	**region**	**2005**	**region**	**2006**	**region**	**2007**	**region**	**2008**
1	FVG	81.7	Vlaams	81.8	Vlaams	84.6	Vlaams	86.1	Baden-W	88.8
2	Vlaams	81.2	Bayern	79.7	Baden-W	84.5	Baden-W	85.8	Vlaams	87.3
3	Umbria	78.8	Baden-W	79.4	Navarra	82.1	FVG	84.4	Bayern	85.9
4	País Vasco	74.6	País Vasco	76.1	País Vasco	78.3	Bayern	84.2	TAA	80.7
5	Marche	72.5	FVG	74.8	Veneto	78.1	Veneto	81.6	País Vasco	78.3
6	Liguria	71.2	Toscana	74.1	Bayern	77.6	Navarra	80.6	Liguria	78.3
7	Veneto	70.7	Umbria	70.7	Toscana	76.6	Umbria	80.4	Marche	78.0
8	ER	68.2	Veneto	69.2	TAA	76.4	TAA	79.6	Hessen	77.4
9	Toscana	66.0	TAA	68.8	ER	72.5	Lazio	76.5	Veneto	76.6
10	TAA	65.8	Navarra	68.8	Umbria	71.6	Marche	75.5	ER	76.6
11	Madrid	65.3	ER	68.7	VDA	70.5	País Vasco	75.3	FVG	75.8
12	Lombardia	64.2	Hessen	66.1	Lazio	70.0	ER	74.6	Toscana	75.8
13	VDA	62.3	VDA	66.0	Liguria	69.2	Hessen	73.1	Navarra	74.7
14	Navarra	61.6	Lombardia	65.0	Lombardia	68.4	Toscana	71.3	Rheinland	73.8
15	Abruzzo	61.0	Lazio	64.5	Abruzzo	68.3	Piemonte	69.9	Lazio	73.6
16	Aragón	60.5	Marche	64.1	Hessen	67.4	Schleswig-H.	69.7	Umbria	72.6

17	Lazio	60.2	Liguria	63.8	Marche	67.3	Lombardia	67.7	Schleswig-H.	70.8
18	Piemonte	59.0	Piemonte	61.7	FVG	64.8	Liguria	67.7	Hamburg	67.7
19	Balears	56.6	Abruzzo	61.5	Madrid	64.4	Rheinland	67.4	Lombardia	67.2
20	Cataluña	55.9	Madrid	61.3	Rheinland	62.8	VDA	64.9	Nieders'n	66.8
21	Cantabria	50.5	Schleswig-H.	58.9	Piemonte	62.1	Abruzzo	63.3	Piemonte	65.8
22	Asturias	48.1	Cataluña	57.9	Schleswig-H.	61.7	Madrid	63.2	Abruzzo	65.7
23	Molise	46.1	Rheinland	57.6	Cantabria	61.1	Nieders'n	63.0	VDA	65.2
24	Castilla M	45.8	Cantabria	57.6	Aragón	60.2	Saarland	62.9	Nordrhein	63.7
25	Valenciana	45.3	Nieders'n	53.8	Cataluña	60.1	Cantabria	60.9	Cantabria	63.4
26	Wallonne	44.7	Nordrhein	52.9	Balears	59.5	Asturias	60.1	Saarland	62.8
27	Castilla L.	43.1	Aragón	52.8	Asturias	57.4	Nordrhein	59.6	Madrid	61.1
28	Murcia	42.2	Balears	52.6	Nieders'n	56.7	Cataluña	59.5	Cataluña	60.8
29	Canarias	39.2	Molise	48.7	Hamburg	54.3	Balears	56.9	Thüringen	59.8
30	Basilicata	36.7	Galicia	48.7	Nordrhein	53.8	Aragón	54.9	Brand'burg	59.3
31	Extremad.	35.5	Asturias	48.2	Valenciana	49.0	Hamburg	53.9	Asturias	58.7
32	Galicia	34.9	Castilla L.	46.8	Sachsen	48.8	Molise	53.5	Aragón	58.3
33	Andalucía	30.5	Sachsen	46.5	La Rioja	48.7	Basilicata	53.2	Balears	58.2
34	Sardegna	30.3	La Rioja	46.4	Castilla L.	48.5	Valenciana	52.0	Sachsen	54.9
35	Bruxelles	24.9	Castilla M	45.5	Castilla M	47.8	La Rioja	51.0	Basilicata	50.4
36	Calabria	24.7	Valenciana	44.6	Galicia	47.1	Galicia	50.3	La Rioja	50.0
37	Puglia	21.7	Thüringen	44.1	Basilicata	46.1	Brand'burg	49.2	Molise	49.1
38	Campania	20.6	Hamburg	44.0	Thüringen	45.8	Castilla L.	48.3	Castilla L.	49.0
39	Sicilia	19.8	Brand'burg	43.0	Molise	45.8	Thüringen	47.7	Galicia	48.8
40	Baden-W		Murcia	42.5	Brand'burg	44.4	Sachsen	47.5	Castilla M	47.8
41	Bayern		Wallonne	42.1	Murcia	44.3	Castilla M	46.8	Valenciana	46.2
42	Berlin		Canarias	41.6	Wallonne	43.7	Wallonne	46.3	Wallonne	46.0
43	Brand'burg		Andalucía	38.4	Canarias	43.5	Murcia	44.3	Bremen	45.5
44	Bremen		Saarland	37.9	Extremad.	43.1	Canarias	43.8	Meckl'burg	44.8
45	Hamburg		Extremad.	36.4	Andalucía	42.5	Extremad.	43.3	Murcia	44.5
46	Hessen		Sachsen-A.	35.8	Saarland	40.2	Andalucía	42.5	Extremad.	43.9
47	Meckl'burg		Basilicata	35.6	Sardegna	39.2	Sardegna	42.0	Canarias	42.1
48	Nieders'n		Meckl'burg	32.0	Sachsen-A.	36.4	Bremen	41.0	Andalucía	41.2
49	Nordrhein		Sardegna	29.0	Meckl'burg	35.4	Meckl'burg	38.5	Calabria	37.3
50	Rheinland		Berlin	28.1	Bremen	32.0	Berlin	37.6	Puglia	36.5
51	Saarland		Calabria	26.6	Melilla	30.6	Sachsen-A.	36.3	Sardegna	35.5
52	Sachsen		Puglia	26.1	Calabria	30.4	Puglia	35.0	Sachsen-A.	35.5
53	Sachsen-A.		Bremen	21.2	Puglia	30.0	Calabria	33.3	Berlin	34.5
54	Schleswig H.		Sicilia	19.0	Berlin	29.1	Campania	30.4	Campania	27.3
55	Thüringen		Campania	18.4	Campania	25.4	Sicilia	26.1	Sicilia	26.2
56	La Rioja		Bruxelles	17.0	Sicilia	25.2	Melilla	25.8	Ceuta	26.0
57	Ceuta		Ceuta	15.0	Ceuta	19.9	Bruxelles	18.3	Bruxelles	17.4
58	Melilla		Melilla		Bruxelles	17.7	Ceuta	14.8	Melilla	

Table 3-22, Ranking of Social Inclusion Measure, Baseline model with survey-based normalization, years 2009-2012

	region	2009	region	2010	region	2011	region	2012
1	Baden-W	88.3	Baden-W	88.4	Vlaams	89.8	Baden-W	89.5
2	Vlaams	87.7	Vlaams	88.0	Baden-W	89.1	Bayern	87.4
3	Bayern	86.0	Bayern	86.9	Bayern	86.7	Hessen	84.9
4	Liguria	84.8	FVG	83.7	ER	85.8	Veneto	81.2
5	Umbria	81.1	ER	83.2	Umbria	84.2	ER	81.0
6	Hessen	81.0	Umbria	81.6	Hessen	83.6	FVG	79.1
7	ER	80.8	Hessen	81.4	TAA	83.4	Hamburg	75.9
8	TAA	79.7	País Vasco	81.1	Navarra	82.8	TAA	75.1
9	FVG	79.0	Navarra	79.3	FVG	82.3	Umbria	75.0
10	País Vasco	78.3	TAA	78.9	Marche	79.8	Schleswig-H.	75.0
11	Marche	76.7	Marche	78.2	Lombardia	75.9	Navarra	74.9
12	Hamburg	76.0	Veneto	77.4	Liguria	75.5	Rheinland	74.7
13	Veneto	76.0	Liguria	75.4	Veneto	74.9	Thüringen	74.4
14	Toscana	75.2	Hamburg	75.2	País Vasco	74.1	Lombardia	74.3
15	Schleswig-H.	75.0	Schleswig-H.	73.2	Schleswig-H.	74.0	Nieders'n	73.7
16	Lazio	73.2	Toscana	71.8	Hamburg	73.5	País Vasco	71.5
17	Navarra	71.9	Lombardia	70.9	Thüringen	71.9	VDA	70.5
18	Rheinland	71.0	Thüringen	69.3	Rheinland	71.2	Saarland	70.0
19	Nieders'n	70.9	Saarland	69.3	VDA	69.5	Nordrhein	69.6
20	Lombardia	67.1	Lazio	68.8	Toscana	69.1	Sachsen	69.2
21	Nordrhein	66.9	Nieders'n	68.8	Brand'burg	69.1	Brand'burg	68.8
22	VDA	66.2	VDA	67.7	Piemonte	68.2	Toscana	68.4
23	Piemonte	64.8	Brand'burg	67.6	Nieders'n	68.1	Marche	68.3
24	Thüringen	64.7	Rheinland	66.6	Nordrhein	67.1	Liguria	67.4
25	Aragón	63.8	Piemonte	66.4	Sachsen	64.6	Piemonte	62.2
26	Saarland	62.8	Nordrhein	64.5	Abruzzo	63.3	Lazio	61.1
27	Abruzzo	62.2	Abruzzo	64.2	Saarland	62.4	Bremen	60.5
28	Brand'burg	61.7	Molise	60.5	Lazio	59.2	Molise	60.1
29	Cantabria	61.5	Sachsen	59.8	Meckl'burg	57.2	Abruzzo	57.4
30	Madrid	60.4	Bremen	55.5	Molise	56.2	Cantabria	55.3
31	Sachsen	57.7	Meckl'burg	52.6	Berlin	51.4	Meckl'burg	54.5
32	Bremen	55.4	Sachsen-A.	51.4	Wallonne	50.2	Berlin	53.6
33	Basilicata	55.4	Madrid	51.2	Bremen	49.0	Basilicata	43.4
34	Cataluña	54.8	Aragón	50.5	Sachsen-A.	48.6	Madrid	38.9
35	Asturias	54.7	Wallonne	48.9	Asturias	46.6	Castilla L.	35.7
36	Balears	53.9	Asturias	48.2	Madrid	45.1	Aragón	35.1
37	La Rioja	53.5	Cantabria	46.0	Basilicata	45.1	La Rioja	34.8
38	Castilla L.	52.4	Galicia	45.5	Aragón	43.0	Cataluña	33.6
39	Galicia	51.8	Sardegna	45.2	Cantabria	42.3	Galicia	32.9
40	Molise	50.9	La Rioja	45.0	Castilla L.	37.8	Asturias	32.2
41	Wallonne	49.2	Calabria	44.1	Galicia	36.8	Calabria	29.8
42	Meckl'burg	47.6	Basilicata	43.8	Balears	35.5	Sardegna	27.4

43	Valenciana	46.1	Castilla L.	43.6	La Rioja	34.7	Puglia	26.3
44	Sachsen-A.	44.8	Berlin	43.5	Calabria	34.4	Castilla M	25.8
45	Castilla M	44.3	Cataluña	40.1	Cataluña	32.8	Valenciana	23.5
46	Berlin	43.1	Balears	38.5	Puglia	32.7	Balears	23.5
47	Calabria	41.6	Castilla M	33.4	Sardegna	32.1	Murcia	23.0
48	Murcia	40.8	Puglia	33.4	Valenciana	26.3	Canarias	22.8
49	Extremad.	37.2	Extremad.	26.3	Castilla M	25.8	Extremad.	22.5
50	Sardegna	36.9	Murcia	25.7	Sicilia	25.3	Sicilia	21.8
51	Puglia	36.3	Sicilia	25.4	Extremad.	23.3	Andalucía	21.0
52	Bruxelles	31.4	Melilla	24.5	Murcia	23.3	Campania	20.3
53	Andalucía	30.5	Valenciana	23.7	Bruxelles	22.8	Ceuta	20.0
54	Canarias	28.8	Campania	23.3	Canarias	22.5	Melilla	19.5
55	Campania	26.2	Canarias	23.3	Andalucía	21.0	Bruxelles	
56	Sicilia	24.3	Bruxelles	22.5	Campania	20.0	Vlaams	
57	Ceuta	16.6	Andalucía	20.5	Melilla	19.0	Wallonne	
58	Melilla		Ceuta	15.8	Ceuta	17.5	Sachsen-A.	

3.9.6 Geometric and Harmonic aggregations

Table 3-23, Social Inclusion, geometric aggregation GD (data-driven normalization) and coefficients of variation

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	52.8	53.9	60.8	64.5	64.7	67.4	68.2	70.4	
Germany		60.0	63.7	66.6	68.6	70.0	70.9	73.4	75.3
Spain	56.5	58.5	62.8	62.8	62.7	63.0	61.7	60.8	57.9
Italy	65.8	65.8	68.9	70.2	71.5	72.1	73.3	71.8	70.0
COV regions BE	0.34	0.33	0.24	0.21	0.23	0.19	0.19	0.21	
COV regions DE		0.18	0.16	0.13	0.13	0.12	0.11	0.10	0.09
COV regions ES	0.21	0.27	0.26	0.25	0.26	0.22	0.24	0.24	0.32
COV regions IT	0.19	0.19	0.18	0.18	0.17	0.17	0.16	0.19	0.19
COV all regions		0.25	0.23	0.21	0.21	0.19	0.19	0.20	

Table 3-24, Social Inclusion, harmonic aggregation HD (data-driven normalization) and coefficients of variation

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	41.2	43.1	52.2	57.9	57.3	61.9	63.9	66.8	
Germany		53.6	59.2	62.6	64.7	66.3	67.7	71.2	73.3
Spain	53.9	55.6	60.6	60.3	60.3	61.6	61.0	60.0	56.0
Italy	64.3	64.2	67.4	68.7	70.4	71.0	72.5	70.3	68.9
COV regions BE	0.58	0.56	0.37	0.30	0.33	0.25	0.23	0.24	
COV regions DE		0.24	0.20	0.17	0.16	0.15	0.14	0.12	0.10
COV regions ES	0.24	0.31	0.29	0.29	0.31	0.24	0.25	0.25	0.36
COV regions IT	0.20	0.20	0.20	0.20	0.18	0.19	0.17	0.22	0.21
COV all regions		0.32	0.28	0.26	0.25	0.22	0.22	0.22	

Table 3-25, Social Inclusion, geometric aggregation GS (survey-driven normalization) and coefficients of variation

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	61.3	59.9	62.0	63.0	63.3	66.2	65.6	66.5	
Germany		52.4	54.7	60.1	65.1	68.3	68.7	69.3	71.8
Spain	19.9	20.3	21.5	21.6	20.5	20.7	16.5	13.9	11.3
Italy	31.6	33.8	42.3	46.6	43.1	41.1	47.4	47.3	45.6
COV regions BE	0.45	0.52	0.52	0.53	0.54	0.45	0.51	0.51	
COV regions DE		0.48	0.45	0.40	0.35	0.27	0.23	0.25	0.27
COV regions ES	0.79	0.85	0.96	0.87	0.84	0.74	1.26	1.57	1.88
COV regions IT	0.69	0.59	0.52	0.52	0.55	0.59	0.51	0.54	0.54
COV all regions		0.55	0.55	0.55	0.55	0.53	0.56	0.59	

Table 3-26, Social Inclusion, harmonic aggregation HS (survey-driven normalization) and coefficients of variation

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	59.5	58.6	60.6	61.1	61.0	63.6	64.0	64.0	
Germany		48.8	51.2	56.7	61.8	65.0	65.4	65.0	67.1
Spain	6.4	6.8	7.4	7.0	6.8	6.3	7.1	7.1	6.4
Italy	19.6	21.9	32.7	38.3	33.3	30.2	39.4	40.5	40.3
COV regions BE	0.52	0.54	0.54	0.55	0.56	0.53	0.54	0.55	
COV regions DE		0.61	0.58	0.51	0.45	0.35	0.31	0.34	0.38
COV regions ES	2.68	2.61	3.07	2.77	2.48	2.39	2.95	3.20	3.30
COV regions IT	1.19	0.93	0.71	0.67	0.76	0.87	0.67	0.69	0.64
COV all regions		0.76	0.74	0.72	0.73	0.73	0.69	0.71	

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ESTRATTO PER RIASSUNTO DELLA TESI DI DOTTORATO

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Titolo della tesi: Il concetto di vulnerabilità e la domanda di assistenza degli anziani non-autosufficienti in Europa. Saggi sull'assistenza formale ed informale, e sulle misure multidimensionali di vulnerabilità e di esclusione sociale.

Abstract:

Questa tesi affronta due sfide principali delle politiche economiche di protezione sociale in Europa, vale a dire, le misure multidimensionali delle condizioni di vulnerabilità e l'interazione tra il pilastro formale e quello informale (familiare) nell'assistenza alla popolazione anziana non-autosufficiente. I primi due capitoli si concentrano sulla disponibilità, l'accessibilità e l'utilizzo di assistenza a lungo termine (Long-term care, LTC) tra gli anziani vulnerabili in Europa. Si esaminano le procedure per la valutazione del bisogno assistenziale ed i criteri di accesso per l'assistenza domiciliare pubblica (in natura o in denaro) a livello nazionale e regionale europeo. Si dimostra che la copertura potenziale dei sistemi formali di LTC è significativamente influenzata dalla definizione e misurazione delle condizioni di vulnerabilità, fortemente eterogenee tra paesi e regioni. Considerando queste eterogeneità in un'analisi empirica su dati SHARE, identifichiamo alcune caratteristiche individuali che influenzano l'accesso alla home-care tra gli individui ammissibili. Un importante ruolo risulta essere giocato dai bassi livelli di istruzione, fattore predittivo di potenziali fallimenti dei sistemi di LTC (vale a dire, quelle situazioni in cui individui vulnerabili non ricevono alcuna assistenza formale, pur avendone la possibilità secondo la legge).

Il secondo capitolo affronta la relazione economica tra l'assistenza domiciliare formale e quella informale, per anziani vulnerabili in Austria, Belgio, Germania e Francia, usando dati SHARE. Ci concentriamo su una direzione di causalità di grande rilevanza per la politica economica, vale a dire, se un aumento (diminuzione) dell'utilizzo di assistenza formale sostituirebbe o meno il contributo degli agenti informali (figli, parenti, amici, vicini). Importanti difficoltà empiriche sorgono nella ricerca di restrizioni di esclusione ragionevoli e valide per la variabile di cura-formale, che è un fattore potenzialmente endogeno rispetto alla cura informale. Adottiamo un modello in due parti (two-part model) introdotto da Duan et al. (1983) la variabile endogena è strumentata con una variabile individuale, costruita sulla base dell'analisi nel primo capitolo, che cattura la condizione di ammissibilità ai programmi di LTC locali. Utilizzando i dati SHARE, riscontriamo una robusta e significativa relazione positiva tra le due fonti di assistenza. Ciò suggerisce l'esistenza di una domanda residua per LTC, che eccede l'offerta pubblica (Stabile et al., 2006) e che viene soddisfatta da fonti formali e informali supplementari.

Infine, il terzo capitolo affronta i problemi metodologici e concettuali legati alla costruzione di misure sintetiche di fenomeni multi-dimensionali. In particolare, ci concentriamo sull'impianto teorico del Consiglio Europeo sull'esclusione sociale, una condizione multiforme di povertà che impedisce a gruppi di individui di prendere parte alla vita sociale e lavorativa attiva in una comunità. Sulla base di una funzione di aggregazione CES flessibile, si mostra come diversi approcci metodologici generino misure contraddittorie di esclusione a livello regionale in Europa, soprattutto a causa delle diverse strategie di normalizzazione e di aggregazione. In particolare, si sostiene che la normalizzazione sia tra un'importante forma di ponderazione, spesso resa non sufficientemente trasparente, sia in termini di come viene eseguita che in termini delle sue conseguenze sui saggi marginali di sostituzione, impliciti in qualsiasi misura multidimensionale. Proponiamo dunque una misura alternativa di esclusione sociale a livello regionale

europeo, caratterizzata da una strategia di normalizzazione determinata attraverso un sondaggio condotto tra i professori di Economia e Management dell'Università Ca 'Foscari di Venezia.