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Three Essays on Employment and Fiscal Policy

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Contents

List of Figures	x
List of Tables	xi
1 Lagging Behind. The Hysteresis of Austerity.	5
1.1 Introduction	5
1.2 Literature Review	9
1.3 Dataset	14
1.3.1 Narrative Consolidations and Orthogonality	16
1.3.2 Narrative Consolidations and Fiscal Foresighth	17
1.4 Testing for Hysteresis	19
1.4.1 Unit-Roots in the Employment Rates?	21
1.5 Fiscal Policy and Hysteresis	23
1.5.1 Identification in a P-SVAR	23
1.5.2 The Effects of Fiscal Policy	25
1.5.3 Extensions	33
1.6 Robustness	37
1.7 Conclusions	38
1.8 Appendix	49
1.8.1 Dataset	49
1.8.2 Esimation of the P-SVAR	58
1.8.3 Unit Root Tests	63
1.8.4 Robustness	65

2	A new estimation method for employment trend.¹	85
2.1	Introduction	85
2.2	Literature Review	87
2.3	Labor Market and Demography	89
2.4	Methodology	92
2.5	Results	97
2.5.1	Cohorts Estimations	97
2.5.2	Aggregate Estimations	100
2.6	Conclusion	105
2.7	Appendix A: List of the variables	115
2.8	Appendix B: Supplementary Results	116
3	Austerity Policies and the Labor Market	129
3.1	Introduction	129
3.2	Literature Review	132
3.3	Data and Methodology	135
3.3.1	Data	135
3.3.2	Methodology	139
3.4	Results	141
3.4.1	The Linear Model	141
3.4.2	Non-Linear Response	142
3.5	Extensions	146
3.5.1	Tax-Based Consolidations	146
3.5.2	Spending-Based Consolidations	148
3.6	Robustness Checks	150
3.7	Conclusions	150
3.8	Appendix	160
3.8.1	Robustness Checks	160

¹This chapter is coauthored with Stefano Scalone, University of Verona

List of Figures

1.1	Employment rate, cross-sectional units	20
1.2	Effects of Tax Hikes	27
1.3	Effects of tax hike on debt-over-GDP ratio, interest rates, and inflation	28
1.4	Effects of Spending Cuts	29
1.5	Effects of spending cuts on debt-over-GDP ratio, interest rates, and inflation	31
1.6	Effects of public expenditure cuts (black line) and taxation increases (red line)	32
1.7	Effects of public expenditure cuts (left panels, black dot-dashed line) and taxation increases (right panels, red solid line) considering $\mu_{0,1}^t$	34
1.8	Effects of public expenditure cuts (left panels, black dot-dashed line) and taxation increases (right panels, red solid line) 1985-2013	35
1.9	LEPL (left panel) and HEPL (right panel)	36
1.10	Difference in change in OECD CAPB VS Alesina et al.'s Measure of Narrative Shocks with (right panel) and without (left panel) Ireland	54
1.11	Effects of public expenditure cuts (black line) and taxation increases (red line) controlling for government debt over GDP, inflation, and monetary policy	65
1.12	Effects of public expenditure cuts (black line) and taxation increases (red line) without considering announcements	66
1.13	IRF for Employment and real GDP – 1 Lag	67
1.14	IRF for Employment and real GDP – 2 lags	68
1.15	IRF for Employment and real GDP – 4 lags	69

1.16	Effects of public expenditure changes (black line) and taxation changes (red line) – Different ordering of variables	70
1.17	IRF on total values	71
1.18	IRFs considering $\mu_{0,1}^{capb}$ (left panel) and $\mu_{0,1}^g$ (right panel)	72
1.19	IRFs considering $e_{i,t}^{a,t}$ and $e_{i,t}^{a,g}$	73
1.20	Effects of public expenditure cuts (black line) and taxation increases (red line) 1978-2007	74
1.21	Effects of public expenditure cuts (black line) and taxation increases (red line) 1978-2007 adding Ireland	75
1.22	IRF for Employment and real GDP Excluding Canada and Germany	76
1.23	Low Employment Protection Level - Countries yearly below the median	77
1.24	High Employment Protection Level - Countries yearly above the median	78
1.25	FAVAR with First (left panel) and Second (right panel) Principal Component	79
1.26	Forecast errors public expenditure cuts (black line) and taxation increases (red line)	80
1.27	Nowcast errors public expenditure cuts (black line) and taxation increases (red line)	81
1.28	IRF Large Consolidations (>1% GDP)	82
1.29	Effects of public expenditure cuts (black line) and taxation increases (red line)	83
2.1	Women fertility rate	90
2.2	Life expectancy and gender difference, United States	90
2.3	Labor force, United States	91
2.4	Male Employment cohort age 15-19 - US	101
2.5	Aggregate KF VS Aggregate HP	102
2.6	Aggregate KF VS OECD Potential Employment	102
2.7	Aggregate KF VS Simple KF	103
2.8	Cyclical Employment Estimation at Different Horizons	105
2.9	Results for females by age cohort 15-19 and 20-24	116

2.10	Results for females by age cohort 25-29 and 30-34	117
2.11	Results for females by age cohort 35-39 and 40-44	118
2.12	Results for females by age cohort 45-49 and 50-54	119
2.13	Results for females by age cohort 55-59 and 60-64	120
2.14	Results for females by age cohort 65+	121
2.15	Results for males by age cohort 15-19 and 20-24	122
2.16	Results for males by age cohort 25-29 and 30-34	123
2.17	Results for males by age cohort 35-39 and 40-44	124
2.18	Results for males by age cohort 45-49 and 50-54	125
2.19	Results for males by age cohort 55-59 and 60-64	126
2.20	Results for males by age cohort 65+	127
2.21	Quarterly figures, total employment	127
3.1	Regular Contracts Level of Protection	138
3.2	Temporary Contracts Lever of Protection	139
3.3	Effects of public expenditure cuts (red line) and tax hikes (black line)	142
3.4	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black)	143
3.5	Point estimation and significance of marginal difference between high-EPL and low-EPL countries for spending-based (red line) and tax-based (black line) actions.	145
3.6	Effects of Tax-Based Consolidations in high-EPL countries (red) and low-EPL countries (black)	147
3.7	Effects of Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black)	149
3.8	Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables	160
3.9	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - no control variables	161
3.10	Effects of public expenditure cuts (black line) and taxation increases (red line) - Employment and GDP	162

3.11	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Employment and GDP	163
3.12	Effects of public expenditure cuts (red line) and taxation increases (black line) - Tax and Expenditure Disentangled	164
3.13	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Tax and Expenditure Disentangled	165
3.14	Effects of public expenditure cuts (black line) and taxation increases (red line) - Tax and Expenditure Purged for Fiscal Foresight	166
3.15	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Tax and Expenditure Purged for Fiscal Foresight	167
3.16	Effects of public expenditure cuts (black line) and taxation increases (red line) - 1978-2007	168
3.17	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - 1978-2007 . .	169
3.18	Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables - Forecast Errors	170
3.19	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Forecast Errors	171
3.20	Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables - Nowcast Errors	172
3.21	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Nowcast Errors	173
3.22	Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables - Large adjustments (>1%)	174
3.23	Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Large adjustments (>1%)	175
3.24	Effects of public expenditure cuts (black line) and taxation increases (red line) on Government Employment	176

List of Tables

1.1	Orthogonality of consolidation measures to GDP forecast errors . . .	17
1.2	Orthogonality of consolidation measures to employment forecast errors	17
1.3	Anticipated Fiscal Spending Shock: Statistical Relevance	19
1.4	Anticipated Fiscal Spending Shock: Statistical Relevance	19
1.5	Panel Unit Root test for employment rate	22
1.6	Panel Unit Root test for employment rate	22
1.7	List of Variables	50
1.8	Narrative Consolidations	51
1.9	Anticipated Fiscal Spending Shock: Statistical Relevance	53
1.10	Orthogonality of consolidation measures to GDP news	55
1.11	Orthogonality of consolidation measures to employment news	56
1.12	Anticipated Fiscal Spending Shock: Statistical Relevance	57
1.13	Orthogonality of forecast and nowcast errors to GDP news	58
1.14	Panel Unit Root test for employment rate	63
1.15	Panel Unit Root test for employment rate - Excluding the Crisis . . .	63
1.16	Unit Root test - Single Country Without Cavalieri and Xu Adjustment	64
1.17	Unit Root test - Single Country Excluding the Crisis	64
2.1	Regression results: significance of explanatory variables	99
2.2	Regression results: significance of cyclical components	103
3.1	Variables	177

Summary

The thesis² is devoted to study some aspects of labor market dynamics and their relation to fiscal policy, and is composed by three chapters. Chapter 1 verifies whether fiscal policy influences the economy equilibrium through the hysteresis in the labor market. Chapter 2 (coauthored with Stefano Scalone, University of Verona) presents an innovative method to estimate the employment trend. Chapter 3 sheds some light on the role of labor market frictions, summarized by the level of protection of employment (EPL), in the transmission of consolidation shocks to the economy.

Chapter 1 documents the role of hysteresis in determining the response of the economic system to fiscal policy. In particular, it verifies whether a fiscal shock triggers hysteresis in the labor market, influencing the economy equilibrium. In the empirical investigation, fiscal shocks are identified in a SVAR framework with the proxy-VAR approach. This methodology, pioneered by Mertens and Ravn (2014), assumes that structural shocks can be identified in a SVAR with narrative measures of the variables sufficiently robust to endogeneity. In Chapter 1 the identification of fiscal shocks is obtained thanks to a dataset recollecting consolidation actions for 16 OECD countries in the period 1978-2013. Therefore, the contribution is twofold:

²The author would like to thank Vincenzo Quadrini, Giovanni Caggiano, Efrem Castelnuovo, Antonio Paradiso, and the two external referee - Roberto Golinelli and Antonio Ribba - for their insightful comments. A particular mention is for Lorenzo Forni, for his overall guidance and support. He also thanks EPCS Conference 2015, University of Groningen; the SMYE 2015, University of Ghent; the Macro Workshop 2015, University of Padua; and the Financial and Macroeconomics Conference 2015, Frankfurt-Am-Mein. He gratefully acknowledges the Marshall School and Economics Department of University of Southern California, where a relevant part of this thesis was developed and the Ca' Foscari University Economic Department. An earlier version of the first chapter previously circulated with the title: Long-Term Effects of Fiscal Consolidation Policies: Hysteresis or Expansionary Austerity? Please address correspondence to: Andrea Tafuro, Ca' Foscari University Economic Department; e-mail: andrea.tafuro@unive.it

on the one hand, we contribute to the debate on the consequences of consolidation shocks on the economic structure, as much as their aptitude to stimulate the economy and to stabilize the fiscal balance. On the other hand, we verify the hypothesis that consolidations can prolong their effect to the long-run through the hysteresis that is present in the labor market. This is crucial to clarify the effects of fiscal consolidation packages recently implemented across industrialized countries to reduce the government debt cumulated during the Great Recession.

The empirical investigation is conducted with a two-step analysis. In the first step we verify whether the employment rate presents hysteresis in our panel. Since in presence of hysteresis the employment deviates persistently from its equilibrium after a shock (Blanchard and Summers 1986), this is equivalent to test if the employment rate is an integrated process.

In the second step we investigate whether tax increases and government spending reductions are able to trigger hysteresis, producing effects on the variables potential level. This is done by analyzing the impulse response functions for employment rate and per-capita output, at both actual and potential levels.

The results suggest that tax hikes persistently reduce both output per-capita and employment rate, producing a decline in potential employment rate and potential output per-capita. On the other hand, spending cuts do not have significant effects in the benchmark specification, while in some extensions they increase the potential level of employment. Therefore, our estimations suggest that only taxation can trigger a hysteresis process and have long-term effects. As predicted by DeLong and Summers (2012), none of these policies are able to reduce the debt-to-gdp ratio.

Chapter 2 proposes a two-step estimation method for the employment trend. The aim of the paper is to incorporate demographical trends directly in the estimates. We estimate the trend of employment using a Kalman filter procedure in a state-space framework, conducting the estimation separately for each age cohort and gender. We then aggregate the gender-cohort specific series to obtain the aggregate potential employment. In this way we account for the specific trends in each cohort. This allows us to incorporate in the estimation the structural demographic changes that society is currently experiencing.

Another important innovation lies in the state-space model formulation. We

augment the measurement equation to include some proxies for the financial cycle, à la Borio (2012). In this way, we retrieve a cleaner and cycle-free estimated series that is significantly more precise and robust over time with respect to other commonly used methodologies - such as simple HP or Kalman filters applied on employment as a whole: it reduces the indeterminacy of estimation, and produces a more accurate quantification of the cyclical and trend components (for instance, reducing the well-known end-point problem).

A simple Kalman Filter (KF) that directly filters the total value of employment usually estimates a smaller fall in employment cyclical component during the Great Recession, with respect to the level we obtain by aggregating the single cohorts estimates. This result confirms that a filter applied without considering the cohorts is unable to cope with structural changes in labor force due to demographic trends, and ends up in overestimating the cyclical component when the share of elders is increasing over time.

Chapter 3 presents new empirical evidence on the dependency of consolidation effects on the level of labor market frictions. We estimate the effects of consolidation using a panel dataset comprising 17 industrialized countries, and compute the average responses to a "consolidation shock" with the local projection technique (à la Jordà, 2005), which allows us to control for non-linearities in a less complex framework than a SVAR (Ramey and Zubairy 2014). Non-linearities are introduced by allowing the estimated coefficient to vary according to a dummy variable which signals whether the employment protection level (EPL) is high or low.

The paper presents three main findings. First, it confirms that consolidation policies have a strong and persistent negative effect on both the employment rate and per-capita GDP. Second, the results are in favor of the presence of non-linearities in tax-based consolidation effects. In fact, tax-based actions reduce employment and economic activity only temporarily in high-EPL countries, while they have long-run contractionary effects in low EPL countries. The empirical evidence for spending-based consolidations is mixed. Third, consolidations do not show a significant effect on debt-to-GDP ratio in both high- and low-EPL countries, with the exception of spending-based actions which reduce the ratio in low-EPL countries. This evidence confirms the findings in Chapter 1, suggesting that governments underestimate the effects of tax-based consolidations on economic

activity.

Chapter 1

Lagging Behind. The Hysteresis of Austerity.

1.1 Introduction

The struggling of industrialized countries to bring potential output and employment back on the pre-crisis path is of major concern for both governments and economists nowadays (IMF, 2016). So far there is little consensus on the causes of and the remedies to the sluggishness of the recovery.

A first strand of literature emphasizes how the low performance of potential growth and employment is related to structural factors (see IMF 2016 and the studies discussed therein). The presence of frictions in labor and product markets restrains the competition among firms and the jobs matching rate, preventing the economic system from adjusting and keeping the economy on a sub-optimal growth path. In order to stimulate potential growth governments have to introduce markets reforms to reduce frictions (IMF 2016). Other policy instruments, such as monetary and fiscal policies, are not able to produce significant effects on their own (Daly et al 2012): they can only help in mitigating the short-run negative effects of the market reforms (IMF 2016).

Other studies argue that technological change is the main driver of the persistent decline in employment (Brynjolfsson and McAfee 2011, 2014; Jaimovich and Siu 2014). These studies highlight as technological innovation has two ma-

job effects: on the one hand more productive machineries replace workers, on the other hand new skills are required to job-seekers. When the rate of technological innovation grows, it becomes more difficult for dismissed workers to update their skills to the new competencies required by the job market. This vicious circle, which tends to be stronger during recessions (Jaimovich and Siu 2014), increases unemployment persistence turning frictional unemployment into structural.¹ In such a framework, markets reforms not only are unable to remove the causes of structural unemployment increase, but they can worsen the labor market conditions in that they stimulate competition and technological improvements. While the reforms can raise productivity and potential growth, the government action cannot stimulate a recover of potential employment.

Another strand of literature finds in hysteresis one of the key factors to explain the differences between the sclerotic labor market in Europe and the US labor market.² employment shows a persistent decline after a negative shock, reducing economic activity and potential growth (Bagaria, Holland and Van Reenen 2012; Galí 2015). In this case demand shocks, as fiscal and monetary policy, can produce long-term effects by influencing the potential level of variables.

DeLong and Summers (2012) advocates that in presence of hysteresis expansionary fiscal policy is self-financing: this prevents a larger government debt from reducing potential growth and propagates the effects of fiscal policy to the long-run.³ Similarly, the presence of hysteresis implies that consolidation policies, as the ones recently implemented in industrialized countries, can persistently reduce the level of employment and output. This can explain the current subdued growth of these variables.

However, despite recent contributions as Ball (2009) and Galí (2015) tried to shed some light on the role of hysteresis on the behavior of the economy, evidence

¹As a matter of facts, recessions are also an opportunity for firms to reorganize production, dismissing workers that are not sufficiently productive or which can be replaced by machineries.

²Hysteresis was first introduced in the economic debate by Blanchard and Summers (1986) and successive extensions (1987a, 1987b) They argued that presence of frictions in the labor market entails that cyclical changes in unemployment level become very persistent, until they transform in structural. Scholar have linked hysteresis to a wide set of frictions: for a review, see DeLong and Summers 2012.

³On the relation between potential (or long-run) growth and the level of government debt see, among the others, Cottarelli and Jaramillo (2012) and studies cited therein.

on the effects of fiscal policy on potential growth is still missing.

This paper fills this gap in the literature. We document the role of hysteresis in determining the response of the economic system to fiscal policy. In particular, it verifies whether fiscal policy triggers hysteresis in the labor market, influencing the economy equilibrium. In our empirical investigation, the identification of fiscal shocks builds on a dataset recollecting consolidation actions for 16 OECD countries in the period 1978-2013.⁴ Our work will also shed a light on the consequences of consolidation shocks on the economic structure, as much as their aptitude to stimulate the economy and to stabilize the fiscal balance. This is crucial to clarify the effects of the fiscal consolidation packages recently implemented across industrialized countries to reduce the government debt cumulated during the Great Recession.

The empirical investigation is conducted with a two-step analysis. In the first step we verify whether in our panel the employment rate is affected by hysteresis. Since in presence of hysteresis employment deviates persistently from its equilibrium after a shock (Blanchard and Summers 1986), this is equivalent to test if the employment rate is an integrated process.

In the second step we investigate whether tax increases and government spending reductions are able to trigger hysteresis, producing effects on the variables potential level. This is done by analyzing the integrated response functions (IRF) for employment rate and per-capita output, at both actual and potential levels.

Our results suggest that tax hikes reduce persistently both actual and potential employment rate, producing a decline of potential output in the medium term. On the contrary spending cuts do not have significant effects in the benchmark specification, while in some extensions they even increase the potential level of employment. Therefore, our estimations suggest that only taxation can trigger a hysteresis process. As predicted by DeLong and Summers (2012), none of these policies are able to reduce the debt-to-gdp ratio.

The paper extends the existing literature on hysteresis which originated from Blanchard and Summers (1986) in two directions. First, this paper is the first that investigates the ability of fiscal shock to modify the employment equilibrium

⁴Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherland, Portugal, Spain, Sweden, UK, US

level. Second, this paper is the first in this literature to present results from a structural VAR analysis on panel data (or P-SVAR), where fiscal policy shocks are identified with the narrative approach (Mertens and Ravn 2014). This allows us to discuss the causal link between fiscal policy and hysteresis, a crucial improvement respect to previous empirical studies based on unit-root analysis (Furuoka 2014 for a review) or on the discussion of data and correlations (Blanchard and Summers 1986, 1987ab; Ball 2009; Galí 2015).

We also contribute to the fiscal SVAR literature, in that the paper assesses the ability of fiscal policy to influence the job creation process. We provide statistical evidence which is seldom discussed in empirical studies on fiscal policy effects, where, with the remarkable exceptions of Fatás and Mihov (2001) and Caldara and Kamps (2008), the analysis focuses on the effects of fiscal shocks on output and its components.⁵ However, the estimation of output response to changes in fiscal stance is not enough to fully characterize the effects of fiscal shocks on the economy, as recent contributions on job-less recovery highlight (Galí, Smets and Wouters 2012; Gordon 2010; Riggi 2010; Shimer 2010).

Our methodology builds on Guajardo, Leigh, and Pescatori (GLP, 2014), which deals with the possible information shortage to correctly identify an unexpected change in fiscal policy⁶ by exploiting a dataset of exogenous fiscal actions in a P-SVAR framework.⁷ The original GLP's approach is extended under several dimensions. First, we account for the "plane" issue raised by Alesina, Favero and Giavazzi (2012), by separating unannounced and announced actions and including them in the VAR specification. Second, following Auerbach and Gorodnichenko (2013), Forni and Gambetti (2015), and Caggiano et al. (2015) we control for fiscal foresight (Leeper, Walker, and Yang 2013). Third, the consolidation episodes exploited in this paper are from the Alesina et al. (2014)'s dataset, which enhanced the GLP's one.⁸

⁵See, among the others, Blanchard and Perotti (2002); Barro and Redlick (2009); Hall (2009); Mountford and Uhlig(2009); Romer and Romer (2010); Ramey (2011a); Auerbach and Gorodnichenko (2012a).

⁶See Lütkepohl 2012

⁷A review of the former methodologies to deal with the endogeneity issue to estimate fiscal policy effects is contained in Guajardo, Leigh, and Pescatori (2014) and Mertens and Ravn (2014).

⁸Both datasets rely on Devries et al. 2011. For a discussion on the differences between

The paper is organized as follows. Next section summarizes the literature on hysteresis and the effects of consolidation policy. Section 3 describes the dataset, assessing the main improvements with respect to previous studies, and investigating its properties. Section 4 presents the evidence on the presence of unit root in the employment rate behavior during the considered period - which is a signal of hysteresis behavior in the employment rate -. Section 5 presents our identification methodology in a P-SVAR and the main results. Section 6 summarizes the robustness checks which are reported in the Appendix. In section 7, conclusions are provided. Robustness checks and a deeper analysis of the dataset are reported in the Appendix.

1.2 Literature Review

This paper is strictly related to two strands of literature. On the one hand, we have studies on hysteresis and its implication for the economic system. On the other hand, we have empirical work on the effects of fiscal policy, and in particular on the effects of fiscal consolidation.

In their seminal paper, Blanchard and Summers (1986) define hysteresis as the ability of temporary shocks to have persistent effects on unemployment. The authors argue that the bargaining asymmetries in the wage-setting process between employed and job-lookers transform frictional unemployment into structural. Therefore, the more a country is unionized, the more shocks will have persistent effects on unemployment. According with the authors, the different strenght of unions would explain the different performance of unemployment between Europe and US during the 80s. In two other contributions, Blanchard and Summers (1987ab) extend their analysis discussing the policies to implement in order to reduce the relevance of hysteresis in the labor market.

After the Blanchard and Summers contribution, a number of empirical works examined the "hysteresis hypothesis". Since in presence of hysteresis unemployment deviates persistently from its equilibrium after a shock, testing this hypothesis is equivalent to conduct a unit root test on the data. The literature

the datasets, see to Alesina, Favero and Giavazzi (2012), whereas for a discussion on the GLP datasets characteristics refer to Devries et al. (2011) and Guajardo, Leigh, and Pescatori (2014).

results, however, are still not definitive, and depend quite often on methodological advancements in unit root testing and on the sample employed.

In a "first generation" of studies, the null of non-stationarity is not rejected in unit root tests conducted on both panel and single-country time-series (Jaeger and Parkinson 1992; Song and Wu 1998; Leon-Ledesma 2002). However, these tests did not allow for structural breaks and cross-sectional dependency (with the exception of Strazicich et al. 2002). A "second generation" of investigations employs tests able to overcome these limitations. The results of these investigations are mixed: we have studies where unemployment is stationary in some countries, while in others it follows a random walk (Camarero and Tamarit 2004; Camarero et al. 2006; Christopoulos and Leon-Ledesma 2007; Chang 2011; Chou and Zhang 2012; Bolat et al. 2014; Kula and Aslan 2014; Khraief et al. 2015), studies as Lee et al (2009) where unemployment is stationary for the entire sample, other studies where hysteresis is never rejected (Chang et al. 2005).

A parallel branch of studies focused on the correlations between hysteresis, inflation and monetary policy. In particular, Ball (1997 and 2009) and Stockhammer and Sturn (2012), argued that in times of tighter monetary policy, the NAIRU tends to increase.⁹ According to the authors, this result implies that monetary policy can modify the unemployment equilibrium: however, the causal link has never been tested.

Hysteresis has been investigated also by theoretical studies. Galí (2015) proposes a classical New-Keynesian model enriched with a bargaining process à la Blanchard and Summers (1986) to explain the non-stationarity of unemployment rate and the equilibrium effects of demand shocks. In this model, unions aim at choosing the highest possible level of wage consistent with preserving the current employment level. This behavior removes the anchor toward which the wage markup converges after any exogenous shock. Therefore, after any shock the unemployment equilibrium changes and the economy stabilizes on a different level of

⁹The NAIRU (Non Accelerating Inflation Rate of Unemployment) is a non-neutral definition of labor market equilibrium (Gordon 1997; Espinosa-Vega and Russell 1997; Dickens 2009). It is defined as the level of unemployment to which the economy adjusts after a supply shock or a policy intervention (Turner, Boone, Giorno, Meacci, Rae, and Richardson 2001; Guichard and Rusticelli 2011) along a given Phillips curve, therefore the combined action of structural breaks and expectations contained in the Phillips curve equation can change the value of the NAIRU (Guichard and Rusticelli 2011).

employment and production. Galí (2015) found this behavior of labor market to explain particularly well the post-1994 performance of unemployment and wages in industrialized countries.

Other recent theoretical contributions explored the causes and the effects of hysteresis. Cheng and Zoega (2010) found that differences in workers' ages can produce the heterogeneity across workers necessary to have hysteresis in the labor market, since both the hiring and the firing thresholds for productivity are age dependent. Craighead (2016), embedding hysteresis in a New-Keynesian framework found that the decline in labor market matching efficiency implied by unemployment hysteresis is consistent with the observed rightward shift of the Beveridge curve since the 2007-09 recession. In addition, it shows that hysteresis leads to larger responses of the unemployment rate and unemployment duration to productivity, intertemporal preference, and monetary shocks. In line with this position, Bagaria, Holland and Van Reenen (2012) found that crisis effects are larger and longer in presence of hysteresis. According to them, hysteresis can keep the productive capacity of the economy persistently low, leading the economy to converge to the steady state in the very long run.

DeLong and Summers (2012) show that in presence of hysteresis expansionary fiscal policy is self-financing, reducing its contractionary effect on potential growth - due to a higher level of government debt -, while hysteresis propagates the short-term gains to the long-term. They also advised that in presence of hysteresis fiscal consolidation produce contraction in output growth larger - and more persistent - than expected.¹⁰ DeLong and Summers argued in favor of the role that fiscal policy can have in stimulating potential growth.

However, the evidence on the effects of consolidation policies is still mixed. On one hand, we have the expansionary austerity perspective (Giavazzi and Pagano 1990, Giavazzi and Pagano 1996, Alesina and Ardagna 2010), according to which fiscal consolidation stimulates growth. This is because austerity diminishes the government debt, lowering future interest rates and tax levels and triggering a crowding-in effect,¹¹ which may produce future gains in productivity. If agents

¹⁰According with DeLong and Summers (2012) in presence of hysteresis austerity can erode the long-run fiscal balance by reducing the burden of financing the debt in the future.

¹¹Since the government is reducing its debt, it also demands funds from the private sector. Therefore, a larger liquidity will be invested in the private sector, lowering the interest rates and

foresee these future tax savings and productivity gains, they start to consume (and invest) when austerity is implemented, offsetting the contractionary effect due to the fall in government demand. This eventually leads the contraction in the fiscal stance to have positive effects on growth.

On the other hand, we have studies as Guajardo, Leigh, and Pescatori (2014), that find as austerity reduces the economy activity. This implies that the Keynesian effect due to the fall in government demand is not offset by the crowding-in effect. In this case, consolidation on impact has a contractionary effect, reducing consumption, employment, and investment.

These contrasting results on the effects of fiscal consolidation reflects the absence of a homogeneous consensus on the effects of fiscal policy. As a matter of facts, studies assessing the extent of the fiscal multiplier give a wide range of empirical results (an overview of this literature is contained in Ramey 2011b). This heterogeneity can be explained taking into account that researchers have to deal with three crucial concerns.

The first is fiscal foresight (Leeper et al. 2013). Standard VARs rely on current and past shocks to interpret the dynamics of the modelled variables. However, agents have usually access to an information set larger than the econometrician's one (Forni and Gambetti 2015), which includes some "news shock" on future fiscal policy. In this case the VAR is defined "non fundamental" and the estimated IRFs are a mixture of current and past shocks.¹² To deal with this shortage, recent empirical researches have enlarged the standard VARs with variables likely to endow information on news shocks as forecast errors (Auerbach and Gorodnichenko 2012a; Caggiano et al. 2015), news on future spending (Ramey 2011a), financial measures (Forni and Gambetti 2015).

The second is that there is a mismatch between *ex-ante* and *ex-post* information with respect to fiscal intervention (Beetsma et al. 2009). When the policy-maker elaborate a fiscal policy it can only observe the current economic status (using *real-time* data), forecasting its outcomes on both fiscal stance and economy. However,

incrementing private investments.

¹²As Leeper, Walker, and Yang (2013) highlighted, an essential reason why the two information sets do not coincide is that there is a time lag between the government proposal of fiscal action and its approval (inside lag); and between the enactment and when the law takes effect (outside lag).

the realized fiscal outcomes may differ from the forecasted ones for several reasons: as Beetsma et al. (2009) highlights, a change in the macroeconomic scenario affects government spending and revenues, as well as the presence of external rules (as the Stability and Growth Pack in the EU) and internal resistances can delay the application of the policy. This may induce a pro-cyclical behavior in fiscal policy (Golinelli and Momigliano 2008).

The third is the dependency of fiscal multipliers on other factors than fiscal policy *per se*. The effects of fiscal policy has been found to depend: *i*) on the state of the economy (Auerbach and Gorodnichenko 2012a; Caggiano et al. 2015); *ii*) on some economy feautres - level of debt, exchange rate regime, and trade openness (Auerbach and Gorodnichenko 2012b; Ilzetzki et al. 2012) -; and, *iii*) on the sign of fiscal policy (Barnichon and Matthes 2015).

In this paper we cope with all this issues. First, our dataset of fiscal actions is based on a real-time approach. Therefore, our results will not suffer from the shortcoming that usually affects the analysis on *ex-post* data.

Second, in this paper fiscal shocks are identified with a narrative measure of fiscal consolidation. Fiscal consolidations are already proved being independend of contemporaneous economic movements (Romer and Romer 2010; Guajardo, Leigh, and Pescatori 2014). However, since fiscal foresight may still be a concern, we evaluate the robustness of our baseline specification introducing a measure of "news shock" in the VAR (Forni and Gambetti 2015).

Finally, we assess whether our results depend on specific country characteristics. Our panel does not display the heterogeneity necessary to evaluate the role of variables as the exchange rate regime, the level of governement, or the degree of trade openness as in Ilzetzki et al. (2012).¹³ Therefore, we focus on the level of labor market protection, since it shows a high degree of heterogenity across countries and it is reasonable that it can play a crucial role in changing the nature of unemployment from frictional to structural.

We have to caveat that our narrative measure contains (with the exception of

¹³Also Ilzetzki et al. (2012) estimated the effects of fiscal policy on a panel of countries. However, the larger number of cross-sectional observetion allowed the authors to directly split the sample to control for the desired variable. This methodology is not replicable in our setting since splitting the sample according to these variables, the number of cross-sectional units becomes too low to guarantee the robustness of the results.

three episodes) only negative shocks (reduction of public expenditure or increase in taxation). Therefore, our results are immediately interpretable and do not suffer of biases due to averaging the effects of positive and negative fiscal shocks.

1.3 Dataset

The analysis is conducted on a panel of 16 industrialized countries (Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, Portugal, Spain, Sweden, UK, US) using annual data from 1978 to 2013.¹⁴ Data are collected using three sources¹⁵: employment rate (total and potential), per capita output (total and potential), government debt, consumers price index, and interest rate, are from the OECD Economic Outlook n. 97 (June 2015)¹⁶. Data on fiscal consolidations are from the dataset by Alesina et al. (2014), collects the consolidation episodes using a narrative approach.¹⁷ Data on CAPB are from Guajardo, Leigh, and Pescatori (2014) until 2010, and OECD Economic Outlook n. 97 for the period 2011-2013 since the the lack of observations in the OECD dataset before 1990. The panel is unbalanced (see Table (1.7)).

The choice of the employment rate as dependent variable presents a certain degree of novelty with respect to the empirical literature on fiscal policy and hysteresis, which usually focuses on unemployment. Focusing on the employment has the invaluable advantage of producing estimations immediately interpretable in terms of shocks consequences on the job creation process. On the contrary the response of unemployment to shocks can be always divided between the variation of employment and the variation of labor force, which are likely to react differ-

¹⁴Despite included in the original dataset, Ireland is omitted because of its CAPB behavior after the great recession, as explained in the Appendix.

¹⁵The source, methodology, original code (when available), and coverage of each variable and country is specified in the Appendix, Table (1.7)

¹⁶Potential levels for the labor market variables are based on the equilibrium unemployment rate (NAIRU). This is estimated using a Kalman filter in a Phillips curve framework which assumes inflation expectations are anchored at the central bank's inflation target (Rusticelli et al.,2015). The potential output is then estimated embedding potential employment in a model for the aggregate supply based on a Cobb-Douglas function. For further details, refer to the OECD Economic Outlook n. 97 Database Inventory

¹⁷Alesina et al. (2014) relies upon Devries, Guajardo, Leigh, and Pescatori (2011). For a comparison among the two dataset, see Alesina et al. 2014 and the Appendix.

ently to shocks. Additionally, we scaled employment with population, in order to remove possible contributions of population behavior.

The Alesina et al. (2014)'s narrative measure identifies events of fiscal consolidation by examining policymakers' intentions and actions as they are described in contemporaneous policy documents, and by recognizing those measures motivated primarily by deficit reduction¹⁸. The Alesina et al.'s measure divides the fiscal consolidation in an *unannounced* component and in an *announced* one. The unannounced component is the changes in the fiscal stance due to consolidation policies announced and implemented in the same year:

$$x_t = \frac{E_t x_t}{E_{t-1} x_t} - 1 \quad (1.1)$$

in Equation (1.1) x refers to the component of fiscal stance (revenues t or expenditure g), $E_{t-1} x_t$ is the level of the variable expected at time $t-1$ for time t , and $E_t x_t$ is the level of the variable expected for the current year after the consolidations approval. Therefore this measure is based on *real-time* data.

The announced component of the consolidation policy is computed as:

$$e_{t+n}^{a,x} = \frac{E_t x_{t+n}}{E_{t-1} x_{t+n}} - 1 \quad (1.2)$$

in Equation (1.11) $E_{t-1} x_{t+n}$ is the level of the variable expected at time $t-1$ for time $t+n$, and $E_t x_{t+n}$ is the level of the variable expected after the consolidation approval. In the VAR we will use the unannounced movement on variable x as proxies of fiscal shocks, while e^a (the sum of revenues and spending expected movements) is added in the model to purge the shocks of their correlation with future announced changes in the fiscal stance.¹⁹

This section analyzes the Alesina et al.'s narrative measure in the light of our estimation methodology (the Appendix contains a deeper discussion of the narrative variable strengths). We will focus on the ability of the narrative measures to explain movements in the CAPB, as well as its orthogonality to other contempo-

¹⁸Additional information on methodological criteria for the construction of the dataset are contained in Alesina et al. (2014) and Devries, Guajardo, Leigh, and Pescatori (2011).

¹⁹Note that as a robustness check we estimated the model also without e^a , and adding both $e^{a,t}$ and $e^{a,g}$ contemporaneously

aneous shocks affecting the business cycle, and its robustness to fiscal foresight.

This is a crucial exercise. In fact our methodology will assume that the SVAR first equation residual is a good proxy for agents' forecast error (Mertens and Ravn 2014), resulting in a better approximation of innovation to fiscal variables. To this aim, the narrative measure has to be orthogonal to contemporaneous output movements and sufficiently robust to fiscal foresight.

1.3.1 Narrative Consolidations and Orthogonality

To assess the narrative measure exogeneity, we regress Alesina et al.'s unannounced measures on forecast errors in employment and GDP.²⁰ The forecast errors measure is based on revisions to OECD forecasts,²¹ which are available from 1985 onward (variables are in growth rates, see the Table (1.7) in the Appendix for further details). The forecast errors are defined as:

$$rev_t^x = 1 - \frac{E_t x_t}{E_{t-1} x_t} \quad (1.3)$$

where rev is the forecast error for variable x - output or employment -, $E_{t-1} x_t$ is the forecast on x made in the fall of year $t - 1$ for the following year, and $E_t x_t$ is the forecast on x made in the fall of year t for the end of the period.

We then estimate this relation with a panel regression, as described in Equation (1.4):

$$\Delta F_{i,t} = f_i + \delta_t + rev_{i,t}^x + \epsilon_{i,t} \quad (1.4)$$

in Equation (1.4) ΔF is the narrative measure, divided in tax and expenditure components, f_i are fixed effects, δ_t are the time dummies, and subscripts t and i indicate, respectively, time series and cross-sectional observations.²²

When forecast errors are informative for the narrative measure the regression coefficient β is significant: in this case the narrative is not independent from

²⁰A similar procedure is employed by GLP on the Alesina and Ardagna (2010)'s CAPB and the Devries et al. (2011)'s measure. They found that the Devries et al. (2011)'s measure is orthogonal to forecast errors, while Alesina and Ardagna (2010)'s is not.

²¹see the Appendix, Table (1.7) for further details on sample coverage

²²Here and in the following exercises panel linear regressions are estimated with heteroskedasticity robust panel-corrected standard errors.

contemporaneous economic developments. Table (1.1) and (1.2) report the results for this tests: as it is shown, coefficients are not significant, implying that the narrative measure is independent from other contemporaneous economic shocks. However, the uncorrelation to contemporaneous economic changes does not imply that this shocks are unpredictable: fiscal foresight may still be a concern for our estimations.

Table 1.1: Orthogonality of consolidation measures to GDP forecast errors

Equation estimated: $\Delta F_{i,t} = f_i + \delta_t + \beta rev_{i,t}^{gdp} + \epsilon_{i,t}$

Measure of $\Delta F_{i,t}$	β	$p - value$	Obs.	R^2
Alesina et al. Tax Hikes <i>s.e.</i>	-0.233 (0.435)	0.591	440	0.172
Alesina et al. Expenditure Cuts <i>s.e.</i>	-0.150 (0.488)	0.758	440	0.181

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Datasets 1985-2013 *10%, **5%, ***1% significance level.

Table 1.2: Orthogonality of consolidation measures to employment forecast errors

Equation estimated: $\Delta F_{i,t} = f_i + \delta_t + \beta rev_{i,t}^{emp} + \epsilon_{i,t}$

Measure of $\Delta F_{i,t}$	β	$p - value$	Obs.	R^2
Alesina et al. Tax Hikes <i>s.e.</i>	0.021 (0.033)	0.516	447	0.164
Alesina et al. Expenditure Cuts <i>s.e.</i>	-0.012 (0.028)	0.659	447	0.180

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Datasets 1985-2013 *10%, **5%, ***1% significance level.

1.3.2 Narrative Consolidations and Fiscal Foresight

Following Forni and Gambetti (2015) and Caggiano et al. (2015), we investigate the agents' ability to forecast the Alesina et al.'s measure by estimating Equation (1.5) (note that we will estimate a panel regression. However, subscripts i are dropped for the sake of the explanation):

$$\Delta F_t = f + \delta_t + \sum_{s=1}^3 \beta^s X_{t-s} + \mu_{0,J;t-1}^y + \epsilon_t \quad (1.5)$$

where ΔF is the narrative measure, divided in tax and expenditure components. The narrative measure is regressed on country fixed effects f , time dummies δ_t , three lags of $X = [emp, gdp, capb]$ (where lower case labels are the growth rates of variables reported in Table (1.7)), and on $\mu_{0,J;t-1}^y$ which is the first lag of the forecast news on variable y . The news is constructed as the sum of contemporaneous and past revisions of expectation on government fiscal policy (see Table (1.7) in the Appendix for further details):²³

$$\mu_{0,J}^y = \sum_{j=0}^J (E_t \Delta y_{t+j} - E_{t-1} \Delta y_{t+j}) \quad (1.6)$$

where:

$$E_t \Delta y_{t+j} = \frac{E_t y_{t+j} - E_t y_{t+j-1}}{E_t GDP_{t+j-1}} \quad (1.7)$$

when $j = 0$, $E_t y_{t+j-1}$ collapse to the actual value of the variable in the previous period.

Since OECD Economics Outlook dataset report only two periods forecasts for variables in the period 1985-2013 we set $J = 1$.²⁴ We compute $\mu_{0,J}^y$ for three variables, the cyclical adjusted primary balance $CAPB$, the government revenues T , the government expenditure G . A significant coefficient of the news variable implies that regressing the narrative measure on endogenous lagged values is not enough to purge the SVAR residuals from anticipated components.

Table (1.3) reports the p-values obtained by regressing Alesina on the news variable for the cyclical adjusted primary balance, $\mu_{0,1}^{capb}$, and its components $\mu_{0,0}^{capb}$ and $\mu_{1,1}^{capb}$.

Two considerations are in a row looking at Table (1.3). First, foresight affects more expenditure than taxation. Second, at odds with Caggiano et al. (2015), also $\mu_{0,0}^{capb}$ - the revision of CAPB forecasts for the previous period - is informative

²³See Forni and Gambetti 2013 for a detailed description of the news variable and its role in solving VARs non-fundamentallness.

²⁴Indeed, we with only two periods forecasts we cannot observe $E_{t-1} \Delta capb_{t+2}$.

for expenditure shocks.

Table 1.3: Anticipated Fiscal Spending Shock: Statistical Relevance

	$\mu_{0,0}^{capb}$	$\mu_{1,1}^{capb}$	$\mu_{0,1}^{capb}$
Expenditure	0.000***	0.575	0.056*
Taxation	0.212	0.000***	0.164

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Dataset 1985-2013. *10%, **5%, ***1% significance level.

The test is repeated to assess whether news on government expenditure and revenues carry information on consolidation. Therefore, Equation (1.5) is estimated again by including only news on taxation (and its components) and expenditure (and its component). Results are reported in Table (1.4): the whole taxation news variable, $\mu_{0,1}^t$, and its components, $\mu_{0,0}^t$ and $\mu_{1,1}^t$, are informative for our narrative measure. Therefore, we will check the robustness of our results to $\mu_{0,1}^t$: results for the other forecast news are left as robustness check and added to the Appendix.

Table 1.4: Anticipated Fiscal Spending Shock: Statistical Relevance

	$\mu_{0,0}^t$	$\mu_{1,1}^t$	$\mu_{0,1}^t$	$\mu_{0,0}^g$	$\mu_{1,1}^g$	$\mu_{0,1}^g$
Expenditure	0.995	0.000***	0.006***	0.110	0.895	0.222
Taxation	0.009***	0.652	0.027**	0.225	0.285	0.908

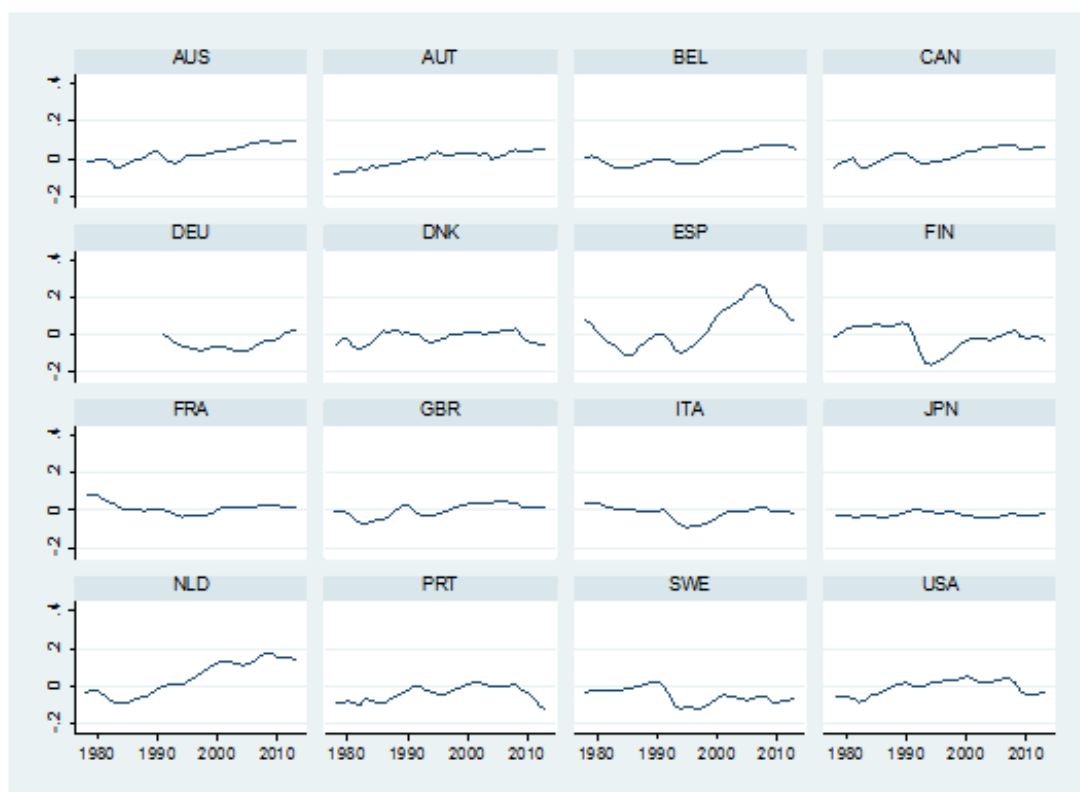
Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Dataset 1985-2013. *10%, **5%, ***1% significance level.

1.4 Testing for Hysteresis

This section discusses some preliminary evidence on the presence of hysteresis in employment rate behavior, in the spirit of previous analysis which examined the "hysteresis hypothesis" with unit root tests (Furuoka 2014). Figure (1.1) shows the behavior of the logs of employment rate in our sample.²⁵ In that, it offers a first assessment on the possibility that employment rate can be described by a non-stationary process. At a glance, we can divide countries in three groups: the first

²⁵Data are scaled on 1992 values to facilitate the comparison.

Figure 1.1: Employment rate, cross-sectional units



Note. The figure reports the logs employment rate behavior with the solid line for all the cross-sectional units. The variable is scaled by its value in 1992.

(Australia, Austria, Belgium, Canada, Portugal - excluding the post 2008 crises period -, and Netherlands) are countries where the employment rate rose steadily in the considered period, showing a possible non-stationary path. In the second group (Denmark, France, Germany, Italy, Japan, UK, and USA) employment rate is stable, not showing long-standing rises or declines.

The third group of countries is composed by Sweden, Finland, and Spain: these countries show sharp changes in the employment rate dynamics. These slumps characterize the dynamics of employment rate in the largest part of countries, and coincide with the last three crises in western economies - the 2007 great recession, the 2001 new-economy bubble, and the 1992 SME crisis. Such a behavior suggests the presence of structural breaks in the variable.

1.4.1 Unit-Roots in the Employment Rates?

In this paper we seriously consider the presence of a unit root in the employment rate. In fact, it is relevant and extremely plausible that some shocks have a permanent effect on employment, as pointed out by recent researches (Ball 2009, Galí 2015). However, the test methodology is not free of concerns.

First, the power of unit root test in panel data is still controversial (Pesaran 2013), in particular because of cross-sectional correlation (Pesaran 2007). Second, given that the employment rate is bounded between 0 and 100, unit root is a statistical *local* approximation to the behavior of employment in a defined period (Galí 2015). Third, the presence of structural breaks would undermine the results of the unit root test (Kilian and Ohanian 2002).

In order to deal with these concerns, we tested the behavior of employment rate with a wide set of methodologies, both for panel and single time series. First, we employ some unit root tests for panel data: the Im, Pesaran, and Shin (2003, IPS)'s and its version to cope with cross-sectional correlation (CIPS, Pesaran 2007). In both tests the number of lags is chosen by maximizing the country-specific AIC.

In these tests the dynamic of employment is represented by the following Augmented Dickey-Fuller of order p_i - ADF(p_i) - regression without a trend:

$$\Delta e_{i,t} = \alpha_i + \rho_i e_{i,t-1} + \sum_{j=1}^{p_i} \gamma_{i,p} \Delta e_{i,t-p} + \epsilon_{i,t} \quad (1.8)$$

where the subscripts refer to country i and time t , $e_{i,t}$ is the employment rate at time t , $\Delta e_{i,t-p}$ are p lags of the employment rate first differences with their coefficients γ , ρ_i is the autocorrelation coefficient that lies between 0 and 1, α_i are country fixed effects, and ϵ_t is a white noise. When the process in (1.8) is non-stationary, $\rho_i = 0 \forall i$: in this case the process is said to contain a unit root and any shock deviates the employment rate from its previous path permanently.

Table (1.5) reports the results for IPS and CIPS unit root tests. The evidence is in favour of non-stationarity: both tests do not reject the null at 5%. However, the IPS specification rejects the null of non-stationarity at 10%: this result may be the consequence of stationarity in a limited number of countries.²⁶

²⁶The uncertainty about the behavior of the variable is confirmed by other panel unit root test, see the Appendix.

Table 1.5: Panel Unit Root test for employment rate

Method	Statistic	P-Value	Cross-Country	Obs
IPS	-0.991	0.088*	16	563
CIPS	-0.265	0.496	16	563

Note. All test are cross-sectional demeaned to reduce the bias induced by the cross correlation. All tests have non-stationarity as null hypothesis. AIC maxlag= 4. All countries. Dataset 1978-2013. *10%, **5%, ***1% significance level.

To verify this possibility, the ADF test is repeated for each single country²⁷ with the Cavaliere and Xu (2014) unit-root test for bounded time series.²⁸ Table (1.6) shows the results of this exercise: the data reject the null of non-stationarity at 10% only for France. This probably motivates the rejection in the IPS specification. This evidence is robust to the use of a ADF test without the correction for bounded time series (see the Appendix).

Table 1.6: Panel Unit Root test for employment rate

Country	Statistic	Prob.	Lag	Obs	Country	Statistic	Prob.	Lag	Obs
AUS	-0.284	0.990	3	32	FRA	-3.215	0.055*	1	34
AUT	-1.587	0.858	1	34	GBR	-1.511	0.861	2	33
BEL	-1.512	0.861	1	34	ITA	-2.518	0.509	4	31
CAN	-1.443	0.864	1	34	JPN	-2.418	0.828	1	34
DEU	-0.089	0.993	2	20	NLD	-0.796	0.898	2	33
DNK	-2.16	0.835	2	33	PRT	-1.541	0.860	1	34
ESP	-2.163	0.835	1	34	SWE	-2.123	0.836	3	32
FIN	-2.071	0.838	2	33	USA	-1.719	0.852	1	34

Note. All test are cross-sectional demeaned to reduce the bias induced by the cross correlation. All tests have non-stationarity as null hypothesis. AIC maxlag= 4. All countries. Dataset 1978-2013. *10%, **5%, ***1% significance level.

In order to check the robustness of the results to the presence of breaks, we re-estimated the tests excluding the Great Recession (see the Appendix). The results on the shorter sample largely confirms the one presented here.²⁹ Despite further refining of the testing methodology are possible, we decided to leave them

²⁷The test equation is the same in (1.8) without the subscript i .

²⁸In our Monte Carlo simulation, under the null of unit root the t-statistic of the ADF test are -3.2576 at 5% and -3.4755 at 1%. (20000 replications with T=38 and an adjustment parameter of 0.5).

²⁹For the period 1978-2007 the IPS test mildly supports a rejection of the null of unit root, since the p-value is now equal to 0.0429, while the single-country tests reject of the null at 10% only for France. This suggests that our results are robust also to structural changes.

to future researchers, focusing here on the ability of fiscal shocks to have long-term effects.³⁰

Overall, we can conclude that employment rate shows a non-stationary behavior in this sample, an evidence which is in favor of the presence of hysteresis in this variable. The presence of a unit-root in the employment rate is independent from labor market characteristics, suggesting that hysteresis may not depend on labor market characteristics in the way described by Blanchard and Summers (1986).

However, the evidence has shown a certain degree of heterogeneity in the test results across units. In order to avoid any possible issue due to the adoption of level data in the estimation of the VAR, we estimate the model in growth rates.

1.5 Fiscal Policy and Hysteresis

1.5.1 Identification in a P-SVAR

The unrestricted P-VAR can be written as:

$$X_{i,t} = \alpha_i + \delta_t + \sum_{s=1}^T \Phi_{t-s} X_{i,t-s} + u_{i,t} \quad (1.9)$$

Where the vector of endogenous is $X = [g, t, e^a, capb, gdp, emp]$. g and t are the narrative measure of, respectively, taxation and expenditure, e^a is the sum of three period ahead announced changes in fiscal balance, $capb$ is the deviation of CAPB in terms of GDP, gdp and emp are the growth rates of, respectively, output per-capita and employment rate. This choice seems to be natural since the uncertainty on the non-stationarity of the employment rate and the use of the $capb$ among the regressors.³¹

$X_{i,t-s}$ is the vector of variables lagged for s periods, Φ_{t-s} is the matrix of coefficients for the correspondent lagged vector of endogenous, α_i is the vector of fixed effects, and δ_t is the vector of time dummies. $u_{i,t}$ is the vector of error terms.

³⁰This is also confirmed by the fact that in our panel we estimated an average autoregressive coefficient of 0.992 with a s.e. of 0.008 (HAC residuals): such a result casts doubts on the ability of employment rate to revert toward a natural rate after a shock and confirms that the employment rate is a long-memory process (Cheng et al. 2012).

³¹For the definition of variables in absolute terms, please refer to Table (1.7) in the Appendix

The number of lags is chosen using the AIC, which suggests three lags for total values and two for potential components.

Following GLP (2014) the estimation of the unrestricted VAR coefficients (Φ_{t-s}) of (1.9) is made with the Two-Way Fixed Effects methodology (TW-FE). This choice is in line with the results of Judson and Owen (1999), that find TW-FE to be the best alternative technique to estimate macro unbalanced panels compared to GMM and bias-corrected estimators.

However, TW-FE is not free of concerns: first, it imposes the same underlining structure across economies, i.e. all the differences among countries are captured by the country-specific dummy. This bias may artificially increase IRFs persistency, in particular when the time-series dimension is small (Assenmacher-Wesche and Gerlach 2008). Second, panel data can present cross-correlation, which biases the estimations. Unfortunately, the size of the dataset rules out the possibility to employ alternative estimators.

We are optimistic that TW-FE results are sufficiently robust to both these issues.³² First, we tested the hypothesis of cross-correlation in the residuals of our benchmark specifications with the Pesaran (2004) CD test. For both sets of VAR residuals³³ the null of cross-sectional dependence is rejected at 10%, with the exception of the equation for the narrative tax change in the model with actual variables.³⁴ Therefore, we are confident that our results are sufficiently robust to cross-sectional dependency in the residuals.

On the other hand, in order to guarantee that our inference is not biased because of too persistent IRF, we corroborated the results on actual variables with the one on potential levels. Thanks to this investigation, we assure that the long-lasting effects of shocks are not the by-product of a methodological bias, but it is the result of a modification in the variables potential level produced by consolidation.

³²A deep discussion of alternative estimators and their features is in the Appendix.

³³have two benchmark VARs, one for actual variables, and one for potential levels. Each of these counts of six equations.

³⁴However, the same equation strongly rejects the null (p-value 0.001) in the model with potential variables. We want to highlight that the equations for the CAPB have the higher p-values (0.072 and 0.079 for the model, respectively, of actual variables and potential levels), while the other are well below the 5% threshold, with p-values ranging from 0.000 to 0.018 (results available upon request).

As in GLP, the narrative measures of consolidation is ordered first in a recursive SVAR where residuals are triangularized à la Cholesky.³⁵ The first two equations residuals are employed to instrument changes in CAPB, which is usually the benchmark variable in analysis on fiscal policy short-term effects (Alesina and Ardagna 2010). In that, we assume that the residuals are good proxies for agents' forecast error on the behavior of expenditure and taxation (Mertens and Ravn 2014), resulting in a better approximation of innovations to fiscal variables. This assumption is supported by the results presented in Section 3, which found our measure to be orthogonal to other business cycle shock.

1.5.2 The Effects of Fiscal Policy

This section presents the results of the P-SVAR analysis, reporting the IRFs for the baseline VAR. We first present the main results for the baseline specification for taxation and expenditure, then we briefly discuss the possible mechanism at the root of our outcomes. In the following discussion, graphs will always report: *i*) cumulated effects on per-capita variables; *ii*) shocks normalized to be a 1% of GDP deviation in the considered fiscal tool; *iii*) years as time measure; and, *iv*) impact effects at time $t=1$.³⁶

Tax Hikes Figure (1.2) reports the baseline VAR IRFs results for tax hikes. The thick red solid lines are point estimates of tax effects, while the thin red lines are the 90% confidence intervals. Left panels report estimations on actual per capita GDP and employment rate, while right panels report reactions of potential components.

A tax hike produces a persistent decline in actual and potential employment. More in details, a 1% of GDP increase in tax levels reduces employment rate of more than 3%, and potential employment of about 1.1%. An increase in taxation does not reduce per-capita output significantly, the decline in potential output is significant for the first two periods - and it consists in a reduction of 0.8% in potential per capita output. This result suggests that tax hikes can persistently

³⁵For a detailed discussion of our methodology, see the Appendix. We ordered expenditure changes first and taxation second following Blanchard and Perotti (2002).

³⁶This is due to concerns in the use of STATA to simulate the IRFs behavior.

reduce employment, and can even negatively affect potential output per-capita in the medium run.³⁷

We then estimate an alternative VAR specification, where $X = [g, t, e^a, capb, gdp, emp, debt, int, inf]$. In the alternative VAR *debt* is the government-debt-over-GDP ratio, *int* is the short-term interest rate, and *inf* is the inflation.³⁸

The results for the new variables are reported in Figure (1.3). Surprisingly, despite consolidation aims at reducing debt-over-GDP ratio, our estimation show that they fail in achieving this goal. This agrees with DeLong and Summers (2012)'s hypothesis, which advocates that austerity can erode the long-run fiscal balance by reducing the burden of financing the debt in the future.³⁹ Interest rate does not show a significant reaction, while we observe and increase in price levels after the tax increase in the medium run.

The negative effect of tax hike is well documented in the literature (see, among the others, Romer and Romer 2010; Guajardo, Leigh, and Pescatori 2014). Broadly speaking, a tax increase can produce a wealth effect, reducing consumption because of the lower disposable income. This in turn will reduce output and labor demand - and therefore, employment. However, in our results per-capita output does not show a significant reaction to consolidation, while its potential level declines only in the medium-term.

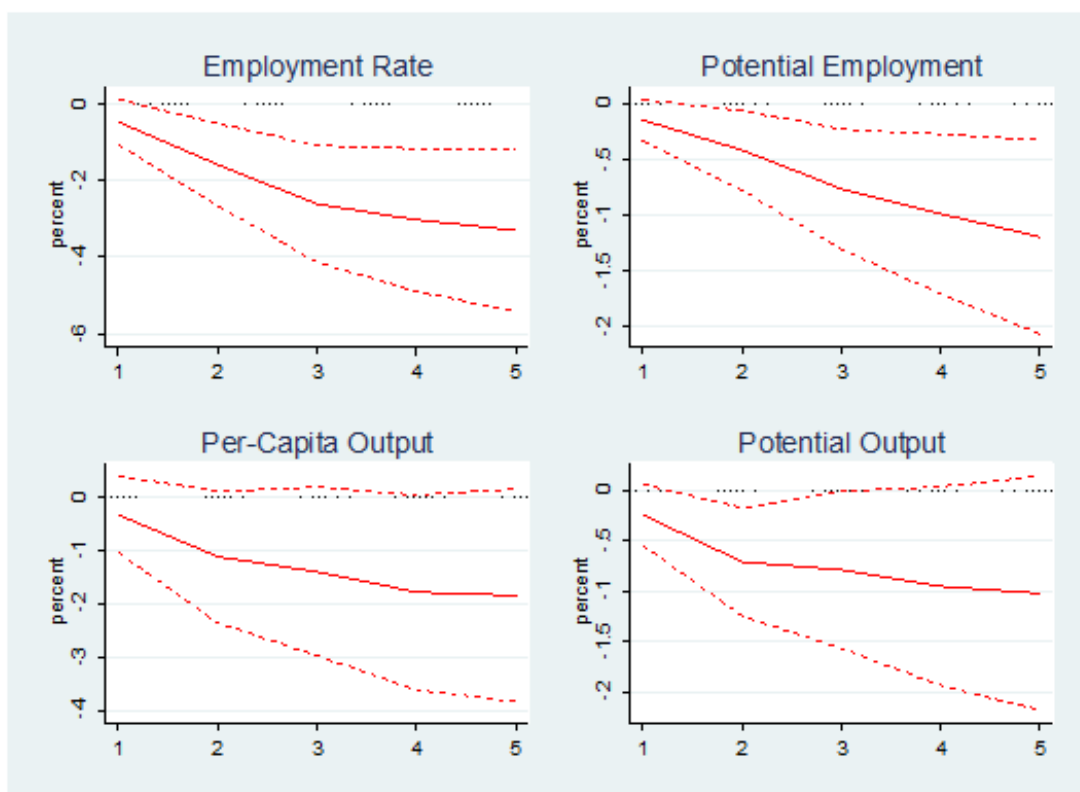
A possible justification of this result is that consolidation in this dataset is achieved increasing taxes on labor. An increase in labor income tax raise the workers preference for leisure, reducing labor supply. In addition, the augment of labor cost can increase investment, since capital becomes more convenient compared with labor. In aggregate terms, this can push the economy to be more capital-intensive, sustaining output growth both in actual and potential terms. Such an effect can prevent the hysteresis in the labor market from affecting the

³⁷Variables in levels show a larger and more persistent reduction following tax hikes. See the Appendix.

³⁸In particular, the inclusion of debt-over-GDP ratio enhances the ability of the VAR to identify unanticipated fiscal shocks because an growth in this ratio raises the probability that the government will introduce a consolidation plan. The exercise (reported in the Appendix) largely confirms the finding of the baseline specification. In this exercise the size of our dataset is smaller than the baseline (see Table (1.7)).

³⁹A further investigation, contained in the Appendix, shows that consolidation does not reduce government debt as well.

Figure 1.2: Effects of Tax Hikes



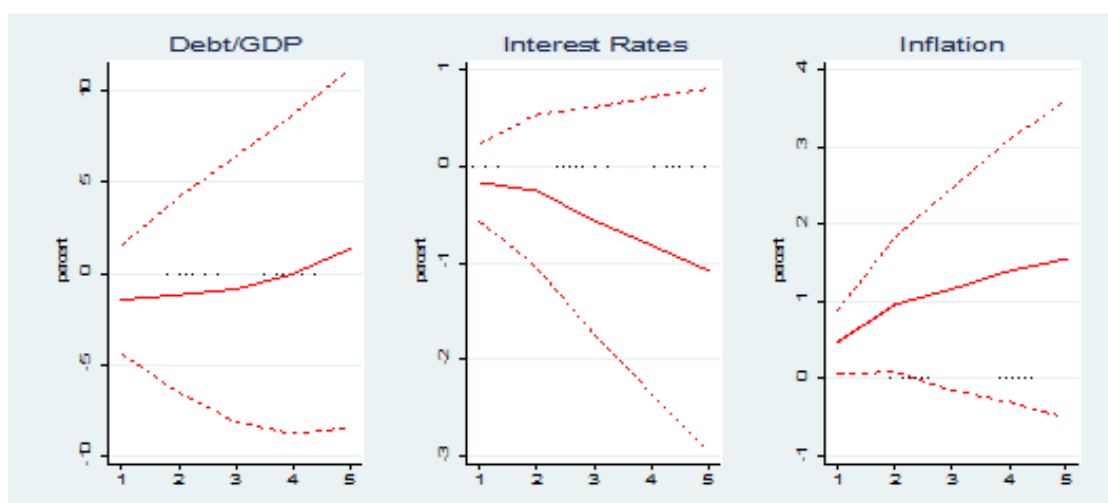
Note. Data are for all 16 countries, period 1978-2013. Shocks on tax level are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in dashed. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

output behavior. On the contrary, a variation of capital income taxes may be beneficial for employment, since it lowers the relative price of labor.

Unfortunately, our dataset does not allow to disentangle tax hikes according to their aim: we are unable to verify whether the decline in output and employment is more or less pronounced depending on tax type. Future research with a more refined dataset should investigate the presence of this theoretical channel.

Expenditure Cuts In Figure (1.4) we report the IRFs to expenditure cuts in the baseline VAR. The thick black dash-point lines are point estimates for shock responses, while the thin black dash-point lines are confidence intervals. As for tax

Figure 1.3: Effects of tax hike on debt-over-GDP ratio, interest rates, and inflation



Note. Data are for all 16 countries, period 1978-2013. Shocks on tax level are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in dashed. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

shocks, left panels report outcomes for actual per-capita output and employment rate, while right panels show the results for potential components.

Spending cuts do not significantly affect any of the variables - with the exclusion of output for only one period -.⁴⁰ The difference between expenditure and taxation results for output is in line with a number of theoretical contributions: for instance, Barro and Redlick (2011) shows that taxation has more persistent effects on the economy because of a smaller crowding-out effect and a larger effect on investment (and saving) decision of private agents. In addition, Blanchard and Summers (1987a) argues that a tax increase should shift also supply on a lower level of output, causing larger movements in the economy.⁴¹

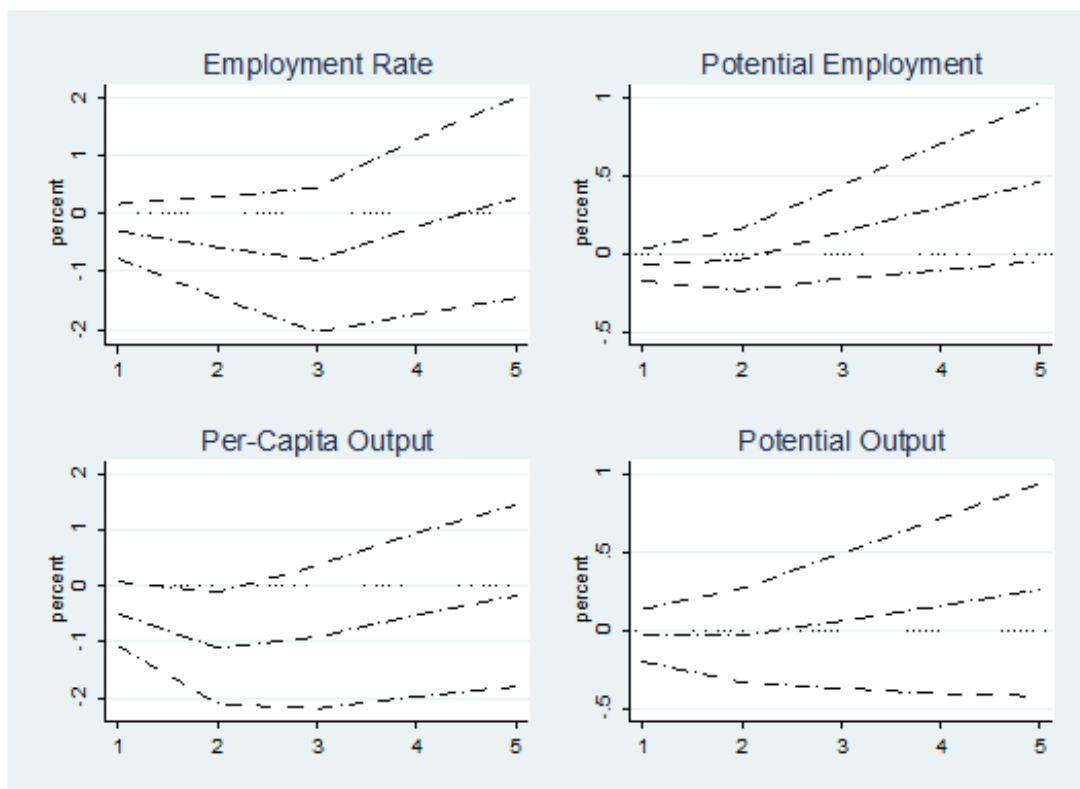
The non-significant response of employment rate to spending cuts is at odds with conventional wisdom on the effects of government spending cuts. According

⁴⁰In some extension and robustness check we found evidence of a raise in employment and output potential level following a spending cut. In addition, spending cuts seem to reduce wages in the short-run.

⁴¹As the Blanchard and Summers (1987) highlights, this result holds in particular when the fiscal action is focused in changing the tax wedge.

to this view, spending cuts (often) consists in a reduction of public employment, producing a large and persistent decline in employment rate. However, in our dataset expenditure reductions are rarely obtained through a reduction of public employment,⁴² which explains our estimates for the effect of expenditure on employment.

Figure 1.4: Effects of Spending Cuts



Note. Data are for all 16 countries, period 1978-2013. Shocks on expenditure level are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in dashed. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

We then estimate our alternative VAR where $X_{i,t} = [g, t, e^a, capb, gdp, emp, debt, int, inf]$. The results for government-debt-over-GDP ratio, short-term interest rate, and inflation are reported in Figure (1.5). For expenditure, we observe

⁴²Only episodes of Australia 1986 and 2000, Belgium 1982/1983, Germany 1995, Italy 1993, Portugal 2006, and Spain 2013 were obtained primarily reducing public employment.

again that consolidation does not reduce the debt over GDP ratio, neither affects interest rates nor inflation.

Our results can be explained by the theoretical background of the "expansionary austerity" hypothesis (Alesina and Ardagna 2010). An expenditure cut today will produce considerable tax savings in the future. This amounts to a reduction in the discounted future taxes, resulting in a positive wealth effect. In this case forward-looking agents will raise their consumption today to smooth the higher future net income, offsetting the fall in aggregate demand due to the lower government expenditure.

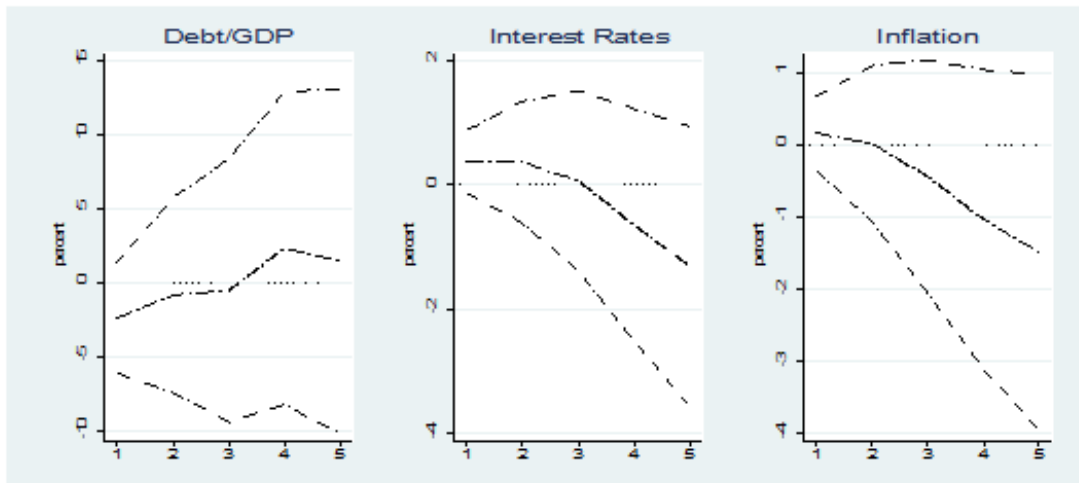
In addition, a large public sector is often seen as generating a number of inefficiencies: *i*) public workers are lower skilled and more protected than the private sector ones; *ii*) it implies hypertrophic bureaucracy, higher level of frictions across markets, lower labor market matching, and discourages investment. In this case, agents may perceive the current fall in government spending as a future gain in productivity,⁴³ starting to invest and consume more in the current period, producing an expansionary austerity effect. This effect is self-fulfilling: expenditure cuts only needs to be perceived as producing future gain in productivity.

Different Mechanisms for Different Tools? As we described above, in the considered sample the presence of a unit root in employment rate - or a very high persistency of employment rates - is a statistical regularity. However, as Galí (2015) argued, there are several models which can justify the presence of a unit root in the employment rate, implying different transmission channels - and effects - for demand shocks. To shed light on the drivers of consolidation effects on the labor market, we estimate an extended VAR. The vector of endogenous of this extended version is $X = [g, t, e^a, capb, gdp, emp, hours, wage, dep]$ where *hours* is the hours worked per employee, *wage* is the nominal wage, and *dep* is the dependent employment.

We obtain the following evidence (Figure (1.6)): *i*) tax hike and spending cut do not show a significant effect on hours worked, *ii*) wages does not show a significant reaction to tax increase, while they decline after a fall in expenditure, and; *iii*) the dependent employment responses mirror the path of total employment

⁴³The productivity gain is the byproduct of factors reallocation and frictions reductions

Figure 1.5: Effects of spending cuts on debt-over-GDP ratio, interest rates, and inflation



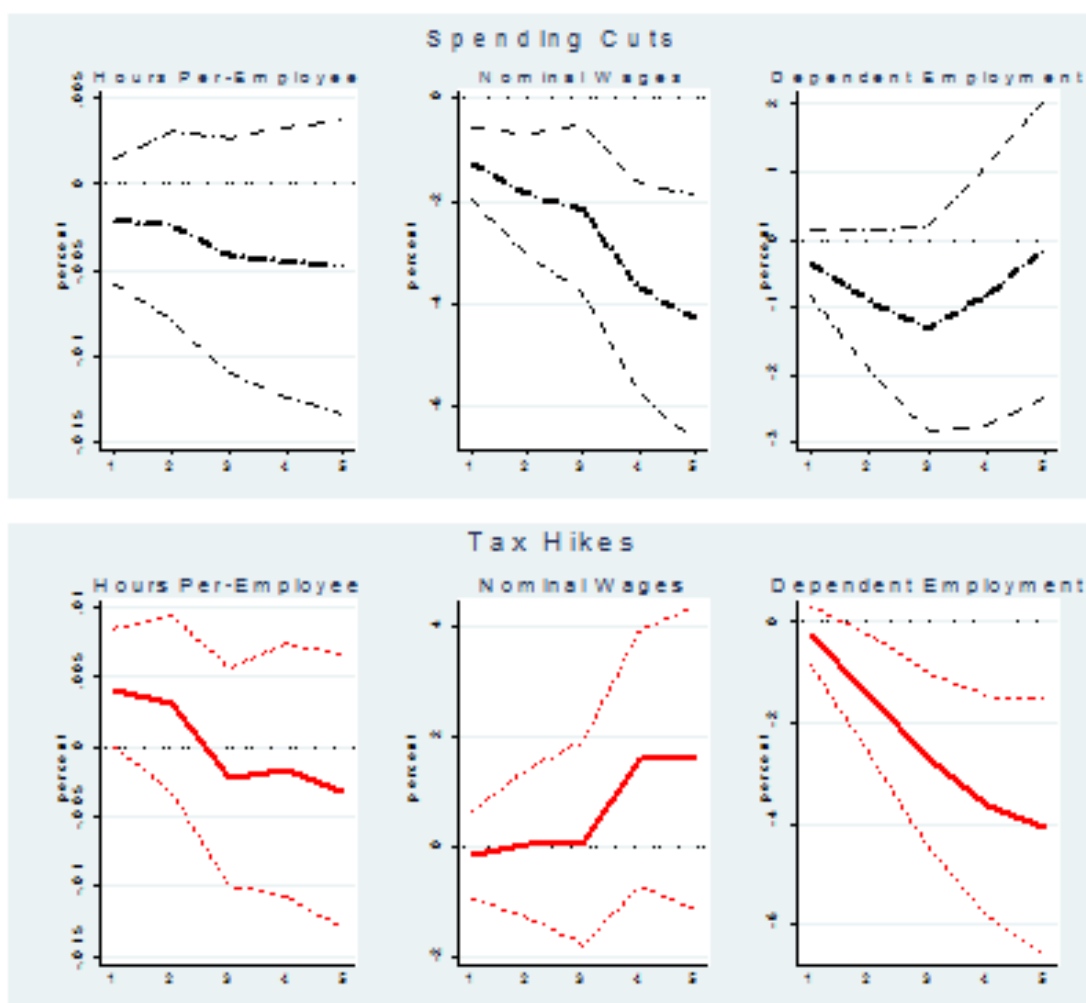
Note. Data are for all 16 countries, period 1978-2013. Shocks on expenditure level are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in dashed. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

rate reactions, confirming that consolidation policies are rarely implemented with a reduction in public employment.

In our estimates, tax hikes do not affect the level of wages and hours-per-employee, while they reduce actual and potential levels of employment rate and per-capita output. This results mirror the one obtained by Galí (2015) in his simulation of the effect of a demand shock in a New-Keynesian model with hysteresis. We can justify this matching assuming that when tax levels are raised, unions try to keep the real wages still, at the cost of persistently lower employment. Furthermore the employment behavior also reflects in the potential output path: tax increases significantly reduce potential output in the medium run.

Ball (2009) find that in presence of hysteresis declining employment correlates with a disinflationary process. However, this correlation is not confirmed in our results. Our feeling is that in Ball (2009) the price decline is not generated by hysteresis, but that changes in prices are a side effect of the shock that trigger hysteresis. Indeed, Ball (2009) analyzes the link between hysteresis and monetary

Figure 1.6: Effects of public expenditure cuts (black line) and taxation increases (red line)



Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

policy, which primarily aims at affecting prices.

As we discussed above, in our baseline specification spending cuts do not produce significant effects on employment rate and output, both actual and potential.

However they persistently reduce wages.

These results suggest that our findings entail a different mechanism for the economy adjustment to the new lower level of demand. When public expenditure falls, the economy adjusts reducing wages instead of employment. Therefore, the employment level remains stable and the economy recovers rapidly: given the decline of labor cost, firms can reduce prices, stimulating aggregate demand.

1.5.3 Extensions

In this section we present two extension of our baseline specification. First, we enlarge our baseline specification with the forecast news variables to verify the robustness of our results to this fiscal foresight.

Second, we divided our sample according to the level of employment protection (EPL), to understand whether labor market frictions can affect the economic response to consolidation shocks.

Controlling for fiscal foresight As highlighted in Section 3, the identification methodology may suffer of non-fundamentalness concerns due to agents' fiscal foresight. As a consequence, the analysis is extended to control for past news shocks. Therefore, the vector of endogenous becomes $X = [g, t, \mu_{0,J}^t, e^a, gdp, emp]$, where $\mu_{0,1}^t$ is the forecast news is computed as described in Section 3.⁴⁴ In this way we purge the VAR residuals of any predictable components, obtaining a better identification of consolidation shocks as claimed Leeper, Walker, and Yang (2013). Figure (1.7) presents the results for this exercise appending.⁴⁵

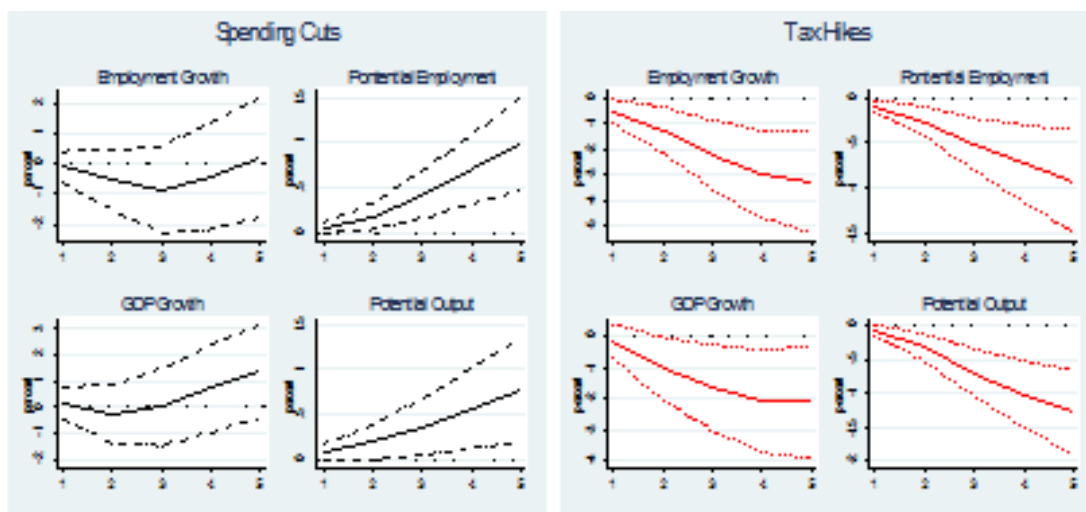
Figure (1.7) shows that controlling for fiscal foresight generally reduces IRFs volatility, in particular for the potential components of variables. Compared with the baseline specification results, in this exercise taxation persistently reduces both actual and potential variables, while spending cuts significantly increment potential levels of employment and output.

However, this results are not significantly different from the ones of the baseline

⁴⁴The news variable is computed as $\mu_{0,J}^t = \sum_{j=0}^J (E_t \Delta t_{t+j} - E_{t-1} \Delta t_{t+j})$

⁴⁵The results we are going to discuss are confirmed also adding different controls for fiscal foresight, see the Appendix.

Figure 1.7: Effects of public expenditure cuts (left panels, black dot-dashed line) and taxation increases (right panels, red solid line) considering $\mu_{0,1}^t$



Note. Data are for all 16 countries, period 1985-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

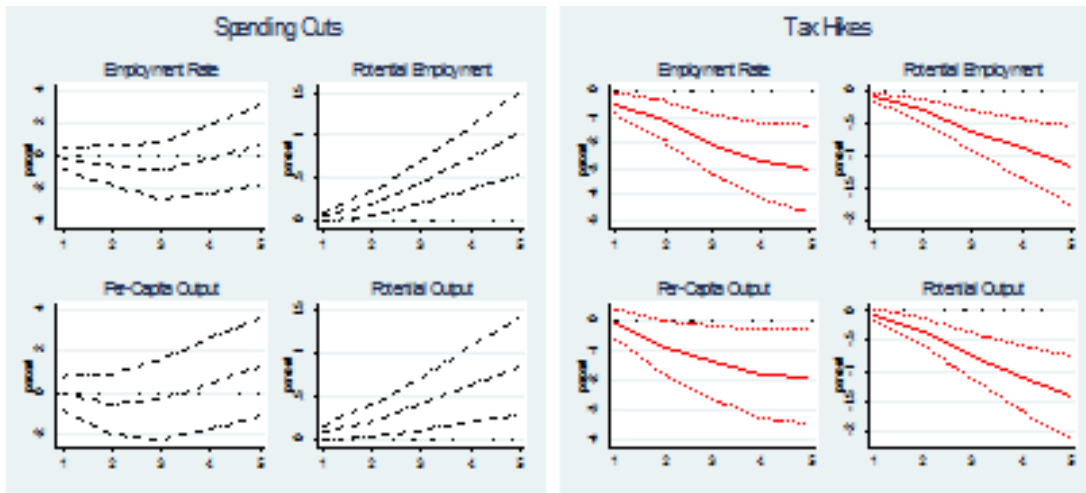
VAR estimated in the sample 1985-2013 (Figure (1.8)).⁴⁶ This leads us to conclude that the change in the sample size has the major impact on the estimates. The inclusion of the forecast news variable in the specification does not carry significant information.

The Role of Labor Market Institutions Most discussions on unemployment focus on labor markets frictions: preexisting distortions contribute to rising unemployment through interactions with market forces. This view suggests that unemployment rose more in countries with more distorted labor markets when they face a similar economic change (Ball 1997, Perotti 2012). Therefore, the extent of the adjustment in labor market variables may depend on labor market frictions, in particular in the long-term (Blanchard and Summers 1986).⁴⁷

⁴⁶The OECD forecasts employed to estimate the forecast news variable start only from 1985.

⁴⁷As an example, suppose that the employment is very highly protected. Under this assumption, the firing-hiring procedures are very costly for firms, and they will try to adjust unexpected

Figure 1.8: Effects of public expenditure cuts (left panels, black dot-dashed line) and taxation increases (right panels, red solid line) 1985-2013



Note. Data are for all 16 countries, period 1985-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

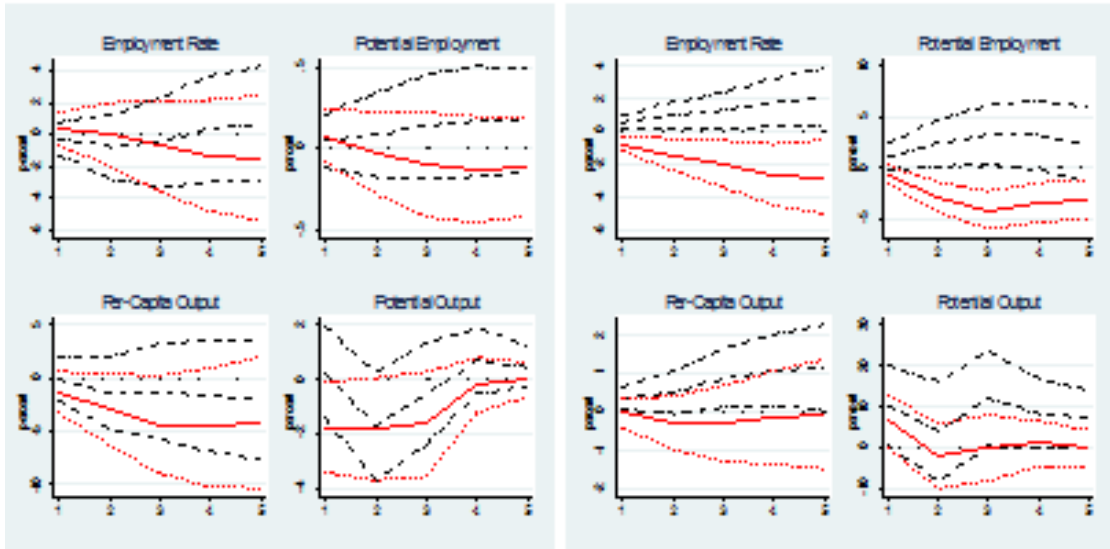
Recent analyses dealt with the role of labor market frictions in fiscal policy transmission either theoretically (Monacelli, Perotti, and Trigari 2010), or with case studies on a smaller number of countries (Perotti 2012), or focusing on cyclical components only (Turrini 2013), or employing local projection (Auerbach and Gorodnichenko 2012b).

A deeper - though not conclusive - look at the role that EPL can play in the transmission of fiscal policies is offered in Figure (1.9). The Figure reports IRFs dividing countries in two groups, one presenting high level of employment protection (HEPL - Austria, Belgium, France, Finland, Germany, Italy, Netherlands, Portugal, Spain, Sweden) and one with a low level of employment protection (LEPL - Australia, Canada, Denmark, Japan, UK, US). The level of employment protection

movements in the demand though a raise of hours worked. Instead, when wages adjust slowly and employment is not protected, a different pattern should be observed: in this case firms will adjust to the new demand curve by hiring/firing new workers.

is based on the OECD employment protection level statistics.⁴⁸ When a country scores above (below) the median for the entire period, it is defined "high-(low-)level of employment protection".⁴⁹

Figure 1.9: LEPL (left panel) and HEPL (right panel)



Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure (1.9) shows two important results. In LEPL countries (left panel) consolidation does not have significant outcomes. In HEPL (right panel), tax hike reduces actual and potential employment without affecting output, while spending cut has a positive effect on all variables with the exception of potential output. As predicted by Blanchard and Summers (1986) the presence of labor market frictions magnifies the effects of fiscal policy in the long term.

⁴⁸This measure indexes countries with a score from 0 (lowest possible level of protection) to 5 (highest possible level of protection) according to a number of variables both economic (for instance, the presence and level of minimum wage) and non economic (as the easiness to fire and hire because of the law).

⁴⁹The Appendix reports a similar exercise where the standard to divide countries is weaker : results do not changes in an appreciable way.

1.6 Robustness

The results are robust to a variety of further perturbation of the baseline model, which include:

- i) A VAR specification without announcements;
 - ii) Different number of lags included;
 - iii) Different variable ordering⁵⁰;
 - iv) Different scaling variable (total GDP and employment instead of variables in per-capita terms);
 - v) The employment of several measure of fiscal foresight;
 - vi) A shorter sample to exclude the great recession;
 - vii) Different set of countries;
 - viii) The use of taxation and expenditure *based plans*;⁵¹
 - ix) The employment of a FAVAR;⁵²
 - x) The use of different proxies for fiscal policy (nowcast and forecast errors);⁵³
- and
- xi) Estimation obtained by considering only largest consolidations (>1% of GDP).

This battery of robustness checks are available in the Appendix. Only small changes in the confidence intervals are present.

⁵⁰In this new order the narrative measure for taxation is ordered first, and the one for expenditure second

⁵¹For an accurate definition of *based plans*, see Guajardo, Leigh, and Pescatori (2014) and Alesina, Favero, and Giavazzi (2012).

⁵²The factor-augmented VAR (FAVAR) combines the information in the additional controls using a two-step approach in the spirit of the method pioneered by Bernanke, Boivin, and Elias (2005). First, the principal component of additional control variables is obtained (inflation, short-term interest rate, real wages, labor force, government-debt-over-GDP ratio, output gap, hours worked, dependency of older population, dependent employment rate, unit labor cost - all in growth terms excluding inflation and the short-term interest rate). Next, the first and second principal components are added one at the time as fourth variable to the baseline VAR.

⁵³Notable, this exercise suggests that tax hikes have always a contractionary effect, independently from their objective, while expansionary austerity is possible only in case of cut in expenditure aiming at strengthening government fiscal balance.

1.7 Conclusions

This paper explores the ability of consolidation policy to stimulate long-term effects in the economy using a SVAR framework. Following Guajardo, Leigh, and Pescatori (2014), fiscal shocks are isolated introducing in the VAR a narrative measure recollecting fiscal policies aimed at reducing public debt and/or government deficits, for 16 OECD countries.

Our macro-fiscal VAR analyzes the effects of consolidation on employment rate and per-capita output, and their potential components.

The results suggest that consolidation policies implemented after 2010 might contribute to the low performance of employment and potential output in industrialized countries. However, the size of the contribution of expansionary fiscal policy in boosting recovery and potential growth is not clear, since positive and negative shocks may have different effects (Barnichon and Matthes 2015). In addition, policy makers should take into account the long-run effects of fiscal shocks when designing their policies. Assuming that only supply-side shocks matter in the long-run may lead to suboptimal policy decisions.

The empirical investigation finds a persistent negative effect of tax hikes on employment (actual and potential) and potential output. The paths of our estimated IRFs mirror the theoretical responses of Galí (2015)'s New-Keynesians model of hysteresis: this suggests that movements in taxation stimulate a hysteresis effect in the economy.

Spending cuts do not have a significant effect on employment rate and per-capita output. These results are in line with the theoretical background of expansionary austerity, in that a decline of public demand does not produce a decline in output. The different effects on the economy of the two policies show that they may affect the economy through different transmission mechanisms.

The larger and more persistent effect of taxation compared to expenditure is in line with previous findings in the literature (Barro and Redlick 2011). However, it is hard to reconcile the medium-term effect of taxation on potential output per-capita with the general neutrality of spending cuts. One hypothesis is that consolidations obtained reducing expenditure are perceived as a signal of commitment to future fiscal discipline. This, in a rational agent framework, can lead

households and investors to positively react to expenditure cuts, anticipating the future savings on debt interests and taxes.

A second hypothesis is that governments have a higher bargaining power than firms. In this case, unions have to respond differently to dismissals in the two sectors, and dismissals do not have the same effects on the labor market. As a consequence, only when consolidation is implemented directly affecting the private sector, it does produce hysteresis. This happens only through tax changes. However, both these hypotheses need to be tested in future investigations.

The extensions of the baseline VAR present evidence in favor of a role of labor market frictions in the transmission mechanism of fiscal policy. The non-linearity which follows from the level of employment protection has to be further investigated. In addition, we exploited only one dimension of country heterogeneity. Given the nature of the dataset, would be interesting to assess the role of debt-to-gdp ratio in the transmission mechanism. However, this asks for an increase in the dataset size, in particular on the time-series dimension, that we were unable to make here.

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1.8 Appendix

1.8.1 Dataset

Description of Variables

Table (1.8) reports the unannounced component of consolidation actions employed in the paper. The Alesina et al. (2014)'s dataset identifies measures of fiscal consolidation by examining policymakers' intentions and actions as they are described in contemporaneous policy documents, and by recognizing those measures motivated primarily by deficit reduction⁵⁴. Because of their motivation, these fiscal actions are unlikely to be systematically correlated with other developments affecting output in the short term. As mentioned in the paper, this avoids the largest part of concerns related to the identification of fiscal policy consolidation made by using a statistical concept such as the increase in CAPB. A further strength of this dataset is that when recollecting the consolidation actions, the authors distinguished between changes in taxation level and cuts in government expenditure with *real-time* data.

Alesina et al. disentangle the Devries et al.'s narrative measure into two different variables, depending on the moment when fiscal interventions are fulfilled: when they are announced and realized in the same period they are defined as "unannounced". If instead they are announced and realized in a different period, they are categorized as "announced". This distinction allows Alesina et al. to analyze the effects of what they call a "fiscal plan".⁵⁵ They also enlarge the sample considered by Devries et al. by adding observations for the period 2011-2013.

⁵⁴Additional information on methodological criteria for the construction of the dataset are contained in Alesina et al. (2014) and Devries, Guajardo, Leigh, and Pescatori (2011).

⁵⁵Alesina et al. (2014) argued that when a fiscal consolidation policy is implemented, it involves an unannounced component, announcement of future changes, and changes announced in the past which are carried out now. As said in Chapter 1 a deep discussion of this methodology compared with a SVAR is available upon request.

Table 1.7: List of Variables

Variable	Extended Name	Computation	Source	Original Label	Sample Size
EMP	Employment Rate	Number of employed (ILO definition) over Working-Age Population	OECD Economic Outlook n. 97	ET = Total Employment POP1574 = Working-Age Population	1978-2013 With exception of Germany (1901-2013) 1980-2013
PEMP	Potential Employment Rate	Potential Total Employment over Population trend	OECD Economic Outlook n. 97	ETPT = Potential Total Employment POFS1574 = Working-Age Population Trend	With exception of Germany (1901-2013) Portugal (1985-2013), and Spain (1978-2013)
GDP	Per-capita GDP	Gross Domestic Product in Real Terms over Working-Age Population	OECD Economic Outlook n. 97	GDPY = Gross Domestic Product's volume POP1574 = Working-Age Population	1978-2013 With exception of Germany (1901-2013) 1980-2013
PGDP	Per-capita Potential GDP	Potential Gross Domestic Product in Real Terms over Working-Age Population	OECD Economic Outlook n. 97 (1985-2013) OECD Economic Outlook n. 97 (1985-2013)	GDVYTR = Potential Gross Domestic Product's volume POFS1574 = Working-Age Population Trend NLGXA = Cyclically Adjusted Primary Balance, value	With exception of Germany (1901-2013) 1978-2013
CAPB	Cyclically Adjusted Primary Balance	Cyclically Adjusted Primary Balance is deflated with the GDP Deflator	Gajardo, Leigh, and Pesatori (2014) (1978-2010) OECD Economic Outlook n. 97 (2011-2013)	GDPY = Gross Domestic Product's volume PCG = Government final consumption expenditure, deflator	With exception of Germany (1980-2013) Portugal (1981-2013) 1978-2013
CGD	General Government Debt	General Government Debt (Maastricht Criteria)	OECD Economic Outlook n. 97	CGEYTR = Gross public debt, Maastricht criterion, as a percentage of GDP	With exception of Australia (1988-2013), Austria (1991-2013), Denmark (1980-2013), Germany (1901-2013), Portugal (1985-2013), Spain (1989-2013) 1978-2013
CPI	Consumer Price Index	Consumer Price Index	Gajardo, Leigh, and Pesatori (2014) (1978-2010) OECD 97th (2011-2013)	CPI = Consumer Price Index for non-euro area OECD countries CPIH = Harmonized Consumer Price Index for euro area countries	With exception of Germany (1901-2013) 1978-2013
INT	Real Interest Rate	Real Short-Term Interest Rate (based on GDP Deflator)	OECD Economic Outlook n. 97 (1978-2013)	IRS = Short-term interest rate PGDP = Gross domestic product	With exception of Germany (1901-2013) 1978-2013
WAG	Nominal Wages	Nominal Wage Level	OECD Economic Outlook n. 97 (1978-2013)	WAGE = Wages, value	With exception of Germany (1901-2013) 1978-2013
HOU	Hours Worked Per-Employee	Hours Worked Per-Employee	OECD Economic Outlook n. 97 (1978-2013)	HNS: Hours worked per worker, total economy	With exception of Austria (1990-2013) Germany (1901-2013) Portugal (1995-2013) 1978-2013
DEP	Dependent Employment	Dependent Employment	OECD Economic Outlook n. 97 (1978-2013)	EE Dependent employment, total economy	With exception of Germany (1901-2013) 1985-2013
T	Government Revenues forecasts	Total Government Receipts	OECD Economic Outlooks n. 36 to 93	YRGT = Total receipts general government	With exception of Germany (1901-2013) Portugal (1991-2013) 1985-2013
G	Government Expenditure Forecasts	Total Government Disbursements	OECD Economic Outlooks n. 36 to 93	YPCT = Total receipts general government	With exception of Germany (1901-2013) Portugal (1991-2013) 1978-2013
t	Consolidation Tax Hike	Discretionary change in revenues scaled by GDP	Alshina et al. (2014)		
s	Consolidation Expenditure Cut	Discretionary change in expenditure scaled by GDP	Alshina et al. (2014)		

Table 1.8: Narrative Consolidations

Country	Year	Total	Expenditure	Taxation	Country	Year	Total	Expenditure	Taxation	Country	Year	Total	Expenditure	Taxation
AUS	1985	0.45	0.45	0	DEU	2012	0.5	0.57	-0.07	ITA	1997	2.23	0.93	1.3
AUS	1986	0.57	0.4	0.17	DNK	1983	2.77	1.85	0.92	ITA	1998	1.28	0.67	0.61
AUS	1987	0.45	0.45	0	DNK	1984	1.38	0.71	0.67	ITA	2004	1.9	0.9	1
AUS	1994	0.25	0	0.25	DNK	1985	1.54	0.77	0.77	ITA	2005	1	0.6	0.4
AUS	1995	0.25	0	0.25	DNK	1995	0.3	0	0.3	ITA	2006	1.39	0.89	0.5
AUS	1996	0.37	0.28	0.09	DNK	2012	0.2	0	0.2	ITA	2007	1.03	-0.29	1.32
AUS	1997	0.05	0.05	0	ESP	1983	1.9	0	1.9	ITA	2010	0.42	0	0.42
AUT	1980	0.8	0.69	0.11	ESP	1984	1.12	0.75	0.37	ITA	2011	1.73	1.03	0.7
AUT	1981	1.56	1.06	0.5	ESP	1989	1.22	0.24	0.98	ITA	2012	1.5	0.3	1.2
AUT	1984	2.04	0.74	1.3	ESP	1992	1.3	0.4	0.9	ITA	2013	0.3	0	0.3
AUT	1996	2.41	1.53	0.88	ESP	1993	0.3	0	0.3	JPN	1979	0.12	0	0.12
AUT	2001	1.02	0.12	0.9	ESP	1994	1.6	1.6	0	JPN	1980	0.09	0	0.09
AUT	2011	0.69	0.3	0.39	ESP	1995	0.74	0.74	0	JPN	1981	0.34	0	0.34
AUT	2012	0.53	0.17	0.36	ESP	1996	1.3	1.1	0.2	JPN	1982	0.48	0.4	0.09
BEL	1982	1.66	1.66	0	ESP	1997	1.2	1.1	0.1	JPN	1983	0.3	0.3	0
BEL	1983	1.79	1.1	0.69	ESP	2009	0.3	0	0.3	JPN	1997	1.43	0.45	0.98
BEL	1984	0.69	0.41	0.28	ESP	2010	2.9	1.8	1.1	JPN	2003	0.48	0.48	0
BEL	1987	2.8	2.8	0	ESP	2011	2.04	2.04	0	JPN	2004	0.64	0.45	0.19
BEL	1990	0.6	0.2	0.4	ESP	2012	2.9	1.07	1.83	JPN	2005	0.22	0.22	0
BEL	1992	1.79	0.8	0.99	ESP	2013	3.6	1.5	2.1	JPN	2006	0.72	0.27	0.45
BEL	1993	0.5	0.1	0.4	FIN	1992	0.91	0.91	0	NLD	1981	1.75	1.22	0.53
BEL	1994	0.37	0.37	0	FIN	1993	1.7	1.7	0	NLD	1982	1.71	1.71	0
BEL	1996	1.3	0.5	0.8	FIN	1994	3.46	2.77	0.69	NLD	1983	3.24	2.75	0.49
BEL	1997	0.91	0.5	0.41	FIN	1995	2.28	2.28	0	NLD	1984	1.76	1.76	0
BEL	2010	1.02	0.63	0.39	FIN	1996	0	0	0	NLD	1985	1.24	1.24	0
BEL	2011	0.33	0.14	0.19	FIN	1997	0.23	0.93	-0.7	NLD	1986	1.74	1.74	0
BEL	2012	2.46	1.17	1.29	FRA	1979	0.85	0	0.85	NLD	1987	1.48	0	1.48
BEL	2013	1.1	0.51	0.59	FRA	1987	0.26	0.76	-0.5	NLD	1988	0.35	0.75	-0.4
CAN	1985	0.71	0.5	0.2	FRA	1991	0.25	0.25	0	NLD	1991	0.87	0	0.87
CAN	1986	0.38	0.1	0.28	FRA	1995	0.28	-0.15	0.43	NLD	1992	0.53	0.5	0.03
CAN	1987	-0.35	0	-0.35	FRA	1996	0.89	0.47	0.42	NLD	1993	1.12	1.08	0.04
CAN	1988	0.03	0	0.03	FRA	1997	0.3	0	0.3	NLD	2004	1.7	1.3	0.4
CAN	1989	0.58	0.16	0.42	FRA	2011	2.48	1.32	1.16	NLD	2005	0.5	0.3	0.2
CAN	1990	0.21	0.21	0	FRA	2012	1.02	0.63	0.39	PRT	1983	2.3	0.95	1.35
CAN	1991	0.03	0.02	0.01	FRA	2013	2	0.6	1.4	PRT	2000	0.5	0.5	0
CAN	1993	0.26	0.26	0	GBR	1978	0	0	0	PRT	2002	1.6	0.4	1.2
CAN	1994	0.27	0.21	0.06	GBR	1979	0.27	0.72	-0.45	PRT	2003	-0.75	0	-0.75
CAN	1995	0.45	0.37	0.08	GBR	1980	0	0	0	PRT	2005	0.6	0.08	0.52
CAN	1996	-0.01	-0.01	0	GBR	1981	1.58	0.16	1.43	PRT	2010	1.16	0.53	0.63
CAN	1997	-0.07	-0.04	-0.02	GBR	1994	0.83	0.15	0.68	PRT	2011	1.1	0.6	0.5
DEU	1982	1.18	0.62	0.56	GBR	1996	0.3	0.3	0	PRT	2012	1.2	0.8	0.4
DEU	1983	0.87	0.57	0.3	GBR	1997	0.69	0.16	0.53	PRT	2013	0.5	0.1	0.4
DEU	1984	0.59	0.59	0	GBR	2010	0.41	0.27	0.14	SWE	1984	0.9	0.69	0.21
DEU	1991	1.11	0.03	1.08	GBR	2011	0.04	0.01	0.03	SWE	1993	1.81	1.39	0.42
DEU	1993	0.39	0	0.39	GBR	2012	-0.09	0.01	-0.1	SWE	1995	3.5	2.1	1.4
DEU	1994	0.73	0.65	0.08	GBR	2013	0.02	0.1	-0.07	USA	1978	0.14	0	0.14
DEU	1997	1.6	1.1	0.5	ITA	1991	2.77	1.08	1.69	USA	1981	0.23	0	0.23
DEU	2000	0.7	0.75	-0.05	ITA	1992	4.77	1.92	2.85	USA	1988	1	0.46	0.54
DEU	2003	0.74	0	0.74	ITA	1993	6.32	3.12	3.2	USA	1990	0.33	0.07	0.26
DEU	2004	0.4	1.1	-0.7	ITA	1994	2	1.7	0.3	USA	1993	0.12	0.02	0.1
DEU	2006	0.5	0.5	0	ITA	1995	4.2	1.79	2.41	USA	2011	0.04	0.04	0
DEU	2011	0.55	0.27	0.28	ITA	1996	2.51	1.09	1.42	USA	2013	0.41	0.25	0.16

Improving Alesina et al. Measure

The Alesina et al. (2014)'s narrative measure identifies measures of fiscal consolidation by examining policymakers' intentions and actions as they are described in contemporaneous policy documents, and by recognizing those measures motivated primarily by deficit reduction⁵⁶. The Alesina et al.'s measure divides the fiscal consolidation in an *unannounced* component and in an *announced* one. The unannounced component is the changes in the fiscal stance due to consolidation announced and implemented in the same year:

$$x_t = \frac{E_t x_t}{E_{t-1} x_t} - 1 \quad (1.10)$$

where x refers to the component of fiscal stance (revenues t or expenditure g), $E_{t-1} x_t$ is the level of the variable expected at time $t - 1$ for time t , and $E_t x_t$ is the level of the variable expected for the current year after the consolidations approval. Therefore this measure is based on *real-time* data.

The announced component of the consolidation policy is computed as:

$$e_{t+n}^{a,x} = \frac{E_t x_{t+n}}{E_{t-1} x_{t+n}} - 1 \quad (1.11)$$

in Equation (1.11) $E_{t-1} x_{t+n}$ is the level of the variable expected at time $t - 1$ for time $t + n$, and $E_t x_{t+n}$ is the level of the variable expected after the consolidation approval. In the VAR we will use the unannounced movement on variable x as proxies of fiscal shocks, while e^a (the sum of revenues and spending expected movements) is added in the model to purge the shocks of their correlation with future announced changes in the fiscal stance.⁵⁷

We improved the Alesina et al. (2014)'s measure. As a matter of facts, their dataset reports as announced action at time t also actions announced at $t - i$ for $t + j$: this may produce biased estimation of the effects of announced actions, in particular if the announced actions are interpreted as shocks, as in Alesina et al. (2014) and Alesina, Favero, and Giavazzi (2012). Recent studies (Beaudry and

⁵⁶Additional information on methodological criteria for the construction of the dataset are contained in Alesina et al. (2014) and Devries, Guajardo, Leigh, and Pescatori (2011).

⁵⁷Note that as a robustness check we estimated the model also without e^a , and adding both $e^{a,t}$ and $e^{a,g}$ contemporaneously

Portier 2014, Forni and Gambetti 2015, Mertens and Ravn 2010, Ramey 2011) suggest that announcements on future spending - i.e. actions announced at t for $t + j$ - are able to affect the economy on impact so far as they modify agents' expectations.

Therefore, this paper considers only changes in primary balance announced at t for $t + j$, or in one of its components. Table (1.9) clarifies this difference, comparing the two narrative measures of government spending for Australia in years 1985-1988. The left panel shows how Alesina et al.'s measure reports announced actions: for instance the policy announced for $t + 2$ in 1985 is reported also for $t + 1$ in 1986. Instead, in the new measure future changes in fiscal policy are reported only in the year of announcement (Table (1.9) right panel).

Table 1.9: Anticipated Fiscal Spending Shock: Statistical Relevance

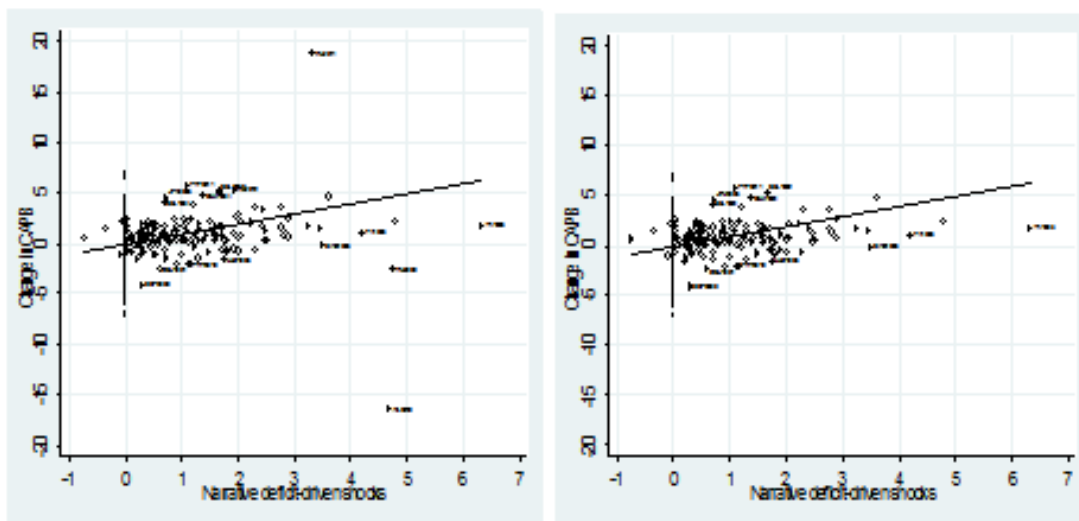
Year	Alesina et al				Paper dataset			
	t	t+1	t+2	t+3	t	t+1	t+2	t+3
1985	0	0.45	0	0	0	0.45	0	0
1986	0.45	0.26	-0.08	0	0	0.26	-0.08	0
1987	0.26	0.37	0	0	0	0.45	0	0
1988	0.37	0	0	0	0	0	0	0

CAPB and the Narrative Measure

The differences between CAPB - which is the variable usually exploited in studies on fiscal policy shocks (Alesina and Ardagna 2010) - and Alesina et al.'s unannounced measure are detailed in Figure (1.10), which reports, for a given year, changes in CAPB on the vertical axis and Alesina et al.'s measure on the horizontal axis. The line is the 45 bisector, representing cases in which CAPB and narrative measure overlaps: the more observations approaches this line, the larger is the variance of CAPB explained by the narrative measure.

Larger discrepancies between CAPB and narrative measure are reported with country name and year: the procyclical behavior of CAPB is remarkable for Ireland in both 2010 and 2011, where CAPB changes are respectively about -16% and +19% of GDP, whereas the narrative measure marks only about +4.5% and

Figure 1.10: Difference in change in OECD CAPB VS Alesina et al.'s Measure of Narrative Shocks with (right panel) and without (left panel) Ireland



Note. Reports difference the two measure of change in fiscal policy in a scatter plot. In the figure, is selected the component of OECD CAPB directly related to a fiscal consolidation, and the principal discrepancies between the two measure are reported

+3.5% (left panel). This is probably a consequence of the economic structure of this country, which is strongly dependent on foreign investments and, therefore, extremely sensible to financial market movements. The presence of these two outliers may be of serious concern in achieving a correct estimation of the relation between consolidation episodes and CAPB. As a consequence, Ireland is excluded from the dataset. Figure (1.10) right panel shows gaps between CAPB and narrative measure without Ireland. It is immediate the improvement in the two variables alignment.

Narrative Consolidations and Orthogonality

To assess the narrative measure exogeneity, we regress the Devries et al.'s and the Alesina et al.'s unannounced measures on news in employment and GDP.⁵⁸ The

⁵⁸A similar procedure is employed by GLP on the Alesina and Ardagna (2010)'s CAPB and the Devries et al. (2011)'s measure. They found that the Devries et al. (2011)'s measure is orthogonal to news, while Alesina and Ardagna (2010)'s is not.

Table 1.10: Orthogonality of consolidation measures to GDP news

Equation estimated: $\Delta F_{i,t} = f_i + \delta_t + \beta rev_{i,t}^{gdp} + \epsilon_{i,t}$

Measure of $\Delta F_{i,t}$	β	$p - value$	$Obs.$	R^2
Devries et al. Tax	-0.200 (0.507)	0.693	440	0.274
Devries et al. Expenditure	-0.434 (0.533)	0.416	440	0.192
Alesina et al. Tax Hikes <i>s.e.</i>	-0.233 (0.435)	0.591	440	0.172
Alesina et al. Expenditure Cuts <i>s.e.</i>	-0.150 (0.488)	0.758	440	0.181

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Datasets 1985-2013 *10%, **5%, ***1% significance level.

news measures are based on revisions to OECD forecasts, which are available from 1985 onward. As explained in the text, we defined the revision as:

$$\Delta F_{i,t} = f_i + \delta_t + rev_{i,t}^x + \epsilon_{i,t} \quad (1.12)$$

where ΔF is the narrative measure, divided in tax and expenditure components, f_i are fixed effects, δ_t are the time dummies, and subscripts t and i indicate, respectively, time series and cross-sectional observations.⁵⁹

Significant values of regression coefficients imply that news are informative for the narrative measure, in this case the narrative is not independent from contemporaneous economic developments. Table (1.10) and (1.11) reports the results for this test : as it is shown, both narrative measures are uncorrelated with GDP news, while only Alesina et al.'s measure is orthogonal to employment news. Then, Alesina et al's measure outperforms the Devries et al's measure. However, the uncorrelation with contemporaneous economic changes does not imply that this shocks are unpredictable: fiscal foresight may still be a concern for our estimations.

⁵⁹Here and in the following exercises panel linear regressions are estimated with heteroskedasticity robust panel-corrected standard errors.

Table 1.11: Orthogonality of consolidation measures to employment news

Equation estimated: $\Delta F_{i,t} = f_i + \delta_t + \beta rev_{i,t}^{emp} + \epsilon_{i,t}$

Measure of $\Delta F_{i,t}$	β	$p - value$	$Obs.$	R^2
Devries et al. Tax	0.721 (0.263)	0.006***	447	0.256
Devries et al. Expenditure	0.051 (0.068)	0.079*	447	0.266
Alesina et al. Tax Hikes <i>s.e.</i>	0.021 (0.033)	0.516	447	0.164
Alesina et al. Expenditure Cuts <i>s.e.</i>	-0.012 (0.028)	0.659	447	0.180

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Datasets 1985-2013 *10%, **5%, ***1% significance level.

Narratives and Fiscal Foresight

We compare the results presented in the paper by regressing the narrative variables on a measure of forecast error with the one for the Devries et al. variable. The forecast news is computed as

$$\mu_{0,J}^{capb} = \sum_{j=0}^J (E_t \Delta capb_{t+j} - E_{t-1} \Delta capb_{t+j}) \quad (1.13)$$

Table (1.12) reports the p-values obtained by regressing Alesina et al.'s and Devries et al.'s measures on the news variable, $\mu_{0,1}^{capb}$, and its components $\mu_{0,0}^{capb}$ and $\mu_{1,1}^{capb}$. The Alesina et al.'s narrative variable slightly outperforms the Devries et al.'s one, i.e. it is more unpredictable.

Narrative Consolidation, Nowcast Errors and Forecast Errors

Studies as Auerbach and Gorodnichenko (2012, 2013), and Ramey (2011) have exploited data on forecast errors to identify their SVAR avoiding fiscal foresight. As articulated by Forni and Gambetti (2015), if the other variables affect the government primary balance with one period delay, the forecasts revisions to the government primary balance f are:

Table 1.12: Anticipated Fiscal Spending Shock: Statistical Relevance

Alesina et al	$\mu_{0,0}^{capb}$	$\mu_{1,1}^{capb}$	$\mu_{0,1}^{capb}$
Total	0.003***	0.012**	0.589
Expenditure	0.000***	0.575	0.056*
Taxation	0.212	0.000***	0.164
Devries et al	$\mu_{0,0}^{capb}$	$\mu_{1,1}^{capb}$	$\mu_{0,1}^{capb}$
Total	0.573	0.000***	0.001***
Expenditure	0.277	0.000***	0.007***
Taxation	00.914	0.000***	0.003***

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Dataset 1985-2013. *10%, **5%, ***1% significance level.

$$f_t - E_{t-1}f_t = \theta_0\mu_t + \theta_1\mu_{t-1} + \delta_1\xi_{t-1} \quad (1.14)$$

where μ is the unanticipated fiscal policy shock, ξ is a non-policy shock reflecting the endogeneity of fiscal policy. θ and δ are parameters specifying the different shocks contribute to forecast error. Therefore, the forecast error in (1.14) consists in the sum of the effects of current and previous period unanticipated shocks, $\theta_0\mu_t$ and $\theta_1\mu_{t-1}$, and the previous period non-policy shock, $\delta_1\xi_{t-1}$.⁶⁰

Compared with forecast errors, our narrative measure identifies better the unanticipated changes in fiscal policy. In facts, the unannounced consolidation are nothing else than the fraction of nowcast error due to discretionary consolidations. This is an improvement with respect to the use of forecast errors: as Forni and Gambetti (2014) shows, nowcast errors largely coincides with the unanticipated shocks. In facts:

$$f_t - E_t f_t = \theta_0\mu_t \quad (1.15)$$

Therefore, we tested the orthogonality of nowcast and forecast errors to news in employment and GDP, using the regression approach employed above. Results are showed in Table (1.14), which contains the coefficients of news measures, their significance, and the regression R-squared. It is remarkable that both forecast and nowcast errors are strongly and significantly correlated with GDP news.

⁶⁰We assume that agents observe μ_t and ξ_t with one period delay.

According to the results, the narrative measure should outperform the Auerbach and Gorodnichenko (2012ab, 2013), and Ramey (2011) ones in identifying unanticipated shocks. These findings also suggest that enlarging the VAR specification with forecasts errors, as in Auerbach and Gorodnichenko (2012ab, 2013), would be not enough to assure the residuals identify true innovations in fiscal policy.

Table 1.13: Orthogonality of forecast and nowcast errors to GDP news

Equation estimated: $\Delta F_{i,t} = f_i + \delta_t + \beta rev_{i,t}^{gdp} + \epsilon_{i,t}$

Measure of $\Delta F_{i,t}$	β	<i>p</i> - value	Obs.	R^2
Forecast Error in Taxation	0.381 (0.012)	0.000***	440	0.751
Forecast Error in Expenditure	-0.403 (0.013)	0.000***	440	0.835
Nowcast Error in Taxation	-0.188 (0.031)	0.000***	440	0.592
Nowcast Error in Expenditure	-0.192 (0.034)	0.000***	440	0.619

Note. The table reports point estimates and heteroskedasticity robust panel-corrected standard errors. All specifications contain full set of country and time fixed effects. Datasets 1985-2013 *10%, **5%, ***1% significance level.

1.8.2 Estimation of the P-SVAR

The identification of structural shocks is the main issue in SVAR methodology. This is because, as a huge literature pointed out, the covariance between the residuals in a VAR as (1.17) is non-null, i.e. the variance-covariance matrix is not diagonal. Instead, it is desirable that a shock affecting the economy is not correlated with the changes in other economic variables. A shock with such characteristic is also named "structural", and produces its effects on the variables of the system only through the matrix Φ_{t-s} of the unrestricted P-VAR (see the paper for the details):

$$X_{i,t} = \alpha_i + \delta_t + \sum_{s=1}^T \Phi_{t-s} X_{i,t-s} + u_{i,t} \quad (1.16)$$

We can think that the structural shocks are directly related to the unrestricted

VAR vector of residuals - which are the one estimated in (1.16) - with a matrix \mathbf{B} of restrictions, i.e.:

$$u_{i,t} = B\epsilon_{i,t} \quad (1.17)$$

$$\Sigma_{uu} = BB' \quad (1.18)$$

Where $\epsilon_{i,t}$ is the vector of structural shocks, i.i.d. and normally distributed. The only information set from which the matrix \mathbf{B} can be retrieved is the variance-covariance matrix of residuals $u_{i,t}$, which is not sufficient to identify the structural shocks because of its symmetry: as a consequence, there are several matrices \mathbf{B} respecting the equivalence in (1.18) and $N(N - 1)/2$ additional restrictions are needed to uniquely identify \mathbf{B} . In the literature there are two approaches to retrieve these restrictions: one is to use the Cholesky decomposition, i.e. premultiplying (1.16) by the lower triangular of the $u_{i,t}$ variance-covariance matrix. The other is restricting \mathbf{B} based either on theoretical assumptions, as in Blanchard and Quah (1989), or on empirically estimated relations (as Blanchard and Perotti 1999).

However, both techniques have drawbacks. Cholesky decomposition is an atheoretical method but it imposes a recursive form to the SVAR: consequently, estimation will highly depend on variables ordering, since the variable coming first responds to structural shocks of following variables only with one period lag. By doing that, the researcher makes two assumptions: i) the first variable Granger-cause all the others; ii) the first equation residual is a forecast error. On the other hand, imposing restrictions on \mathbf{B} using theoretical hypothesis is in contrast with the idea behind the VAR approach, which is to let the data speak imposing the smallest number of (possible none) theoretical assumptions to the model.

Beyond the model adopted to obtain the structural shocks, there is another reason why the identification method does not imply necessarily to retrieve a fundamental shock, which is often underrated. As Lütkepohl (2012) and Leeper, Walker, and Yang (2013) articulated, the number of variables on which agents form their expectations is usually much larger than the variables contained in a SVAR: therefore, the information on which the econometrician regresses the fiscal policy is not enough to guarantee that residuals are unanticipated movements in

this variable. In this case, the obtained residual is a mixture of unanticipated and anticipated shocks, despite it is orthogonal to other structural shocks (Mertens and Ravn 2010). Since agents anticipate a component of the identified shock, the simulated IRFs are not consistent because the VAR discount factor is not equivalent to the agents one (Leeper, Walker, and Yang 2013). Lütkepohl (2012) proposes two possible alternative approaches to deal with this problem: enlarging the number of variables in the VAR, or using a FAVAR.

Following Guajardo, Leigh, and Pescatori (2014), the paper exploits the dataset of consolidation fiscal policy of Alesina et al. (2014) as an instrumental variable for the changes in the CAPB, which is usually the benchmark variable for the analysis on the short-term effects of fiscal policy (Alesina and Ardagna 2010). In this way, the anticipated component of estimated residual of SVAR first equation is reduced with respect to the one derived from the usual VAR, carrying less biased IRF.

This methodology assures that the SVAR first equation residual, which is interpreted as the structural shock, is closer to the forecast error of agents compared with other identification techniques.

Following GLP (2014) the estimation of the unrestricted VAR coefficients (Φ_{t-s}) is made with the Two-Way Fixed Effects methodology (TW-FE). This choice is in line with the results of Judson and Owen (1999), that find TW-FE to be the best alternative technique to estimate macro unbalanced panels compared to GMM and bias-corrected estimators.⁶¹ TW-FE has two major drawbacks: first, it imposes the same underlining structure across economies, i.e. all the differences among countries are captured by the county-specific dummy . Hence, all the cross-sectional information is lost because parameters are constrained to be the same for all countries, and cross-country relations cannot be exploited. This bias the results of shock persistency, in particular when the time-series dimension is small, leading to extremely persistent IRFs. In order to overcome this issue scholars have developed a set of different tools, as the Random Coefficients Model (RC, Swamy 1970), Mean Group Estimator (MG, Pesaran and Smith 1995) and the Pooled Mean Group Estimator (PMG, Pesaran, Shin, and Smith 1999), which un-

⁶¹By and large, this methodology consists in demeaning each cross-sectional unit: doing that, I can treat my panel VAR as a stacked time series. Roughly speaking, I deal with my panel as it is a unique time-series of 576 observations from a single country.

fortunately require longer dataset compared to the one employed here to provide unbiased estimations of the parameters.⁶²

Second, panel data can present cross-correlation, which biases the estimations. This can be due to common effects, spatial correlation, or economic networks (Pesaran and Chudick in Baltagi, 2014). TW-FE helps in controlling only for the presence of common effects,⁶³ while a number of estimation methodologies can deal with other types of cross-country correlation. Again, the size of the dataset rules out the most important alternative estimators: Generalized Least Squares techniques based on Seemingly Unrelated Regression equations (Zellner 1962) requires large T and small N. Spatial econometric techniques⁶⁴ (Anselin 1988 and 2001) and residual multifactor approaches⁶⁵ need very large N. Common Correlated Effects (Pesaran 2006) and its dynamic version (Chudick and Pesaran 2015) require large N and dramatically reduces the degree of freedoms as T increases.⁶⁶

⁶²Specifically, RC are based on the assumption that coefficients for each countries are drawn from a normal distribution, which is a quite strong assumption for a dataset of 17 cross-sections. For the MG and PMG estimators (Pesaran and Smith 1995; Pesaran, Shin, and Smith 1999) the dataset does not present a sufficient number of time-series observations to provide an unbiased estimation of single countries coefficients. In this case, a solutions would be to bootstrap the dataset as suggested by Pesaran and Zhao (1997). However, this technique is not effective for large values of the lagged variables coefficients, as is this case.

⁶³Ignoring cross-sectional dependence of errors can have serious consequences since conventional panel estimators, such as fixed or random effects, can result in misleading inference and even in inconsistent estimators, depending on the extent of the cross-sectional dependence and on whether the source generating the cross-sectional dependence (such as an unobserved common shock) is correlated with regressors (Phillips and Sul 2003; Phillips and Sul 2007; Sarafidis and Robertson 2009).

⁶⁴The spatial econometric approach assumes that the structure of cross-sectional correlation is related to location and distance among units, defined according to a pre-specified metric given by a connection or spatial matrix that characterizes the pattern of spatial dependence according to pre-specified rules. Hence, cross-sectional correlation is represented by means of a spatial process, which explicitly relates each unit to its neighbors (see Whittle (1954), Moran (1948), Cliff and Ord (1973 and 1981), Anselin (1988 and 2001), Haining (2003, Chapter 7), and the recent survey by Lee and Yu (2013)). This approach, however, typically does not allow for slope heterogeneity across the units and requires a priori knowledge of the weight matrix.

⁶⁵The residual multifactor approach assumes that the cross dependence can be characterized by a small number of unobserved common factors, possibly due to economy wide shocks that affect all units albeit with different intensities. Geweke (1977) and Sargent and Sims (1977) introduced dynamic factor models, which have more recently been generalized to allow for weak cross-sectional dependence by Forni and Lippi (2001), Forni et al. (2000), and Forni et al. (2004). This approach does not require any prior knowledge regarding the ordering of individual cross-section units.

⁶⁶This happens since the CCE methodology adds in the RHS their cross-sectional means of

As highlighted in the paper, we are confident that our inference is relatively unbiased: the Pesaran cross-dependence test (Pesaran 2004) reject the null of cross-correlation in our residuals, while the estimation of consolidation effects directly on the equilibrium variables cope with the possible excessive persistence in the IRFs which may suggest long-term effects while they are not in the data.

covariates in each period.

1.8.3 Unit Root Tests

Table 1.14: Panel Unit Root test for employment rate

Method	Statistic	P-Value	Cross-Country	Obs
IPS	-0.9909	0.031	16	563
Fisher	96.7014	0.000	16	563
PP	22.8554	0.475	16	563
CIPS	-0.265	0.623	16	563

Note. All test are cross-sectional demeaned to reduce the bias induced by the cross correlation. All tests have non-stationarity as null hypothesis. AIC maxlag= 4. All countries. Dataset 1978-2013. *10%, **5%, ***1% significance level.

Table 1.15: Panel Unit Root test for employment rate - Excluding the Crisis

Method	Statistic	P-Value	Cross-Country	Obs
IPS	-1.7179	0.0429**	16	467
CIPS	-0.124	0.451	16	387

Note. All test are cross-sectional demeaned to reduce the bias induced by the cross correlation. All tests have non-stationarity as null hypothesis. AIC maxlag= 4. All countries. Dataset 1978-2007. *10%, **5%, ***1% significance level.

Table 1.16: Unit Root test - Single Country Without Cavalieri and Xu Adjustment

Country	Statistic	Prob.	Lag	Obs	Country	Statistic	Prob.	Lag	Obs
AUS	-0.284	0.925	3	32	FRA	-3.215	0.019**	1	34
AUT	-1.587	0.489	1	34	GBR	-1.511	0.529	2	33
BEL	-1.512	0.528	1	34	ITA	-2.518	0.111	4	31
CAN	-1.443	0.562	1	34	JPN	-2.418	0.136	1	34
DEU	-0.089	0.949	2	20	NLD	-0.796	0.819	2	33
DNK	-2.16	0.221	2	33	PRT	-1.541	0.512	1	34
ESP	-2.163	0.22	1	34	SWE	-2.123	0.235	3	32
FIN	-2.071	0.257	2	33	USA	-1.719	0.422	1	34

Note. All test are cross-sectional demeaned to reduce the bias induced by the cross correlation. All tests have non-stationarity as null hypothesis. AIC maxlag= 4. All countries. Dataset 1978-2013. *10%, **5%, ***1% significance level.

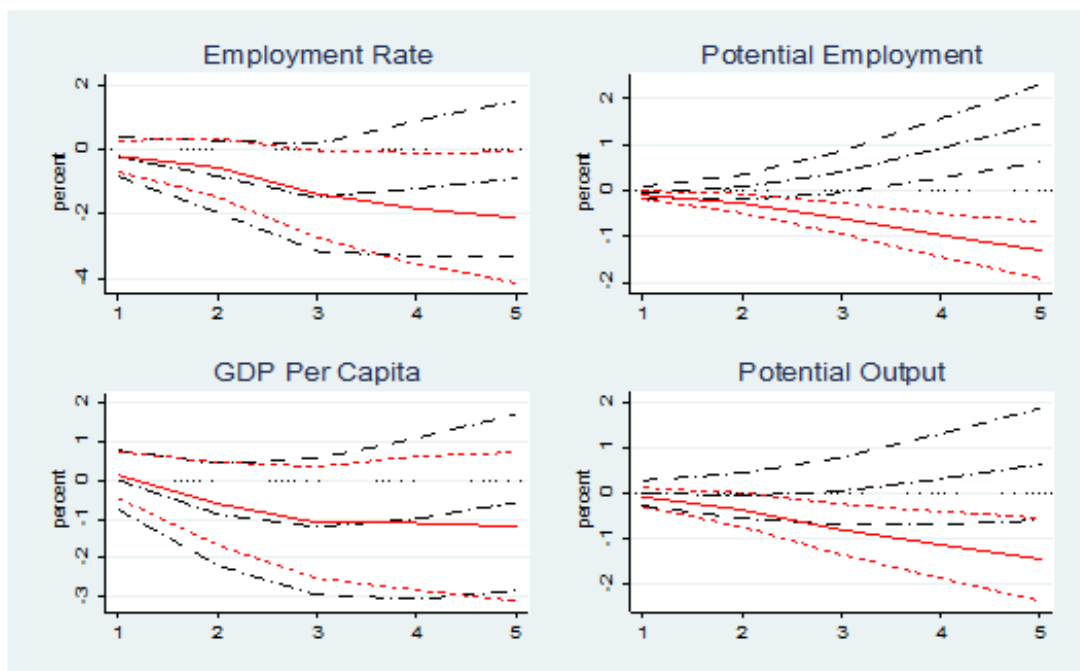
Table 1.17: Unit Root test - Single Country Excluding the Crisis

Country	Statistic	Prob.	Lag	Obs	Country	Statistic	Prob.	Lag	Obs
AUS	-1.278	0.871	1	32	FRA	-3.209	0.057*	1	34
AUT	-1.948	0.843	1	34	GBR	-0.859	0.893	2	33
BEL	-1.579	0.858	1	34	ITA	-2.278	0.832	1	31
CAN	-1.253	0.873	1	34	JPN	-2.28	0.832	1	34
DEU	-2.4	0.829	2	20	NLD	-0.038	0.993	2	33
DNK	-1.956	0.843	1	33	PRT	-1.433	0.864	1	34
ESP	-0.201	0.991	2	34	SWE	-1.606	0.857	2	32
FIN	-1.775	0.85	2	33	USA	-1.026	0.885	1	34

Note. All test are cross-sectional demeaned to reduce the bias induced by the cross correlation. All tests have non-stationarity as null hypothesis. AIC maxlag= 4. All countries. Dataset 1978-2007. *10%, **5%, ***1% significance level.

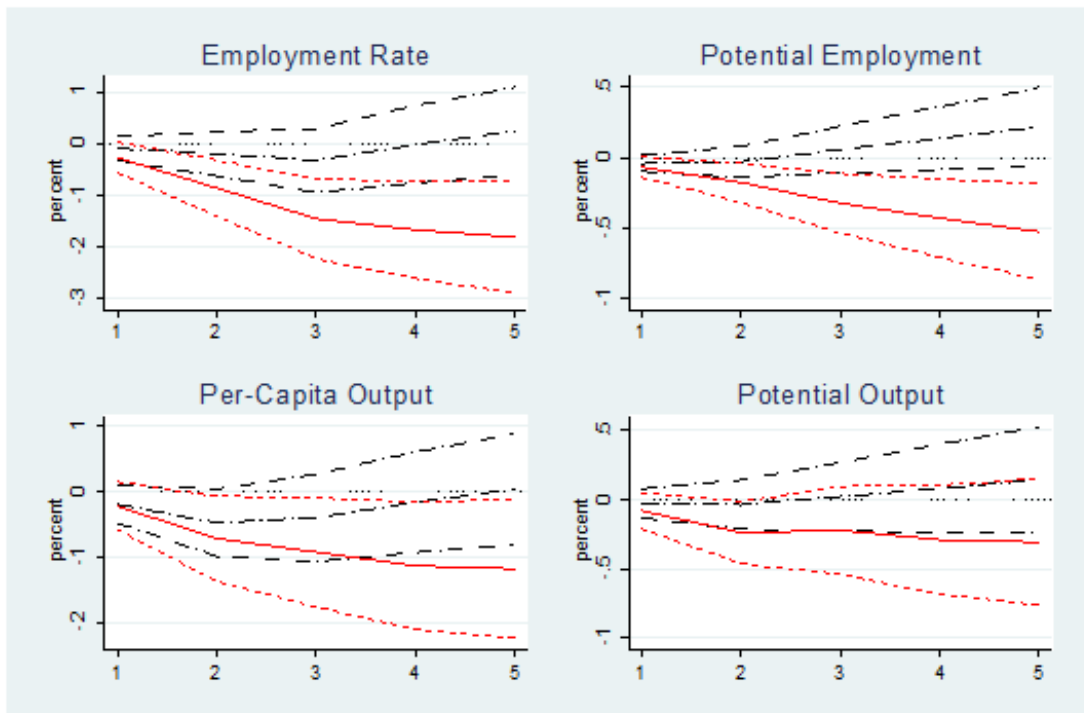
1.8.4 Robustness

Figure 1.11: Effects of public expenditure cuts (black line) and taxation increases (red line) controlling for government debt over GDP, inflation, and monetary policy



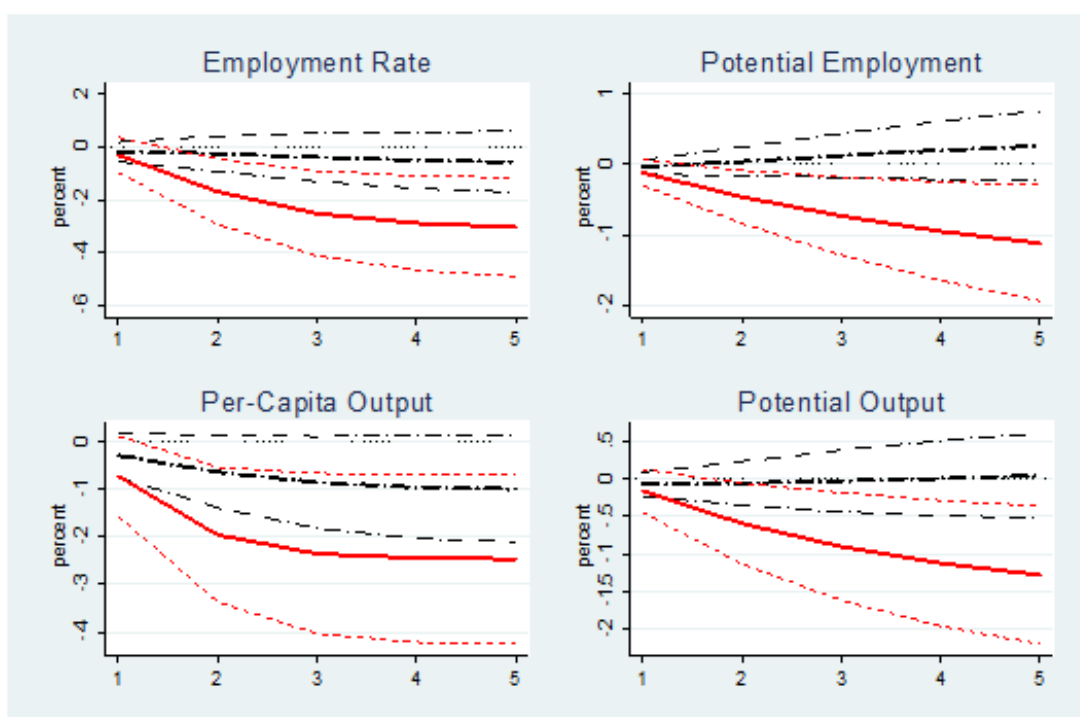
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.12: Effects of public expenditure cuts (black line) and taxation increases (red line) without considering announcements



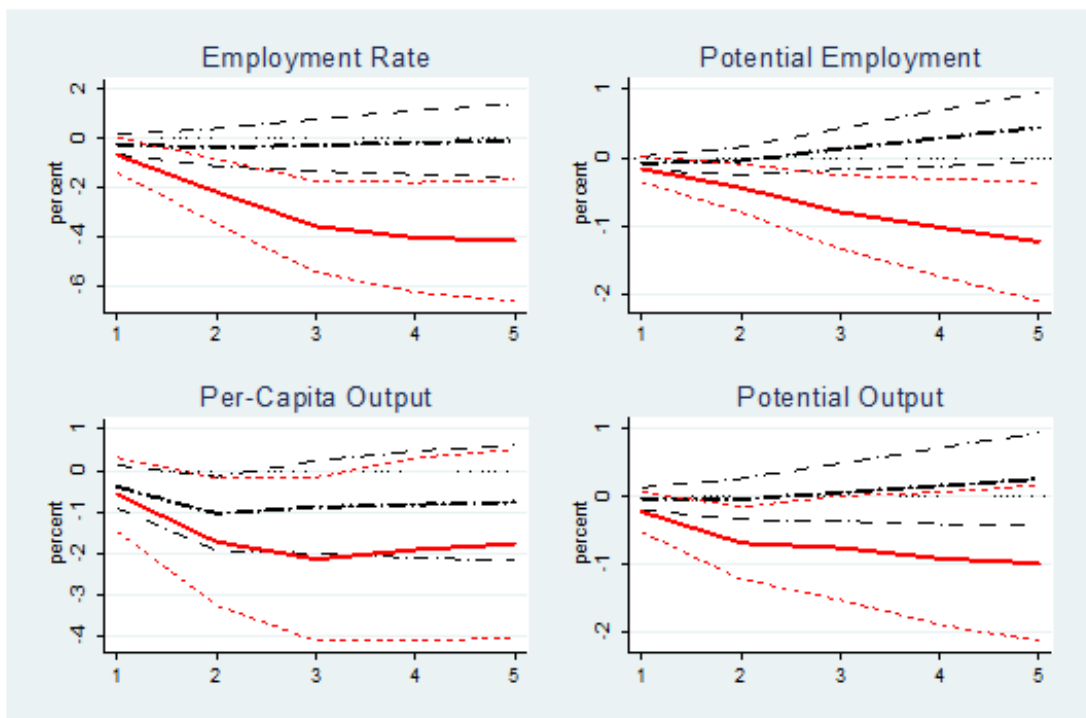
Note. Data are for all 16 countries, period 1979-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.13: IRF for Employment and real GDP – 1 Lag



Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.14: IRF for Employment and real GDP – 2 lags



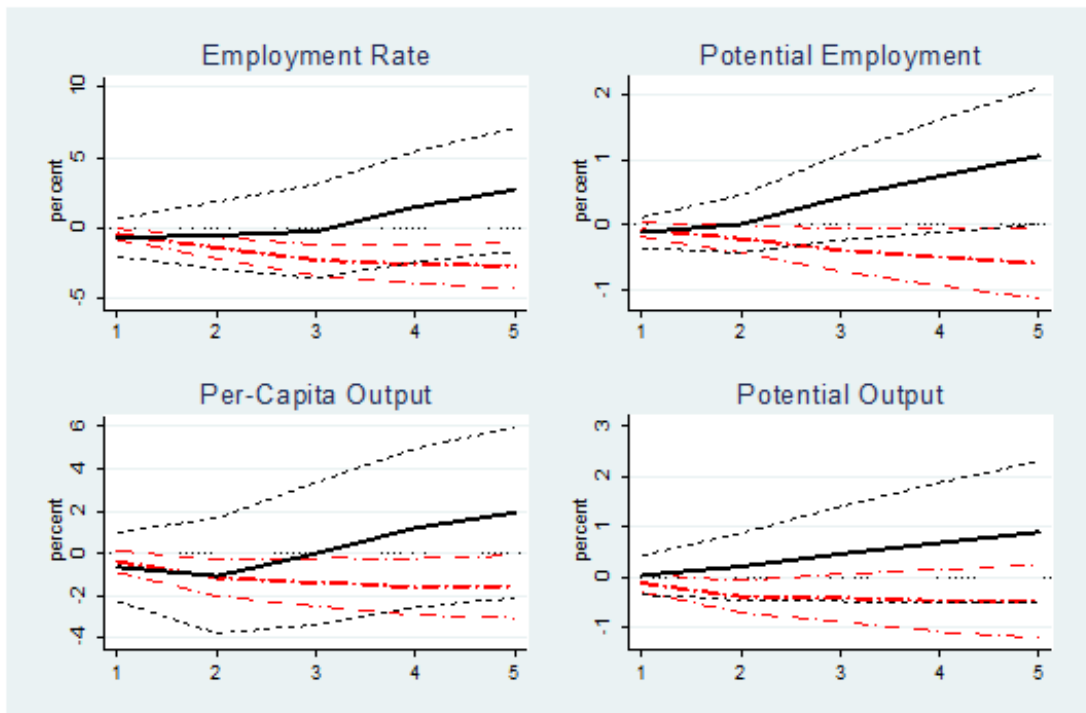
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.15: IRF for Employment and real GDP – 4 lags



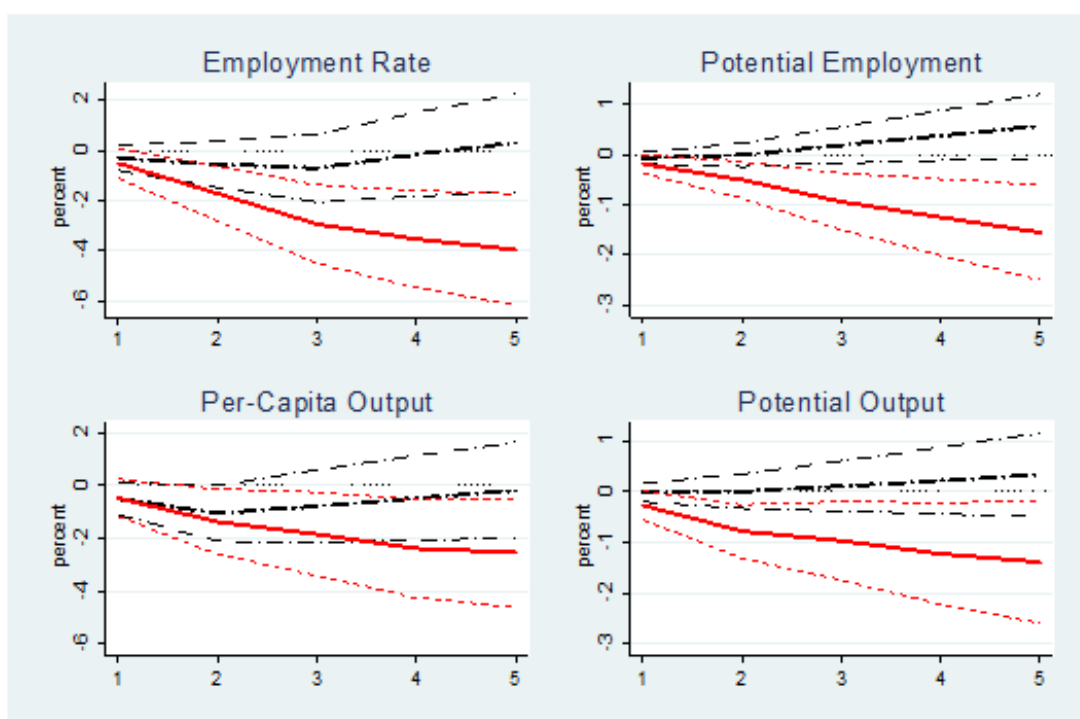
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.16: Effects of public expenditure changes (black line) and taxation changes (red line) – Different ordering of variables



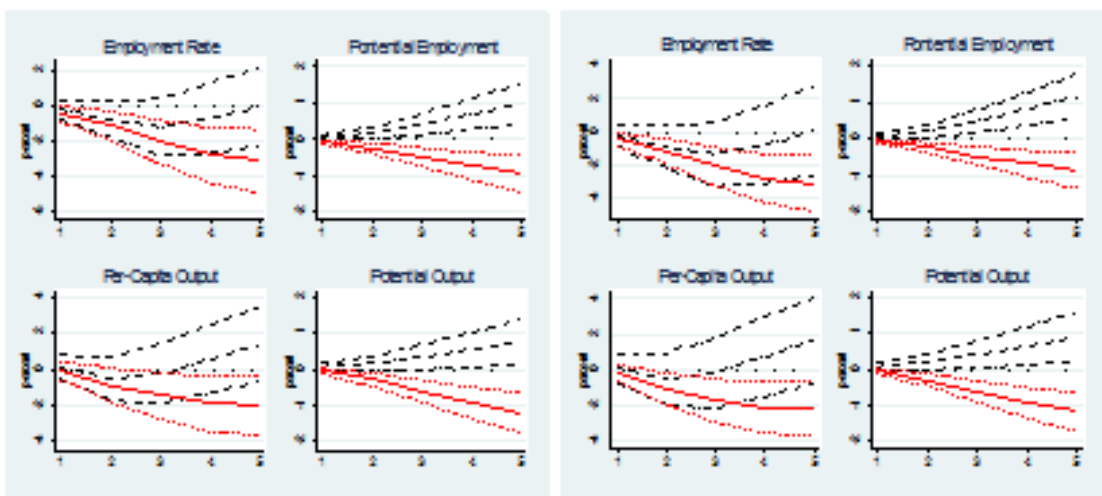
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.17: IRF on total values



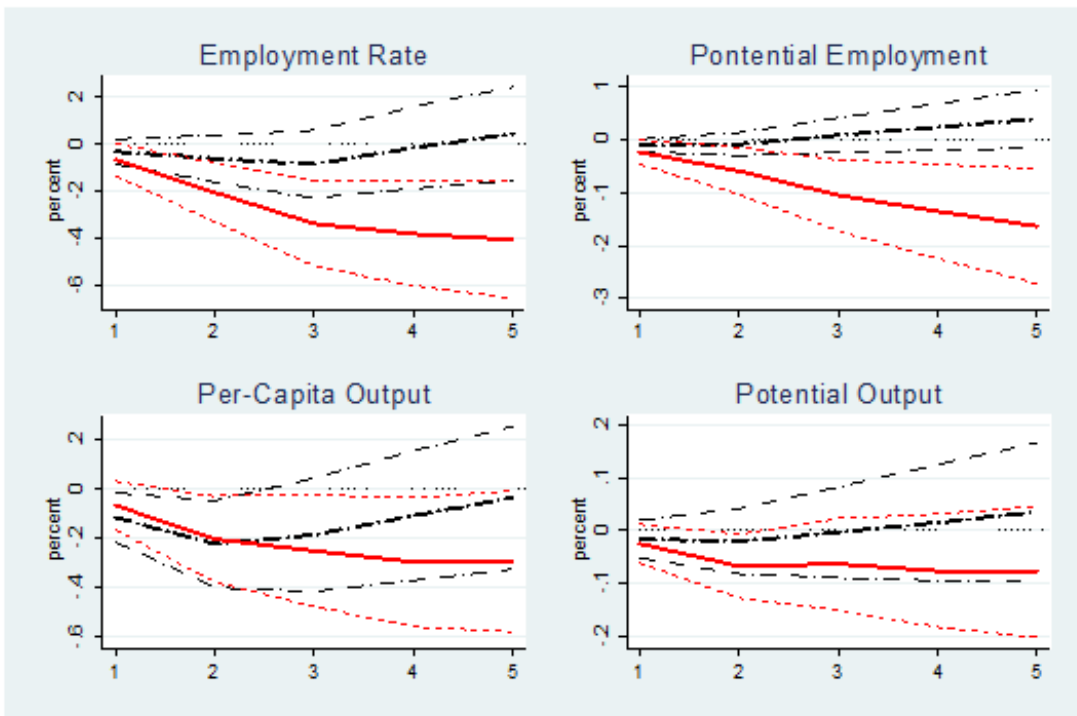
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.18: IRFs considering $\mu_{0,1}^{capb}$ (left panel) and $\mu_{0,1}^g$ (right panel)



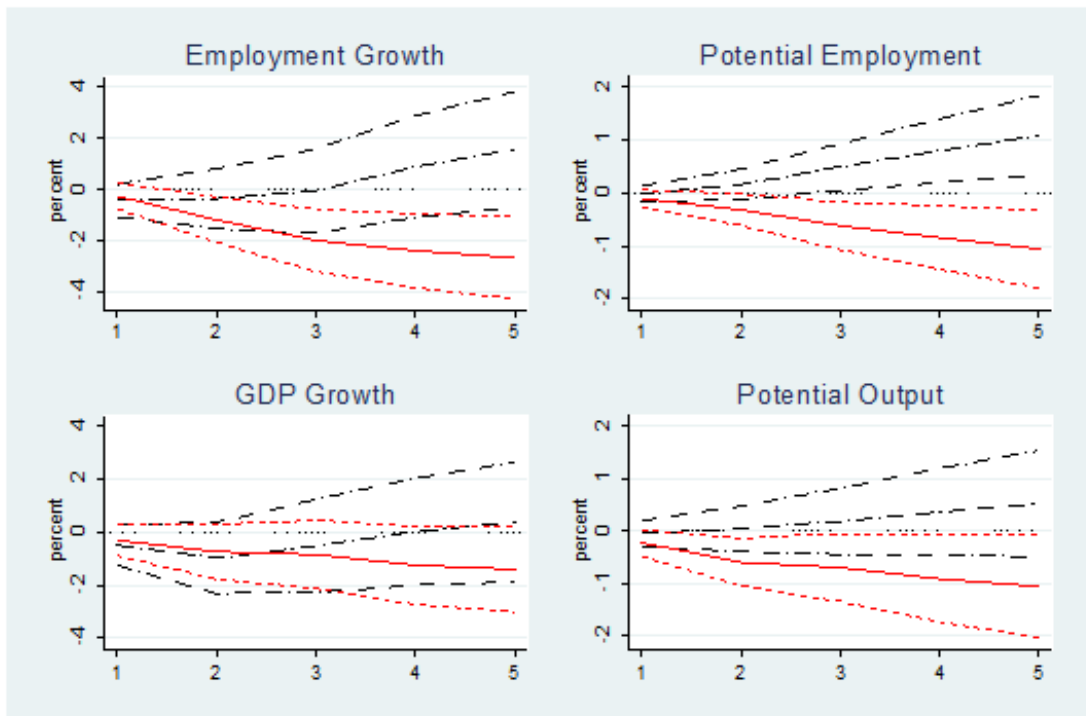
Note. Data are for all 16 countries, period 1985-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.19: IRFs considering $e_{i,t}^{a,t}$ and $e_{i,t}^{a,g}$



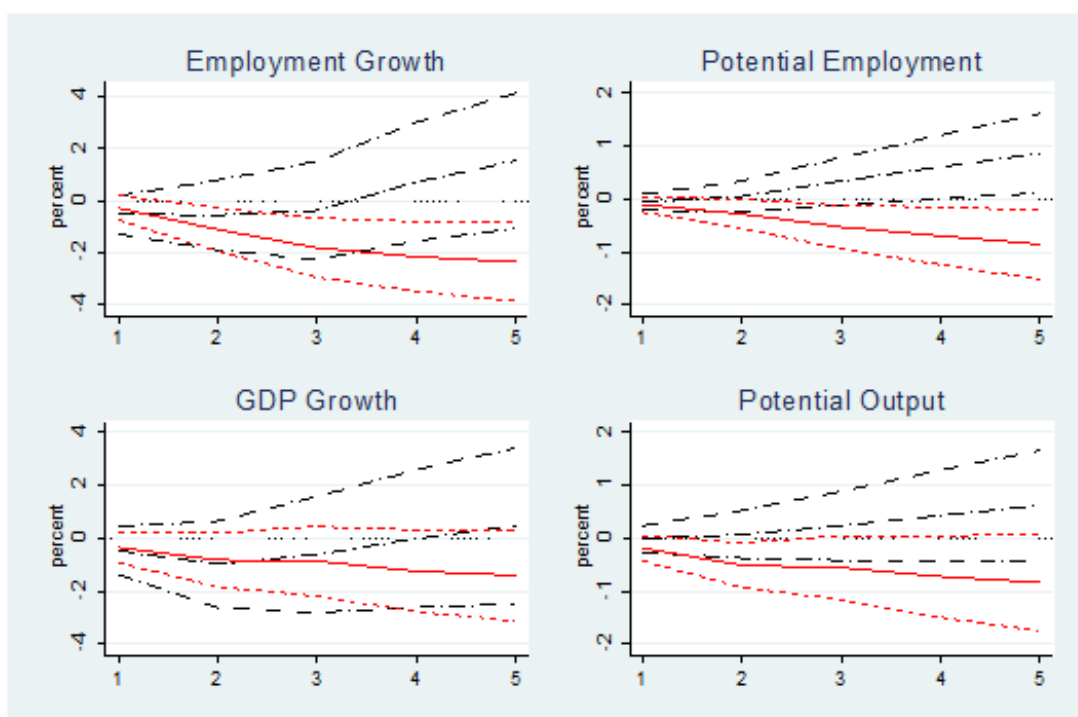
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.20: Effects of public expenditure cuts (black line) and taxation increases (red line) 1978-2007



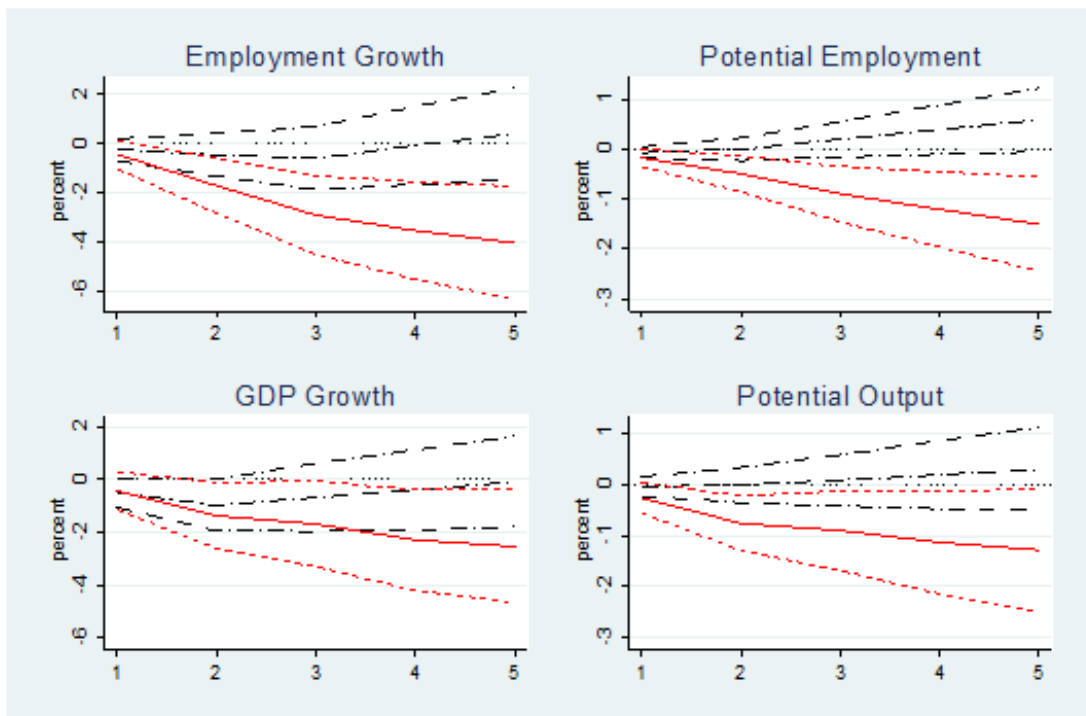
Note. Data are for all 16 countries, period 1978-2007. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.21: Effects of public expenditure cuts (black line) and taxation increases (red line) 1978-2007 adding Ireland



Note. Data are for all 16 countries, period 1978-2007. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.22: IRF for Employment and real GDP Excluding Canada and Germany



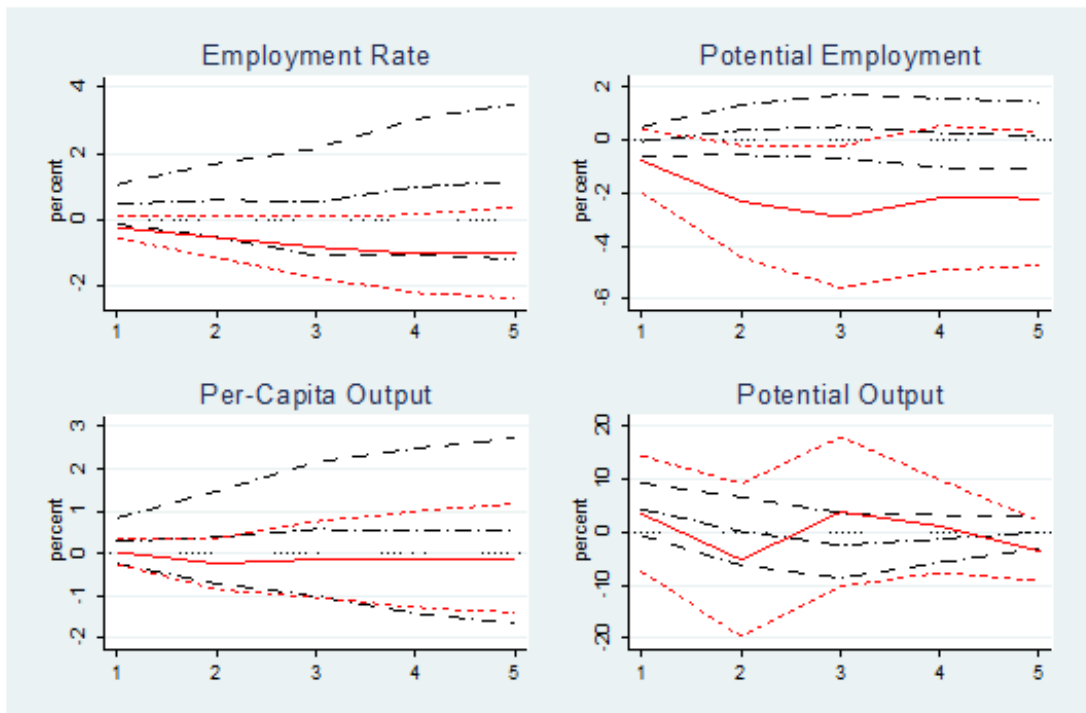
Note. Data are for 14 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.23: Low Employment Protection Level - Countries yearly below the median



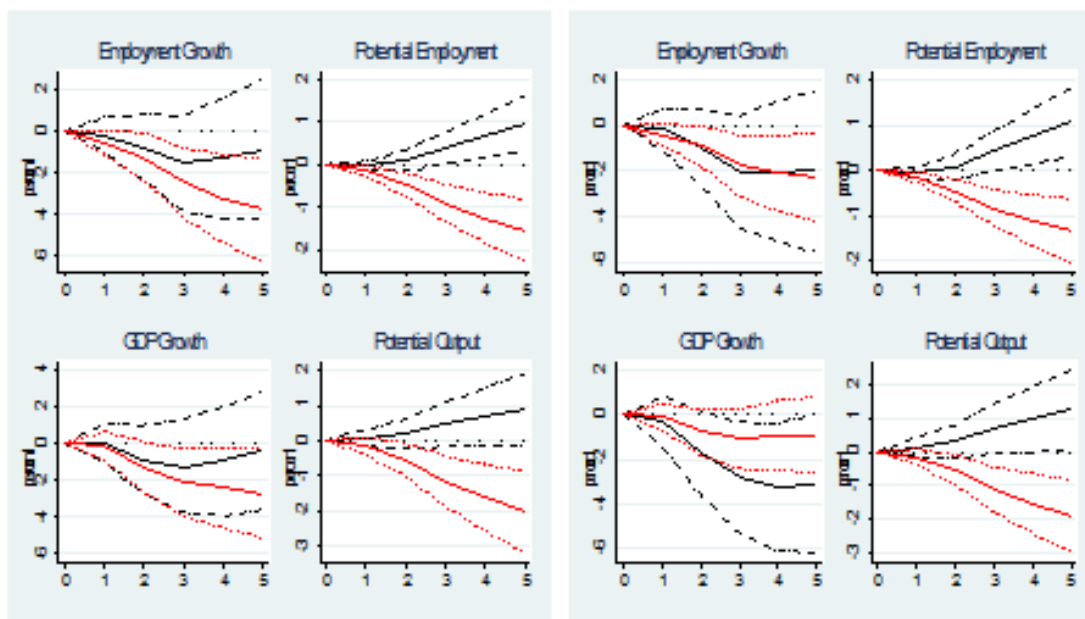
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.24: High Employment Protection Level - Countries yearly above the median



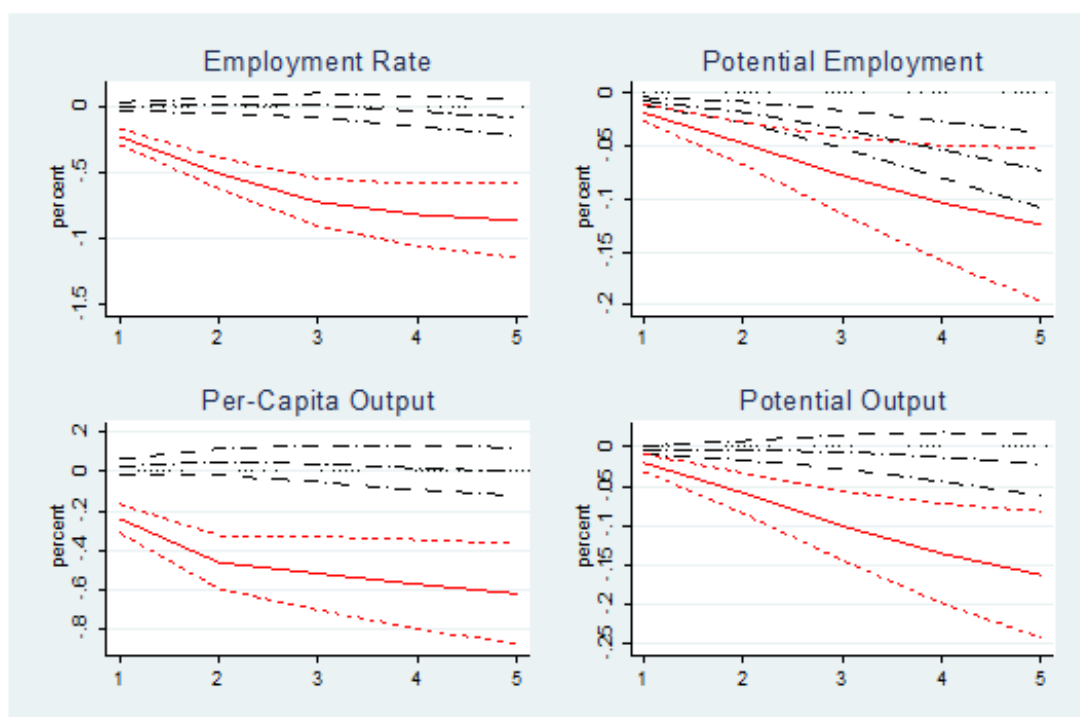
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.25: FAVAR with First (left panel) and Second (right panel) Principal Component



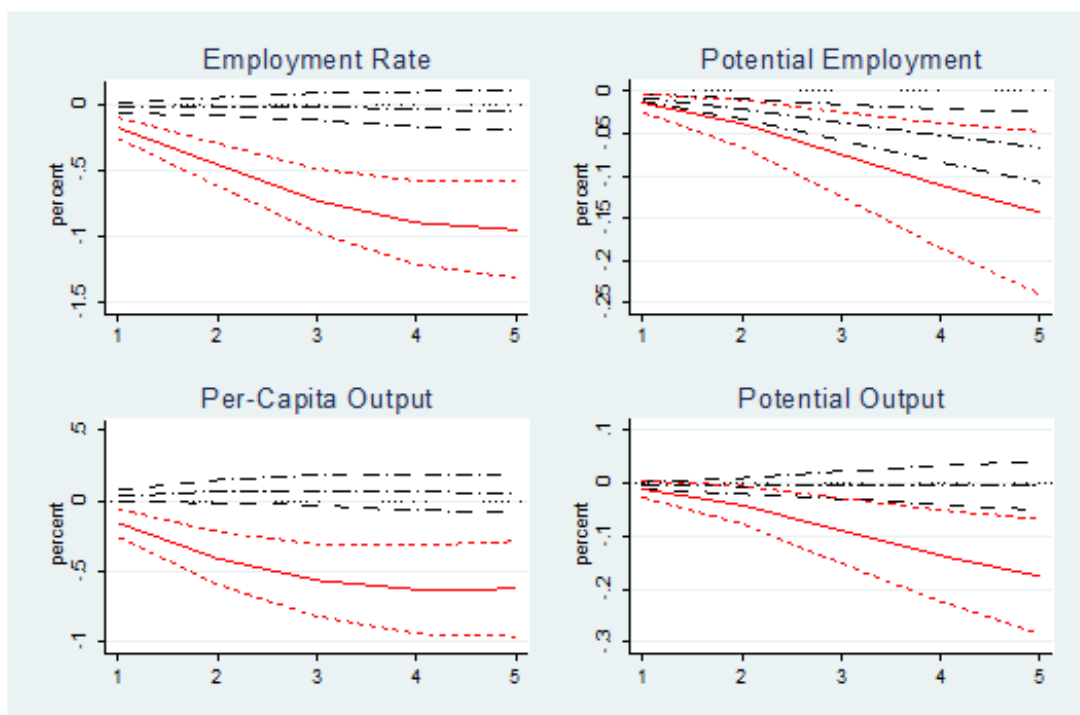
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.26: Forecast errors public expenditure cuts (black line) and taxation increases (red line)



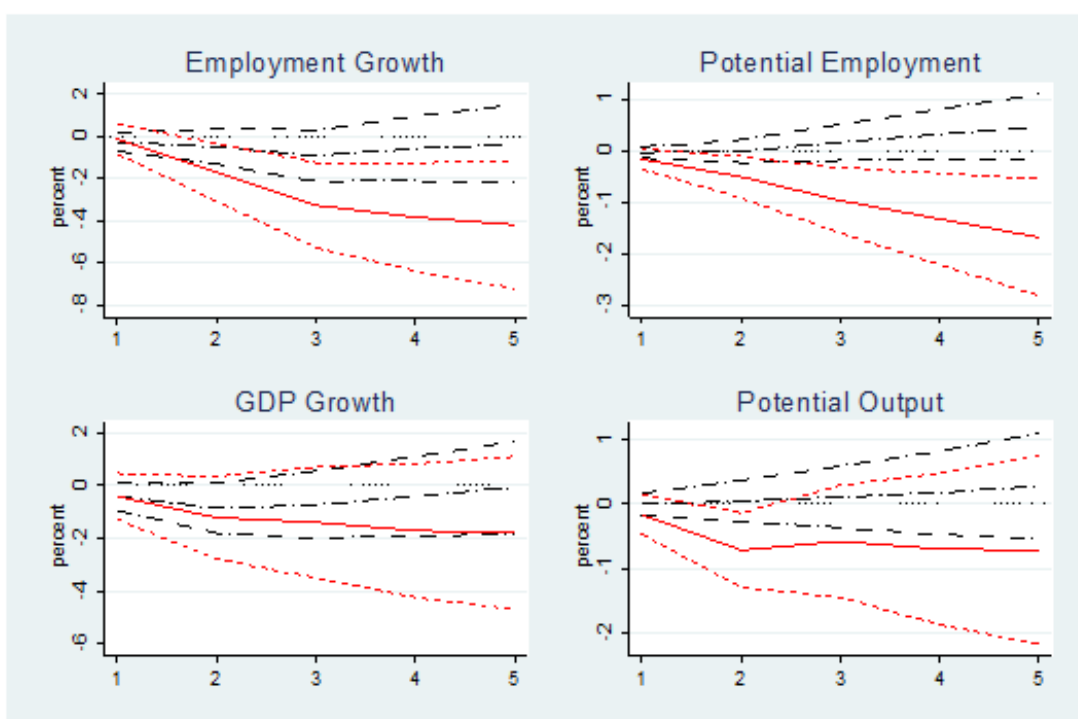
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.27: Nowcast errors public expenditure cuts (black line) and taxation increases (red line)



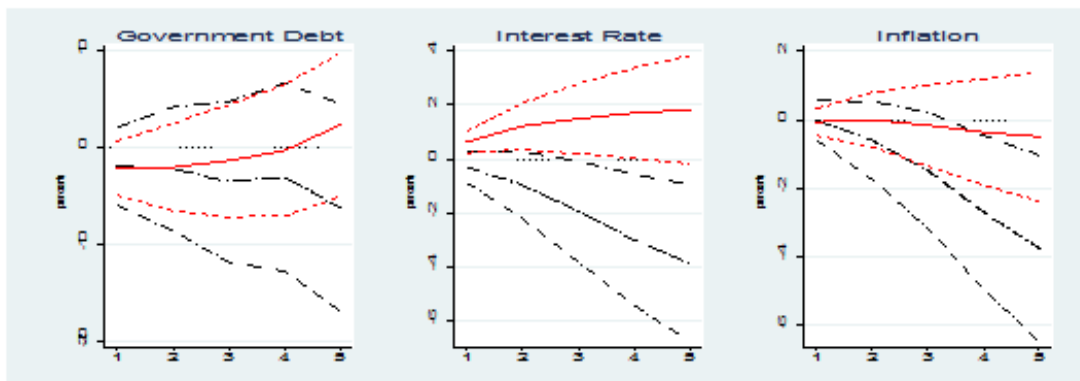
Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.28: IRF Large Consolidations (>1% GDP)



Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Figure 1.29: Effects of public expenditure cuts (black line) and taxation increases (red line)



Note. Data are for all 16 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports point estimates and 90% confidence intervals, in red dashed lines for taxation and black dash-point lines for expenditure. All specification contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy

Chapter 2

A new estimation method for employment trend.¹

2.1 Introduction

Estimating the potential and cyclical component of labor market variables is of crucial importance for economic research. Recent studies have tried to quantify the effectiveness of policy intervention on the process of job creation (Monacelli et al. 2010, Bruckner and Pappa 2012, and Turrini 2013), and have focused on the ability of discretionary policies (both fiscal and monetary) to reduce the cyclical component of unemployment. This is usually estimated as the deviation of the unemployment rate from the NAIRU². However, methodologies employed to identify the cyclical component, such as purely statistical filtering techniques (e.g. univariate or multivariate HP filters) and more structural model approaches (see Borio et al. 2014 for a discussion), suffer of some shortcomings, both conceptual and methodological.

Regarding conceptual issues, simple filtering techniques do not capture the demographic and social factors that are strongly modifying the composition of the population, and will deeply change its future structure. Social phenomena such as population aging or the increase of female participation strongly affect

¹This chapter is coauthored with Stefano Scalone, University of Verona

²Non-Accelerating Inflation Rate of Unemployment.

the labor force; these are long-term dynamics that slowly modify and smooth the age composition of the labor force and push it towards a different equilibrium. The aggregate level of employment represents the average behavior of different population cohorts dynamics, which can be similar as well as divergent. Traditional estimation methods are unable to account for these different dynamics, and for their consequences on the labor market.³

On the methodological side, recent contributions by Borio et al. (2013 and 2014) underlined how augmenting the measurement equation with financial variables in a state-space framework to estimate potential variables (in their case GDP) potentially produces a more precise and robust estimate. However, as recent theoretical studies (Monacelli et al. 2011; Petrosky-Nadeau 2014; Garín 2015; and Miao et al. 2016) highlight, changes in credit conditions also directly affect the labor market. Therefore, we add to our state-space model some proxies for the financial cycle in order to filter out their possible contribution to cyclical employment movements.

What we propose here is a two-step estimation method for the employment trend that tries to solve some of these issues. We estimate trend employment using a Kalman filter procedure in a state-space framework, and conduct the estimation separately for each age-gender cohort. We then aggregate the gender-cohort specific series, to obtain the final time series for the population trend employment. This procedure allows us to account for the structural demographic changes society is currently experiencing.

The second important innovation lies in the state-space model formulation. We augment the measurement equation to include some proxies for the financial cycle, à la Borio (2012). In this way, we retrieve a cleaner and cycle-free estimated series that is significantly more precise and robust over time with respect to other methodologies commonly used - such as simple HP or Kalman filters applied on employment as a whole: it reduces the indeterminacy of estimation, and produces a more accurate quantification of the cyclical and trend components (for instance, reducing the well-known end-point problem).⁴

³On this see e.g. Gordon (2014) and Hall (2014), whose works investigate how population aging can modify the labor market participation rates, and thus induce a different employment potential level.

⁴This refers to the unreliability of traditional filters near the endpoints of the data set.

A simple Kalman Filter (KF) that directly filters the total value of employment usually estimates a smaller fall in employment cyclical component during the Great Recession, with respect to the level we obtain aggregating the single cohorts estimates. This result confirms that a filter applied without considering the cohorts is unable to cope with structural changes in labor force due to demographic trends, and ends up underestimating the cyclical component when the share of elders is increasing over time.

Our methodology builds on Borio et al. (2012), which uses a similar technique to improve the estimation process of potential output. Their augmented KF embeds proxies for the cycle, and filters out eventual cyclical components from the estimated series. We also include in our state-space specification some extra variables to filter out the cyclical component of the employment trend, and we expect these variables to affect mostly the marginal cohorts of workers (young men and young to middle-aged women; see on this Krusell et al. 2010 and Elsbay et al. 2013).

The paper is organized as follows: section 2 presents the literature review on the topic, section 3 introduces the main issues that undermine the typical estimation methods; section 4 describes our model and the estimation process, section 5 presents our results and section 6 concludes.

2.2 Literature Review

This paper encompasses two separate branches of literature: one discussing the estimation of potential unobserved variables, and one which tries to quantify the economic impact of the structural changes in the composition of the labor force.

The first strand of literature addresses the role that social phenomena such as aging, female labor participation, and schooling have for the structure of the labor market itself. Pissarides (1989) was among the first to highlight the importance of population aging to economic research, in his innovative work analysing the impact of demographic factors on the labor market. Among his theoretical findings, the robust result that population aging contributes to reduce unemployment is probably the most relevant with respect to our work. However, the topic had then been forgotten for more than a decade. It is in fact only in the early 2000s

that Börsch-Supan's (2001) work shed more light on the influence of demographic factors on unemployment. His models resulted in insights on how the intervention of the policy maker can mitigate the effects of aging on the labor market. The interest on the topic remained sporadic, and most of the works have focused on the general economic impact of population aging (see e.g. Bloom et al. 2011).

However, the interest in the role of aging in the labor market behavior has recently renewed. Hall (2014) showed that about half of the 2007-14 decline in labor-force participation is due to the aging of the population as the baby-boom generation retired. Similarly, Cline and Nolan (2014), using a simple regression model for participation rates found that demographic factors can account for up to two thirds of the changes in labor force participation in the US (mostly due to population aging). Surprisingly, many policy discussions do consider this issue, while only few academic studies underline the importance of this cause. In addition, existing measures to estimate trend employment and labor force participation rates do not have the ability to fully capture the impact of demographic changes.

On the other side, the discussion has been fervent in the development of innovative methods to estimate potential variables. In this literature, two very different approaches co-exist: we have fully-specified structural models, mainly developed by supranational institutions like the IMF or the European Commission (Havik et al., 2014), and which deliver precise estimates but that tend to be strongly model-dependent, and research papers that dig into the statistical methodology to improve the ways to deal with the non-observability of potential variables (for a full literature review on the different estimation method techniques, see Cotis et al. 2004).

Because of the relevance of the estimation of the NAIRU for the policy maker, the literature on this topic is vast; we here focus more narrowly on the use of state-space modeling to estimate potential variables. We have to highlight as the usage smoothing techniques to estimate the NAIRU has been wide in the last few years: see Schumacher (2008), Fitzenberger et al. (2007), Apel and Jansson (1999ab), Laubach (2001), Fabiani and Mestre (2000, 2004) among others. In particular, the state-space framework is among the most commonly used: Basistha and Startz (2004) and Staiger et al. (1997) estimate the US NAIRU in different state-space frameworks, while Greenslade et al. (2003) focus on the UK in a slightly different

statistical framework.

There have already been some attempts to refine the estimation method of the NAIRU, with Kalman Filter techniques performing better than HP in this context (see the discussion in Borio et al., 2012). At the same time, we are not the first ones to try to estimate long-term trend employment (Carone, 2005, develops a two-step methodology to make projections on the labor supply of the 25 EU member states), to underline the link between labor force participation and economic variables (Daly 2007; Monacelli et al. 2011; Petrosky-Nadeau 2014; Garín 2015; and Miao et al. 2016) or to disaggregate potential to retrieve more precise estimates (Fleischman and Roberts, 2011). The innovation behind our paper is to bring together these branches of literature, and to unite them into a unique estimate for the long-term labor force, incorporating the structural brakes of the population via the estimation by cohort and gender and filtering out some proxies for the financial cycle.

2.3 Labor Market and Demography

Population aging is the result of a lower fertility rate - especially in developed countries, see figure (2.1)- combined with a higher life expectancy - in particular that of men is rapidly catching up with that of women, see (2.2). Moreover, with "baby boomers" reaching the age of retirement, the ratio between workers and pensioners is falling down. This trend is putting increasing pressure on pension systems in most industrialized countries, and constraining the governments fiscal stance.

Another important factor affecting the dynamics of employment is the steadily increasing participation of women in the job market. This trend has at least two important consequences: one is the direct increase of labor supply, which contributes to enlarge the labor force and the level of employment. Not surprisingly, the women employment kept on increasing during the recent global economic downturn (and decreased only slightly, right after the crisis, see (2.3)).

The second and more recent phenomenon is strongly related to periods of crisis: when one member of the family unit remains unemployed, the other - often a woman - is likely to enter the labor force (Eltis et al., 2013).

Figure 2.1: Women fertility rate

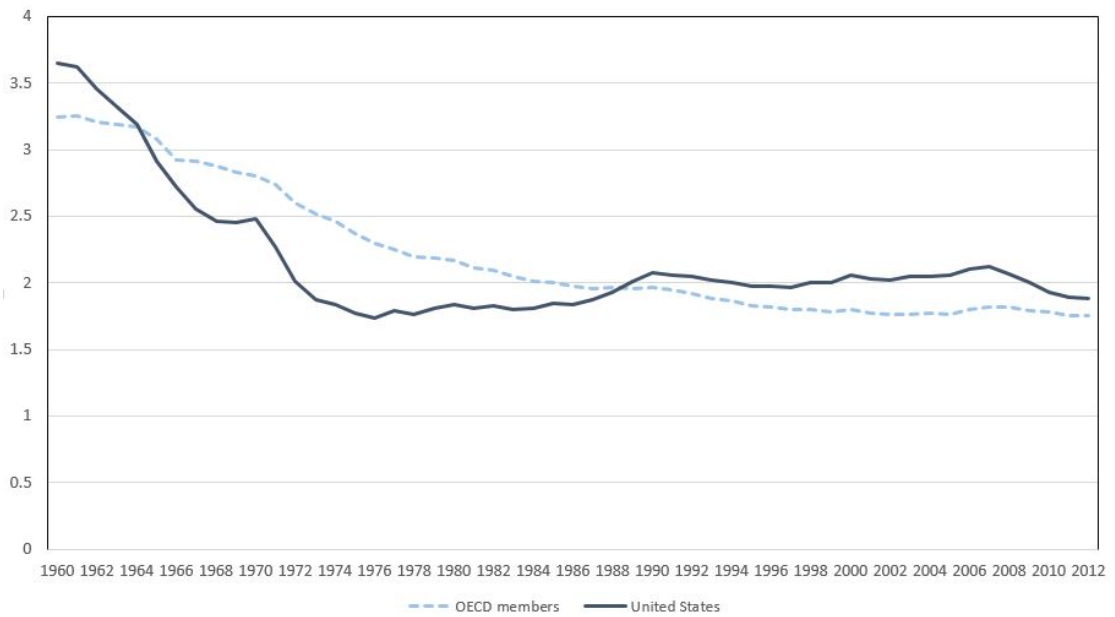
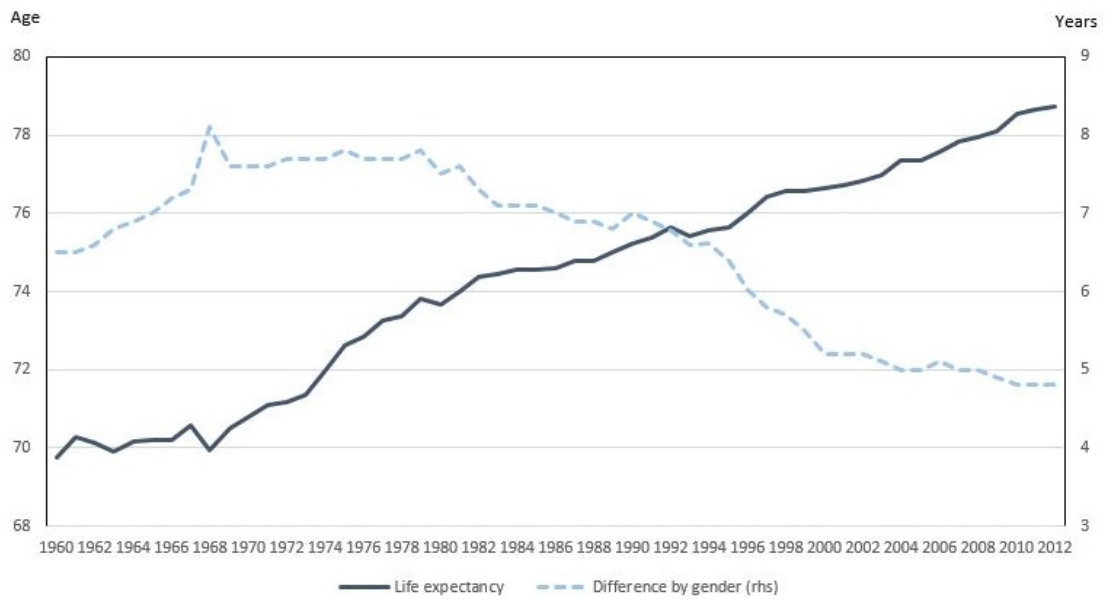
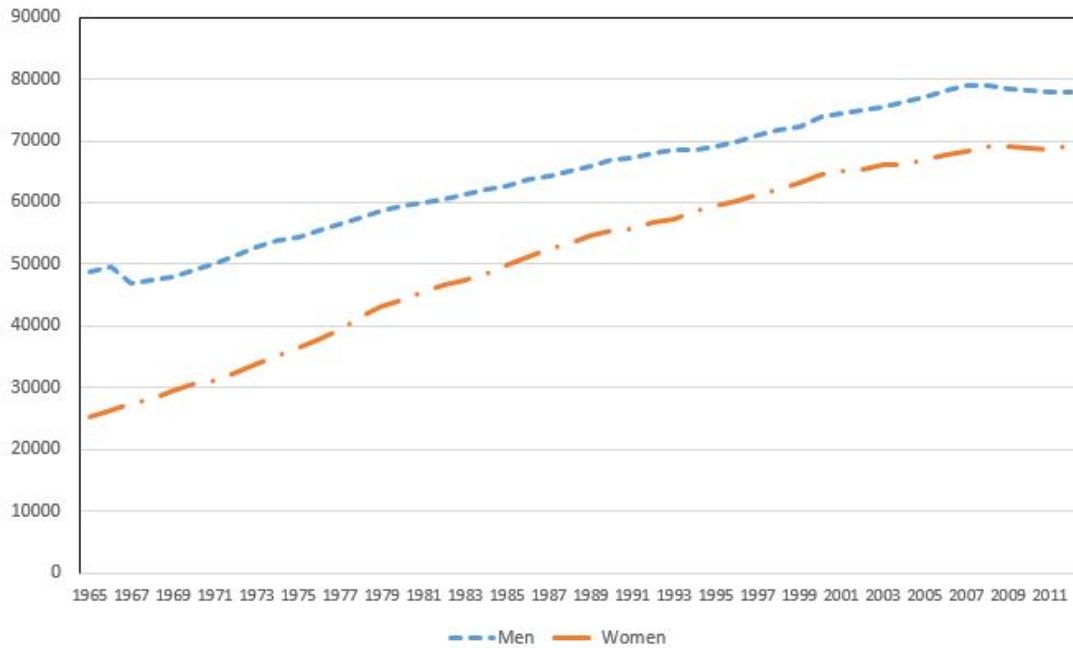


Figure 2.2: Life expectancy and gender difference, United States



The increasing level of education is also contributing to modify the composition of employment, in particular for the youngest cohorts: secondary education and

Figure 2.3: Labor force, United States



university delay the entrance of young workers into the labor market (CEA 2016). Our methodology, which estimates the potential level of employment for single cohorts, helps account for all these phenomena.

When analyzing the labor market, researchers tend to underestimate the role of demographic changes in modifying the composition of the labor force. The process of population aging creates a long term dynamic which - together with migrations - is deeply modifying the structure of the labor force.

In addition, the different population cohorts are affected by this process in a different way. It is reasonable that in younger cohorts potential employment reduced because of schooling and demography, while in the middle cohorts potential employment increased because of baby-boomers aging. The most common estimation methods fail to account for these long-term dynamics, and their estimates may be biased.

Instead, by estimating the potential employment within the single cohorts, we account for many of the causes of the long-term transition that are affecting the labor market: population aging, low fertility rates, migration, and schooling. For

instance, the equilibrium measure of the male labor force in the 19-24 years old cohort will slowly embody the reduction of both population and people actively looking for a job due to schooling and fertility. Furthermore, the business cycle and other structural dynamics should differently affect the probability to find a job for agents in different cohorts (Krusell et al. 2010; Elsby et al. 2013). Once we aggregate all cohorts in our final estimation, the method will incorporate the long-term population dynamics in the results, with a large gain both in the precision of the identification of the potential employment, and in the ability of the model to produce reliable projections of the future employment.

2.4 Methodology

This study aims to increase the accuracy of potential employment estimates. In order to do so, we need to employ a methodology suitable to correctly disentangle the cyclical component of a variable from its trend. Three techniques are commonly used by scholars and policy makers to achieve this goal⁵.

A first strand of literature adopts a purely statistical approach to estimate a reduced form relation, as the Hodrick-Prescott filter or the estimation of time-series regressions. A second group of studies examine the equilibrium - or full-utilisation - level of the variables estimating calibrated theoretical models. In these models the extent of the gap between the equilibrium and the actual level of the variables strictly depends on the presence of frictions, or rationing, in the economic system. A third set of researches is a compromise between these two approaches: while they allow the potential component to be estimated with statistical techniques, they also rely on theoretical recommendations to impose certain identifying constraints on the path of the estimated variable.⁶

We have to highlight as the purely statistical approach and the model approach suffer from crucial problems. On the one hand, in theoretical model the frictions are considered exogenous, and hence cannot be a target measure for the policy-

⁵For an extensive discussion of the evolution of the methodologies to disentangle potential and cyclical components of economic variables - and on the concept of "potential" and "cyclical" itself - see, among others, Borio et al. (2012, 2014).

⁶This methodology has been widely used for the estimation of the NAIRU, see Turner et al. (2001).

makers. As a consequence, different assumptions on the presence and nature of these frictions lead to different results (Borio et al. 2014).

On the other, the reduced form univariate model (such as the HP filter, the Baxter and King filter, or other unobserved component methods) suffers from the well-known end-point problem: the reliability of the end-of-the-sample estimates is limited. This concern affects the usefulness of the results for real-time analysis or policy decisions. Moreover, in the most used technique - the HP filter - the amplitude of the frequency is exogenously set by the researcher.

For these reasons Borio et al. (2012) proposed an alternative estimation process, using a refined version of the Kalman Filter (KF).⁷ The higher accuracy of the KF with respect to the other procedures listed above is ensured by two different facts. First, the frequencies are no longer set exogenously by the researcher, but computed by the filter itself with an estimation update algorithm that enlarges the convergence speed to the true signal-to-noise ratio. The second is the possibility to make the filter better fit the data, by adding some additional explanatory variables - that we will call conditioning variables - to the estimation process.

This procedure assures transparency in the estimation methodology and simplicity compared with structural models. The explanatory variables that lack statistical significance are excluded from the estimated model since they fail in helping the filter to rule out the cyclical component. This can be tested with a standard *t-statistic*. Therefore, it is the model itself suggesting which variables are significant and have therefore to be included.

We include in the estimated model some proxies for the financial cycle. The rationale behind this is that the presence of financial variables can significantly improve the identification, provided the statistical significance of the variables embedded in the model. This hypothesis is supported by recent studies on the role of financial cycle in determining labor market movements.

As Monacelli et al. (2011), Petrosky-Nadeau (2014), and Garín (2015) point out, changes in credit conditions affect the bargaining power of firms. According to these models, firms will borrow more when the credit conditions are favorable, increasing their bargaining power in the labor market. This, in turn, will increase

⁷Unobservable Components Models have been widely used in economics since Harvey (1989) contribution

their willingness to hire. Vice versa, when credit conditions worsen, firms' willingness to hire will decrease. This result is confirmed by studies like Miao et al. (2016), where the collapse of a credit bubble produces high and persistent unemployment.

In addition, as suggested by the Okun's law, any shocks affecting the business cycle have the ability to modify the level of (un)employment. Therefore, the documented relation between credit and output (Borio 2014) also spreads to the labor market.

Looking at our model in detail, the Kalman filter can be represented by a state-space model. This model will account for a *state equation* of the form:

$$\Delta e_t^* = \beta_1 \Delta e_{t-1}^* + \epsilon_{1,t} \quad (2.1)$$

and a *measurement equation*:

$$e_t = e_t^* + \beta_2(e_{t-1} - e_{t-1}^*) + \gamma' x_t + \epsilon_{2,t} \quad (2.2)$$

where $e_t = \ln(E_t)$ represents the log of employment, e^* is its potential level, and Δe_t^* is its cyclical component. $\epsilon_{1,t}$ and $\epsilon_{2,t}$ are normally and independently distributed errors with zero mean and variance σ_1^2 and σ_2^2 .⁸ Finally, x_t is the vector including our the proxies for the financial and the business cycles - the interest rate (as proxy for the monetary policy), the inflation rate, the potential output, and the credit-to-gdp ratio.⁹

The KF jointly minimises the squared residuals in (2.1) and (2.2), since it calculates the least squares forecasts for the variables in the model. As a result, the solution for e^* will depend on the ratio of the two variances, which is called *signal-to-noise ratio* and is defined as:

⁸For robustness, we also perform the estimation including a further lag in equation (2.1), which takes then the form:

$$\Delta e_t^* = \beta_1 \Delta e_{t-1}^* + \beta_3 \Delta e_{t-2}^* + \epsilon_{1,t}$$

To check whether β_1 is able to capture the whole persistence of the model. The results do not change substantially, as the beta is not significant.

⁹For further details on variables source and coverage, see the Appendix A. On the relevance of potential output for business see Borio et al. 2012.

$$\lambda_1 = \frac{\sigma_1^2}{\sigma_2^2} \quad (2.3)$$

The equations play a different role. Equation (2.1) defines the growth of the variable's potential level as an AR(1), with a persistency determined by β_1 . Equation (2.3) allows for protracted one-sided deviation of potential employment estimates from the level of actual employment.

Equation (2.2) is the measurement equation. It anchors potential to actual employment, imposing that their difference is described by an AR(1) process where a vector of proxy for the financial and the business cycles x_t carries significant information. The idea behind equation (2.2) is that the cyclical component, which fills the gap between the trend component of the variable and its actual value, is more than a normally distributed error term, as supposed by filters such as the HP (Borio et al. 2014). As a consequence, in this state space model the measurement error has a well-defined behavior that might be better identified thanks to the conditioning variables included in the vector x_t .

Equation (2.3) determines the relative variability of the estimated employment equilibrium level, setting the extent to which the potential employment is anchored to its actual level. When λ_1 becomes very large, our equilibrium level of employment will approximate a linear trend. If λ_1 gets close to zero, there will be no difference between the estimated trend and the actual measure. In our exercise, the value of λ_1 is settled equal to 100 for the HP filter (which we use as a benchmark), while we restrict the signal-to-noise in the Kalman Filter, $\lambda_1 = \frac{\sigma_1^2}{\sigma_2^2}$, to be:

$$\frac{\text{var}(e_t - e_{(hp),t}^*)}{\text{var}(\Delta^2 e_{(hp),t}^*)} = \frac{\text{var}(e_t - e_{(kf),t}^*)}{\text{var}(\Delta^2 e_{(kf),t}^*)} \quad (2.4)$$

where $e_{(hp),t}^*$ and $e_{(kf),t}^*$ are the potential output from the HP filtering and the Kalman Filter, respectively. In this way we preserve the frequencies of HP and Kalman estimations to be the same.

We estimate our model for each age-gender cohort of US employment. Our dataset uses OECD data on employment for the United States in the period 1960-2015 (extraction: August 2016). The data are annual and divided by gender and

ages classes (the length of a class is 5 years, starting with the 19-24 and ending with the 65 and over).

In order to obtain the most parsimonious model, the choice of the variables to insert in equation (2.2) follows a *general-to-particular* procedure: we start by testing the significance of the variables (potential output, inflation rate, monetary policy, and government primary balance) in each cohort, which we considered meaningful to detect the cyclical component of the labor force, and their three lags (results are available upon request). It is then the model itself to suggest the eventual statistical significance of the various variables included. The variables included in the final specification are reported in table (2.2) - that will be discussed in the following sections -, with the respective estimated coefficients and *t* - statistic.

We want to highlight two crucial aspects of our methodology. First, - as expected - different cohorts present a different behavior of the trend component. For instance, the largest part of male cohorts (25-29 to 50-54) rose steadily until the 90s and then seem to stabilize. Moreover, also the cyclical frequency varies across cohorts. Therefore, the signal-to-noise ratio has to continuously adjust.

Second, building on Borio et al. (2012) the model is estimated with Bayesian techniques. We employed gamma distributions as priors for all coefficients, and inverted gamma distribution for the error terms. In our priors autoregressive coefficients are restricted to lie between 0 and 0.99, while coefficients for the conditioning variables is restricted to be positive. In order to assure a sufficient persistency for both the trend and cyclical components the prior means for the autoregressive coefficients is fixed, respectively, to 0.85 for the trend and 0.6 for the cyclical (both with a prior variance of 0.6), while for conditioning variables we opted for a prior mean of 0.3 (with a variance of 0.3).

We then aggregate the estimated potential and cyclical components of employment. The aggregation is done with a weighted average, where the weights are the shares of single cohorts in total employment - i.e., cohort employment over whole employment. The final result of these estimates is a new series for employment, with the cyclical component filtered out and able to account for the demographic factors modifying the composition of the labor force.

It is important to highlight that the conditioning variables should have a stable

mean. This characteristic is rarely present in economic time series, which also tend to show a high degree of cyclicity. Following Borio et al. (2012), we therefore decided to demean the conditioning variables via Cesàro means,¹⁰ which increase the rate of convergence of our model.

2.5 Results

2.5.1 Cohorts Estimations

In this section we report the main figures of our results. The Appendix contains all the estimation for the final model for each cohort, i.e., the complete list of results for the second step of our methodology, plus some additional robustness experiments.

Table (2.1) reports the statistical significance of our proxies. After the *general-to-specific* procedure we included, in different cohorts, the credit over gdp cr_t and the lag of inflation inf_{t-1} .¹¹ In addition, table (2.1) contains also the results for the autoregressive coefficients β_1 and β_2 (respectively for trend and cyclical components). For each coefficient, we provide both the estimated coefficients and their respective t-statistics in each cohort. As Borio et al. (2014) underline, the significance of a variable implies not only that this variable is correlated with the employment, but also with the *frequencies* implicitly set by the scaling factor.

Some considerations are in a row. First, male and female employment seems to be very reactive to credit conditions. Among the cohorts analyzed, only the 50-54 for male does not show significant coefficients (the critical values are 1.298 at 10%, 1.675 at 5%, and 2.400 at 1%). An increase in the credit over gdp level, which is a proxy of the presence of a boom in the credit market, is correlated with a higher (cyclical) employment level. Male and female prime-aged cohorts (15-19 and 20-24) are the ones with highest coefficients, followed by the 55-59

¹⁰Named after Ernesto Cesàro, who proved that if a sequence of numbers converge to a constant - the mean - the sequence of arithmetic means taken over the first n first elements also converge to the same constant.

¹¹In the variable-by-variable estimations also the lagged value of credit was significant. However, when we estimated the final model it always result not significant, and therefore we excluded it in the final specification

cohort for male and 65+ for female: not surprisingly, among males, the more affected by contemporaneous credit conditions are the prime aged - the ones that have to decide whether to enter the labor market or not, and those that have to decide whether to retire or not (cohort 55-59). These results are in line with the aforementioned literature on the role of credit in the behaviour of cyclical employment (Monacelli et al. 2011; Petrosky-Nadeau 2014 and Garín 2015; Miao 2016).

Business cycle conditions, approximated by the contemporaneous inflation rate, in general do not play a significant role in determining cyclical employment. We observe significant coefficients in the cohorts 55-59 and 40-44 for males; and 50-54, 30-34, and 15-19 for females: this indicates that middle-aged employees are more affected by the movements of the business cycle.

The estimations for β_1 lie between 0.87 and 0.97 and are strongly significant: as expected, the trend component is very persistent. β_2 coefficient is more variable and not always significant. However as highlighted by Borio et al. (2014) the presence of an autoregressive term enhances the estimation robustness, while does not modify the punctual result.

Figure (2.1) shows the results we obtain for male employment in the age cohort 15-19¹². Panel (a) shows the behavior of actual employment (blue line) compared with the KF estimated potential (red, dotted line) and the HP estimated potential level (yellow, pointed line). Panel (b) compares the HP cyclical component (red, dotted line) with the KF cyclical component (blue line). Panel (c) and (d) report the KF - Panel (c) - and HP - Panel (d) - cyclical components with a blue line, and the relative confidence bands, with a red pointed line.

¹²This has to be considered as an example of the gains of our methodology with respect to other techniques, such as the HP filter. As we said above, our full estimates are reported in the Appendix. We decided to not report the full set of estimates here both because they present a similar behavior among cohorts, and because our final goal is to discuss the most relevant characteristics of our methodology. The final estimated series of employment is however obviously available upon request.

Table 2.1: Regression results: significance of explanatory variables

Variable	Male Employment										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
β_1	0.871*** (14.348)	0.889*** (14.210)	0.903*** (2.455)	0.954*** (2.863)	0.945*** (3.574)	0.928*** (2.919)	0.946*** (3.732)	0.954*** (4.100)	0.911*** (6.768)	0.950*** (2.856)	0.974*** (4.225)
β_2	0.237* (1.478)	0.315** (1.786)	0.227 (1.100)	0.652 (0.163)	0.465 (1.275)	0.604 (0.146)	0.242 (0.151)	0.394** (2.000)	0.286* (1.305)	0.614 (0.154)	0.335 (1.720)
σ_t	1.283*** (3.047)	1.014*** (2.799)	0.311* (1.436)	0.807*** (3.735)	0.652*** (3.590)	0.898*** (4.372)	0.462*** (2.492)	0.114 (0.715)	0.882*** (6.312)	0.490** (2.217)	0.593** (2.230)
in_{t-1}	0.222 (0.471)	0.196 (0.505)	0.144 (0.638)	0.236 (1.056)	0.003 (0.017)	0.532*** (2.509)	0.108 (0.560)	0.163 (1.030)	0.608*** (4.140)	0.265 (1.125)	0.048 (0.169)
Female Employment											
Variable	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
β_1	0.905*** (17.326)	0.950*** (5.534)	0.946*** (2.839)	0.901*** (5.890)	0.948*** (4.652)	0.900*** (3.952)	0.954*** (3.966)	0.933*** (3.378)	0.954*** (4.012)	0.948*** (3.076)	0.949*** (8.508)
β_2	0.237* (1.586)	0.685*** (4.061)	0.586*** (3.417)	0.260 (1.092)	0.262 (1.283)	0.614 (0.153)	0.700 (0.175)	0.373** (2.148)	0.429* (1.377)	0.797*** (3.882)	0.682*** (3.624)
σ_t	1.527*** (4.503)	0.910*** (4.948)	0.623*** (3.416)	0.946*** (4.860)	0.982*** (5.353)	0.486*** (2.514)	0.331** (2.056)	0.621*** (3.543)	0.383*** (2.130)	0.402** (2.371)	0.991*** (3.736)
in_{t-1}	0.556* (1.478)	0.229 (1.220)	0.173 (0.875)	0.769 (4.149)	0.196*** (0.994)	0.045 (0.218)	0.095 (0.551)	0.714*** (4.019)	0.065 (0.347)	0.0638 (0.361)	0.1585 (0.617)

*Note: *10%, **5%, ***1% significance level. For each cohort is reported the explanatory variables estimated coefficient and the respective t-statistic in parenthesis.

The KF filter estimation of the cyclical component shows much narrower confidence intervals if compared to the HP estimates. This is a signal of an "identification gain", which is the result of the larger information set that enters the KF thanks to the proxies for the financial and business cycle.¹³

We can observe that the KF estimates a larger cyclical loss with respect to the HP during the last economic crises. Such result is in favor of a lower role of the 2008 recession in diminishing *potential* employment, while supports a larger impact on cyclical employment. In particular, the larger fall in cyclical employment is related to the inclusion of credit-over-GDP in the specification: excluding this from the specification the gap between HP and KF estimations reduces. This finding is similar to the one of Borio et al. (2012), where the inclusion of credit-to-gdp ratio among in the model increase the output gap in the Great Recession. Therefore, without considering the behavior of financial markets models fail in identify cyclical and trend components, overestimating the role of the recessions in influencing potential variables.

2.5.2 Aggregate Estimations

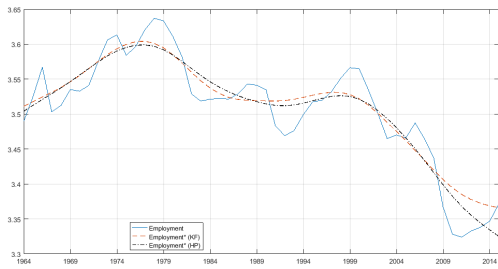
In this section we present the estimations of potential and cyclical employment obtained by aggregating the KF estimation results in each of the single cohorts. From now on, we will refer to these measures as "aggregate KF".

We divide this section into two parts: in the first, we discuss the performance of the aggregate KF compared with: a KF on total employment, to the potential level of employment as estimated by the OECD, and to "aggregate cohort" HP. In the second, we present the gains in terms of real-time estimation, i.e. to what extent the methodology helps in dealing with the end-point problem, and in explaining the behavior of other macro-variables. All the figures report logs of estimated and actual values.

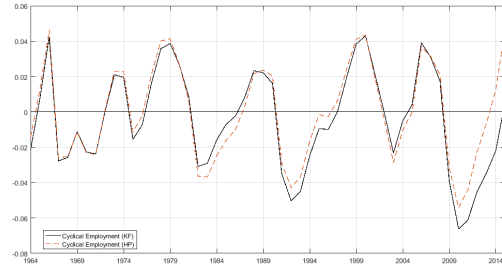
Figures (2.5) and (2.6) show the results for the aggregate KF compared with

¹³In the HP filter the cyclical component is imposed to be an erratic term. Specifically, in our model the estimated standard error of the cyclical component is 0.0271 for the HP and 0.0186 for the KF. This implies a lower indeterminacy of the cyclical component. In addition, the R^2 of the HP is 0.884 while is 0.945 for the KF, supporting that the latter explains a larger share of the employment variation.

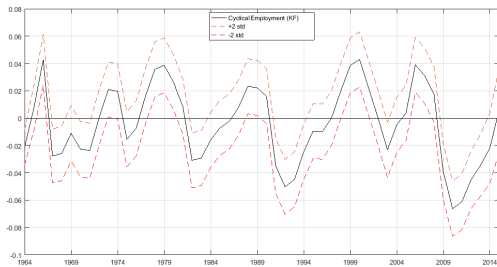
Figure 2.4: Male Employment cohort age 15-19 - US



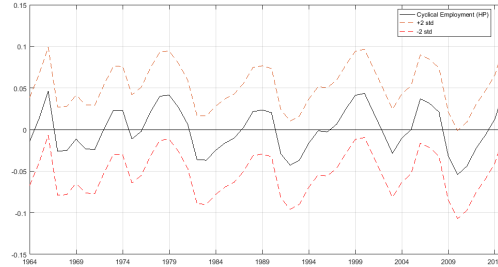
(a) Actual and Potential Employment



(b) KF and HP Cyclical Employment



(c) KF Cyclical Emp and Confidence Bands



(d) HP Cyclical Emp and Confidence Bands

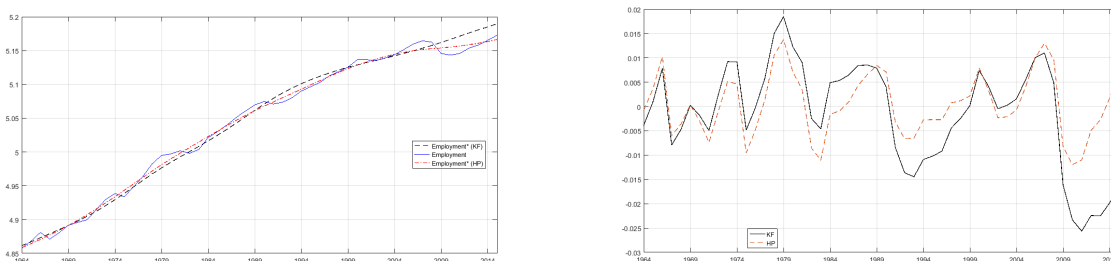
the aggregate HP and the OECD potential (and cyclical) employment measures, respectively.¹⁴ In both figures, the left panel reports the potential estimation (red pointed line the aggregate HP and OECD, black dotted line the KF), with the actual levels (blue, continuous line). The right panel reports the cyclical components without the confidence bands: the continuous black line is the estimation of the aggregate KF, while the red pointed line is the aggregate HP (Figure (2.5)) and OECD measure (Figure 2.6).

The the two estimations have patterns similar to the one in the cohort 15-19 analyzed above. Compared to the aggregate HP, the aggregate KF estimates a

¹⁴OECD potential (and cyclical) employment components are based on a mixed model, in which a NAIRU estimated with a statistical approach is then used in a model to estimate potential output and the other potential variables - see the Statistical Annex to the OECD Economic Outlook. This methodology has been recently modified, and data for the US covers the period 1980-2013 - more recently data only back to 1985.

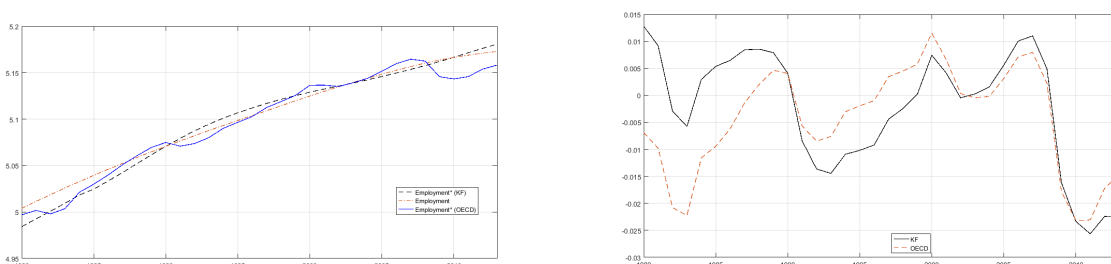
larger loss in the cyclical employment during the last economic crisis and while there are larger positive changes until 1991.

Figure 2.5: Aggregate KF VS Aggregate HP



(a) Actual and Potential Employment (KF and HP) (b) Aggregate KF and HP Cyclical Employment

Figure 2.6: Aggregate KF VS OECD Potential Employment



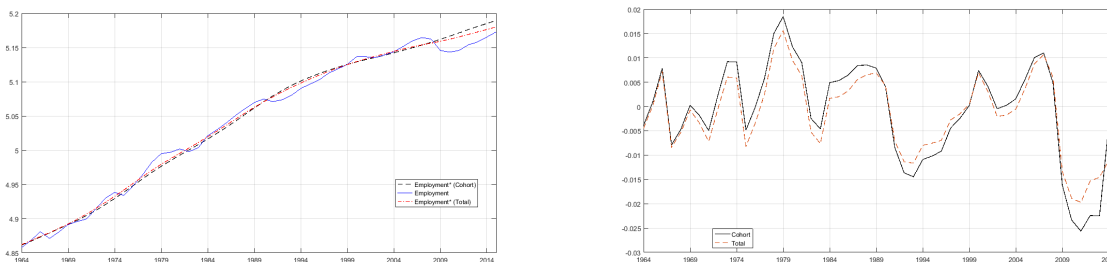
(a) Actual and Potential Emp (KF and OECD) (b) Aggregate KF and OECD Cyclical Employment

Our methodology also performs well with respect to the OECD potential employment estimations (Figure (2.6)). In particular, the gap among the two measures during the Great Recession is tiny compared to the one with the aggregate HP. On the contrary, until 1990, the OECD measure estimates a large cyclical employment loss, larger than the ones computed with both the aggregate KF and the aggregate HP.¹⁵

¹⁵This difference is wide: the OECD measure estimates a negative cyclical employment between 1980 and 1987 (aggregate HP: 1982-1985; aggregate KF 1982-1984), with a trough of -5%

Therefore, our estimations lie somewhere in between the ones provided by the other methodologies investigated. They perform reasonably well both at the end-point - which is a concern for the HP - with estimates similar to the OECD procedure, and the start-point, with estimates similar to the HP.

Figure 2.7: Aggregate KF VS Simple KF



(a) Actual and Potential Employment

(b) Aggregate and Simple KF Cyclical Employment

The aggregate KF estimates (Figure (2.7)) show a smoother path with respect to the standard KF ones applied to the aggregate employment. In particular, the cyclical employment (Figure (2.7), panel (b)) for the aggregate KF has a smoother path with lower oscillations. As a matter of fact, the cyclical effect of the financial crises is larger in the non-aggregate KF estimation. This result implies that without taking into account the population dynamics the filter is more sensible to deep recessions.

Table 2.2: Regression results: significance of cyclical components

Variable	Simple Regression				AR(2) Regression			
	Aggregate KF	Simple KF	Aggregate HP	OECD	Aggregate KF	Simple KF	Aggregate HP	OECD
<i>gdp</i>	0.467*	0.578	0.616	-0.365	0.594*	0.817	0.950	-0.349
<i>p-value</i>	(0.096)	(0.116)	(0.185)	(0.363)	(0.077)	(0.071)	(0.105)	(0.317)
<i>R</i> ²	[0.054]	[0.048]	[0.035]	[0.025]	[0.177]	[0.182]	[0.170]	[0.076]
<i>ngdp</i>	1.614***	1.836***	1.226*	0.490	1.447***	1.487***	1.333**	0.407
<i>p-value</i>	(0.000)	(0.000)	(0.055)	(0.274)	(0.004)	(0.009)	(0.016)	(0.434)
<i>R</i> ²	[0.334]	[0.253]	[0.071]	[0.037]	[0.560]	[0.551]	[0.534]	[0.153]
<i>inf</i>	1.454***	1.723***	1.189	1.001*	1.409***	1.403**	1.242***	0.706
<i>p-value</i>	(0.000)	(0.000)	(0.051)	(0.058)	(0.000)	(0.016)	(0.006)	(0.232)
<i>R</i> ²	[0.297]	[0.229]	[0.073]	[0.107]	[0.747]	[0.739]	[0.723]	[0.211]

*: 10%, **: 5%, ***: 1% significance level. The table reports estimated coefficients, standard errors (parenthesis) and *R*² (squared brackets).

(aggregate HP: -2.65%; aggregate KF: -1.1%. This, together with the fact that the procedure has been recently revised, casts doubts on the validity of these estimates - especially in the early part of the sample.

This intuition is confirmed by analyzing to what extent cyclical employment rate explains macro-variables behavior. This exercise consists in running some auxiliary regressions where growth rates of output (nominal and real) and inflation are regressed on the cyclical component of employment estimated with different techniques: the aggregate HP, the Kalman filter on aggregate data, the aggregate Kalman filter, and the OECD estimations (see table (2.2)). We employ two different estimation frameworks, a simple OLS and an AR(2), and we report estimated coefficients, p - values, and R^2 .

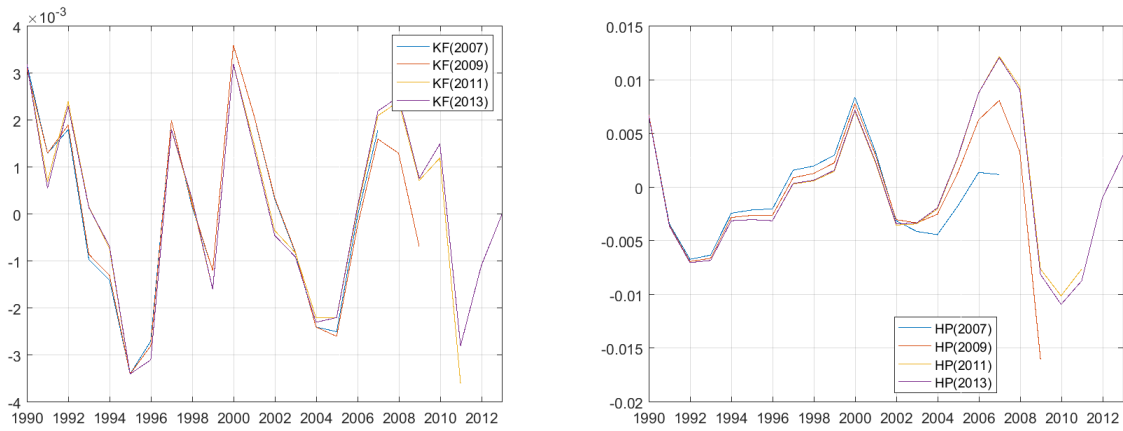
The regressions containing the series estimated via Kalman filter have larger and significant coefficients for nominal GDP and inflation, while they are smaller - but significant - for real GDP. The R^2 suggest that the regression employing the aggregate KF explains a larger portion of the variation of the dependent variable compared with the other methodologies, the only exception being the regression for output with AR(2) components, where the simple KF has a larger R^2 : however, in this case the coefficient for the simple KF is not significant, while the one for the aggregate KF is significant at 10%.

Another important feature of our estimation method is that it seems to be less subject to *ex-post* revisions, and to the addition of new data with respect to simple filtering. Figure (2.8) reports the in-sample estimations of the cyclical component of employment with various end-points. We present the results for three methodologies: the aggregate KF, the aggregate HP, and the OECD model. We evaluate the series at four different end-points: 2007, 2009, 2011, 2013 (we excluded the last two years because of missing observations in OECD time series).¹⁶

This exercise helps in evaluating the robustness of our model to the end-point problem and, consequently, in assessing its ability to provide reasonable real-time estimations. As Figure (2.8) illustrates, our model seems to perform well. Especially around the end of the sample, the aggregate KF is subject to lower *ex-post* revisions than the aggregate HP and the OECD model. In particular regarding the latter methodology, Figure (2.8) highlights the major issue of a model-based approach to potential/cycle components identification: when the model is revised,

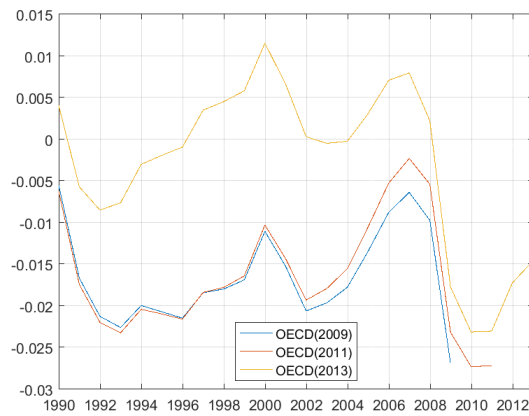
¹⁶Unfortunately, as we highlighted above, the OECD model has been subject to deep modifications both in 2008 and in 2012: we were not able to retrieve the contemporaneous estimations for cyclical employment in 2007.

Figure 2.8: Cyclical Employment Estimation at Different Horizons



(a) Aggregate KF

(b) Aggregate HP



(c) OECD Model

the estimates vary significantly.

2.6 Conclusion

In this paper we derive an innovative method for filtering the cyclical component out of employment. The estimation procedure consists of a state-space model in

which the measurement equation is augmented to include some proxies for the cycle. We performed this analysis by age cohort and gender, in order to be able to account for the demographic factors that are currently modifying the composition of the labor force (population aging, migration, increasing female participation). This allowed us to obtain an estimated series that is free of influence from both business cycle and demographic factors.

We compared the results of our methodology with the most important alternative: a simple Kalman Filter on aggregate employment, the HP filter, and the OECD cyclical employment. Our model outperforms this "traditional" methods under several dimensions. First, as the analysis of the R^2 obtained regressing these variables on the cyclical employment suggests, our aggregate Kalman Filter explains a larger portion of the variation of macro-variables growth compared with other methodologies. Second, it is more robust to in-time and ex-post revisions. Third, the indeterminacy of the cyclical component reduces, since the standard errors are generally smaller compared with the HP ones.

In addition, the proxy for the financial business cycle, the credit-over-gdp ratio, is significant in many of the cohorts analyzed. This supports a recent theoretical literature (Monacelli et al. 2011; Petrosky-Nadeau 2014; and Garín 2015) which suggest that the financial cycle can directly influence the labor market, and the job creation in particular.

The middle-aged cohort responds to variation in inflation - which we interpret as a proxy for the business cycle. This result is in line with most studies on the Phillips curve and the NAIRU, in finding that inflation contributes to explain the cyclical behavior of employment. Finally, our results suggest that the levels of employment among the youngest cohorts are the most closely related with the financial and business cycle. This last result is of particular interest for studies on labor market behavior, and it should be better investigated by future researches.

The results have to be refined in two directions. The first is methodological: in this framework, projecting the variables trend for a long period is complex and time-consuming. However, one of the aim of estimating unobserved components is to forecast the future behavior of the variables. This claims for a methodological improvement to obtain forecasts of the components in an immediate way.

The second is theoretical. The fact that prime-aged are more sensible to credit

conditions needs to be further investigated in future researches.

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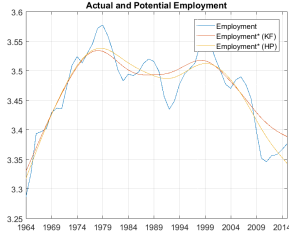
2.7 Appendix A: List of the variables

List of the variables used, including only the variables included in the final specification of the model:

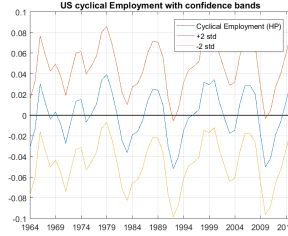
- *Inflation rate*: consumer price index, United States, annual data, St. Louis Fed,
- *Interest rate*: monetary policy interest rate, 3-month treasury bill, United States, annual data, St. Louis Fed,
- *Labor force and population*: disaggregated for gender and age cohorts, annual data, OECD-LFS statistics,
- *Credit to non-financial corporations*: credit to private non-financial sector (PNFS), annual data, Bank for International Settlements.
- *Output gap*: calculated as percent deviation of actual gdp from its potential, United States, quarterly data, St. Louis Fed.

2.8 Appendix B: Supplementary Results

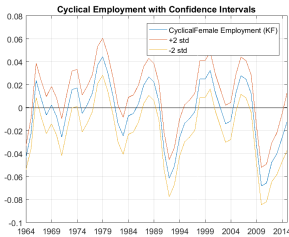
Figure 2.9: Results for females by age cohort 15-19 and 20-24



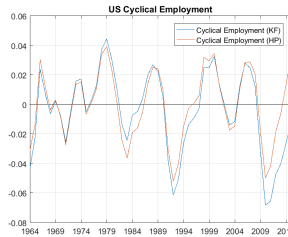
(a) 15-19 Actual and potential employment



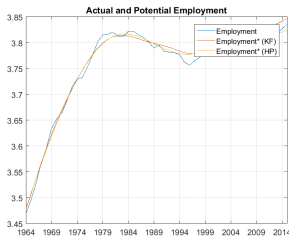
(b) 15-19 HP confidence bands



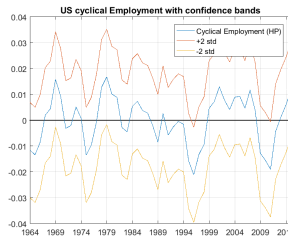
(c) 15-19 Actual and potential employment



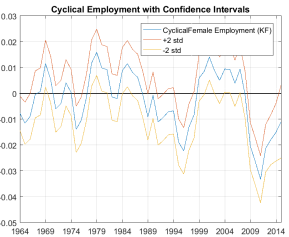
(d) 15-19 HP confidence bands



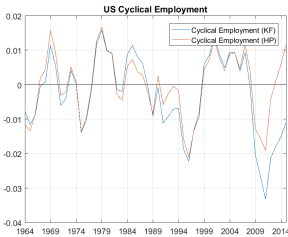
(e) 20-24 Actual and potential employment



(f) 20-24 HP confidence bands

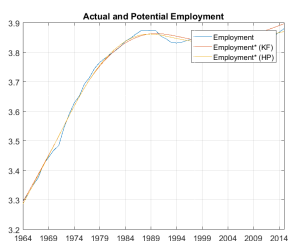


(g) 20-24 Actual and potential employment

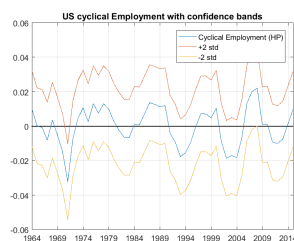


(h) 20-24 HP confidence bands

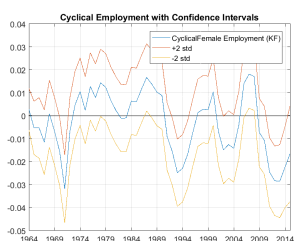
Figure 2.10: Results for females by age cohort 25-29 and 30-34



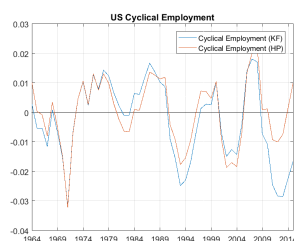
(a) 25-29 Actual and potential employment



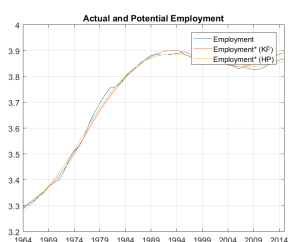
(b) 25-29 HP confidence bands



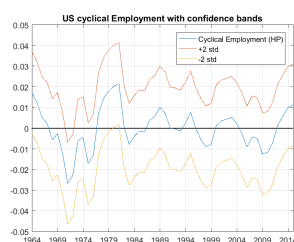
(c) 25-29 Actual and potential employment



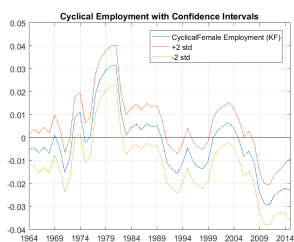
(d) 25-29 HP confidence bands



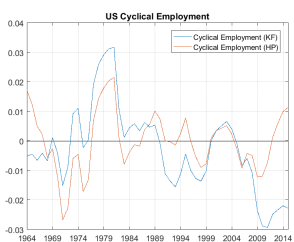
(e) 30-34 Actual and potential employment



(f) 30-34 HP confidence bands

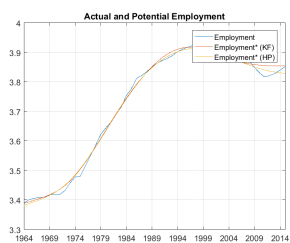


(g) 30-34 Actual and potential employment

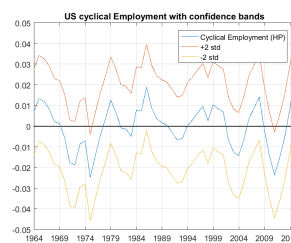


(h) 30-34 HP confidence bands

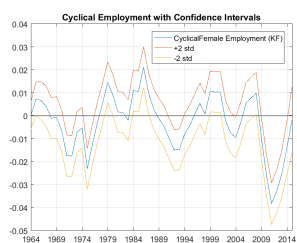
Figure 2.11: Results for females by age cohort 35-39 and 40-44



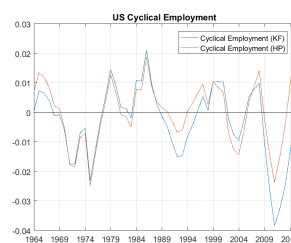
(a) 35-39 Actual and potential employment



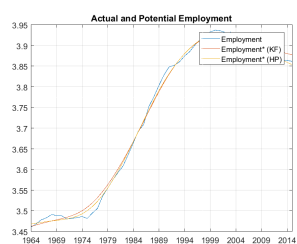
(b) 35-39 HP confidence bands



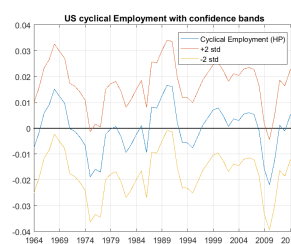
(c) 35-39 Actual and potential employment



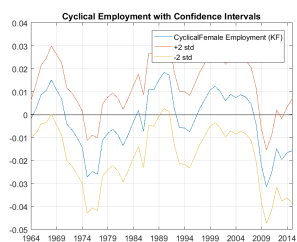
(d) 35-39 HP confidence bands



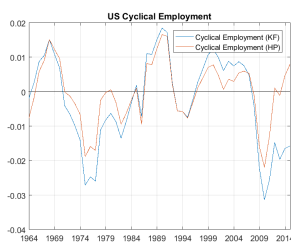
(e) 40-44 Actual and potential employment



(f) 40-44 HP confidence bands

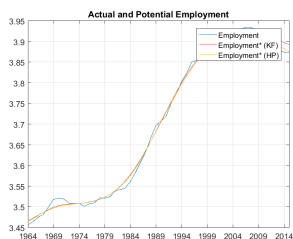


(g) 40-44 Actual and potential employment

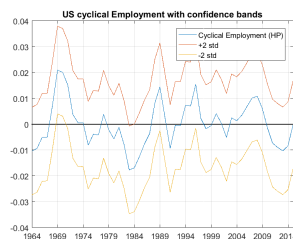


(h) 40-44 HP confidence bands

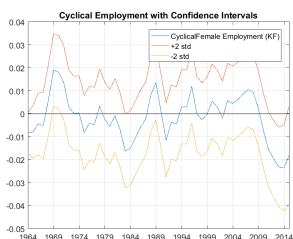
Figure 2.12: Results for females by age cohort 45-49 and 50-54



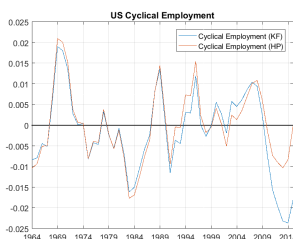
(a) 45-49 Actual and potential employment



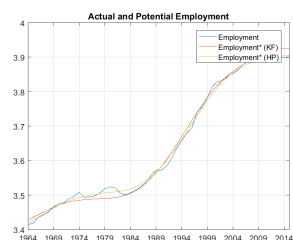
(b) 45-49 HP confidence bands



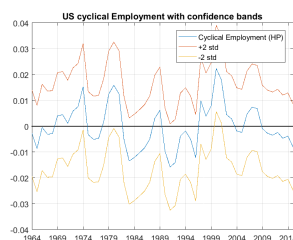
(c) 45-49 Actual and potential employment



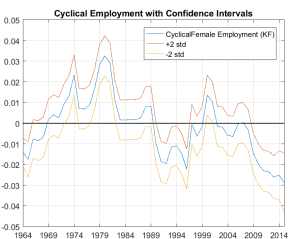
(d) 45-49 HP confidence bands



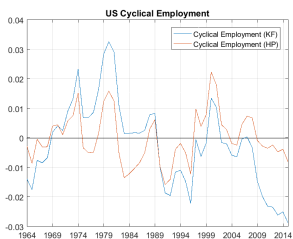
(e) 50-54 Actual and potential employment



(f) 50-54 HP confidence bands

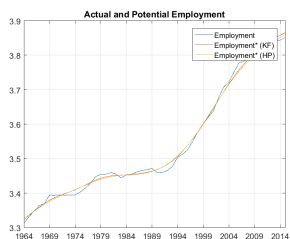


(g) 50-54 Actual and potential employment

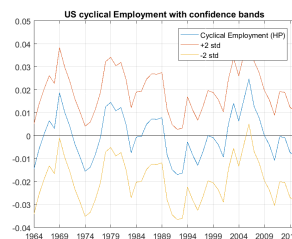


(h) 50-54 HP confidence bands

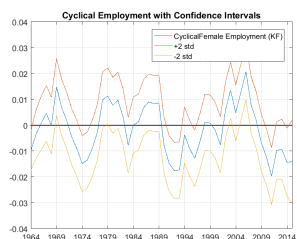
Figure 2.13: Results for females by age cohort 55-59 and 60-64



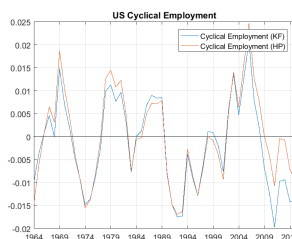
(a) 55-59 Actual and potential employment



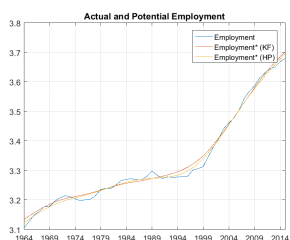
(b) 55-59 HP confidence bands



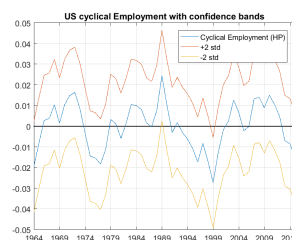
(c) 55-59 Actual and potential employment



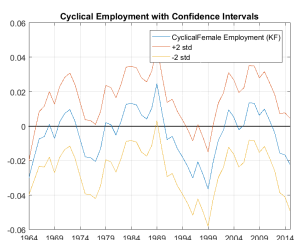
(d) 55-59 HP confidence bands



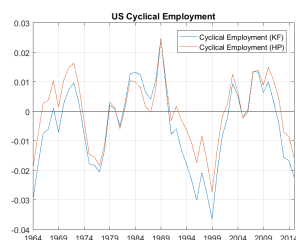
(e) 60-64 Actual and potential employment



(f) 60-64 HP confidence bands

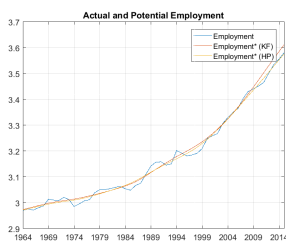


(g) 60-64 Actual and potential employment

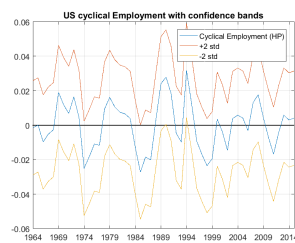


(h) 60-64 HP confidence bands

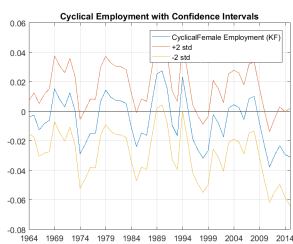
Figure 2.14: Results for females by age cohort 65+



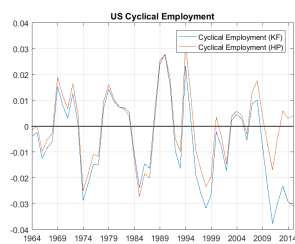
(a) 65+ Actual and potential employment



(b) 65+ HP confidence bands

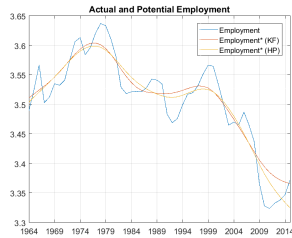


(c) 65+ Actual and potential employment

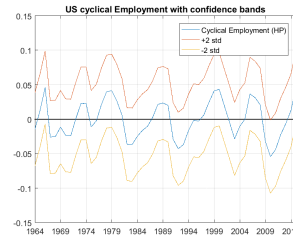


(d) 65+ HP confidence bands

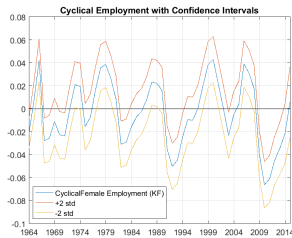
Figure 2.15: Results for males by age cohort 15-19 and 20-24



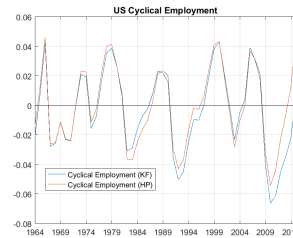
(a) 15-19 Actual and potential employment



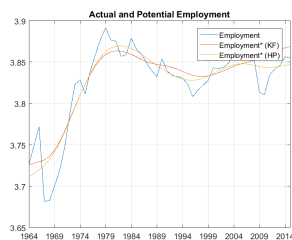
(b) 15-19 HP confidence bands



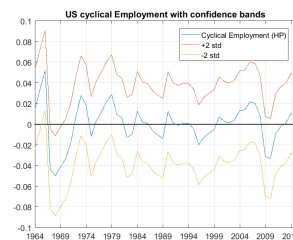
(c) 15-19 Actual and potential employment



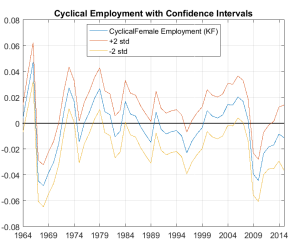
(d) 15-19 HP confidence bands



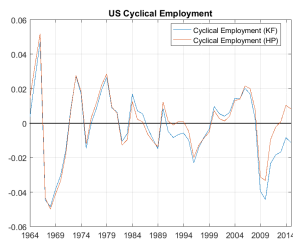
(e) 20-24 Actual and potential employment



(f) 20-24 HP confidence bands

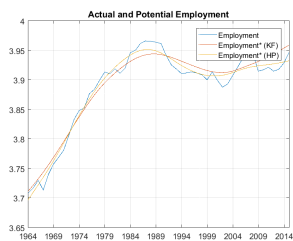


(g) 20-24 Actual and potential employment

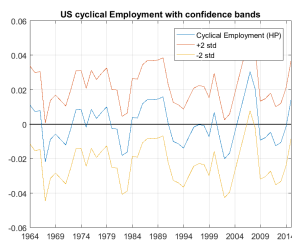


(h) 20-24 HP confidence bands

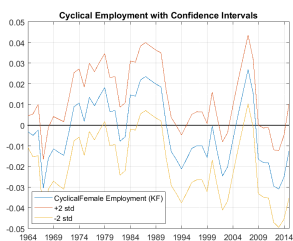
Figure 2.16: Results for males by age cohort 25-29 and 30-34



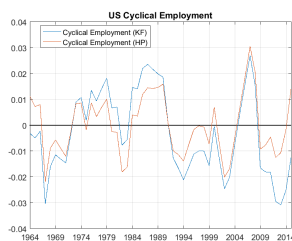
(a) 25-29 Actual and potential employment



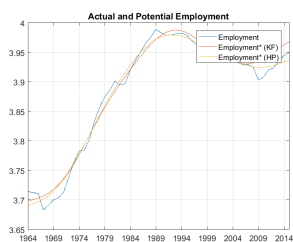
(b) 25-29 HP confidence bands



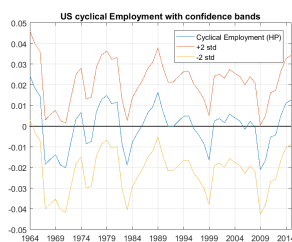
(c) 25-29 Actual and potential employment



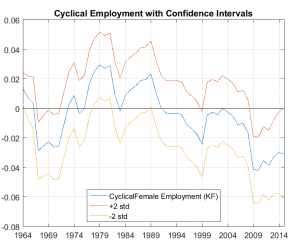
(d) 25-29 HP confidence bands



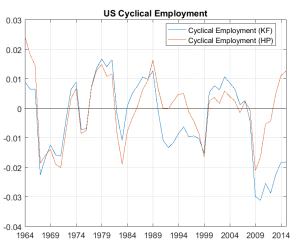
(e) 30-34 Actual and potential employment



(f) 30-34 HP confidence bands

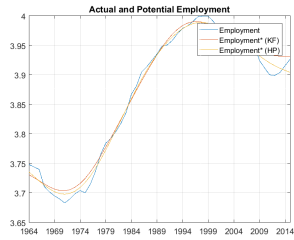


(g) 30-34 Actual and potential employment

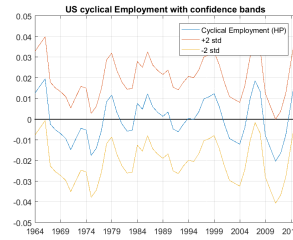


(h) 30-34 HP confidence bands

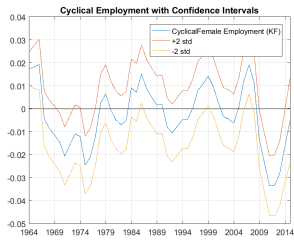
Figure 2.17: Results for males by age cohort 35-39 and 40-44



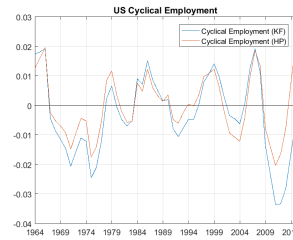
(a) 35-39 Actual and potential employment



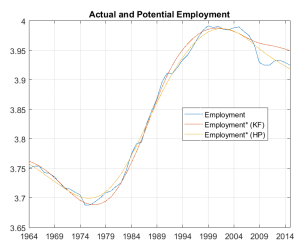
(b) 35-39 HP confidence bands



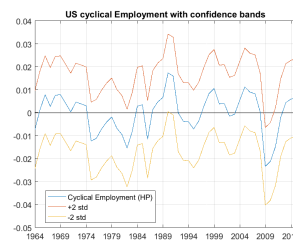
(c) 35-39 Actual and potential employment



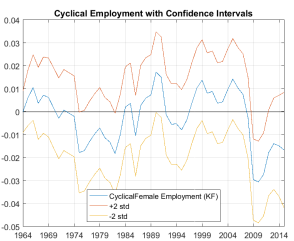
(d) 35-39 HP confidence bands



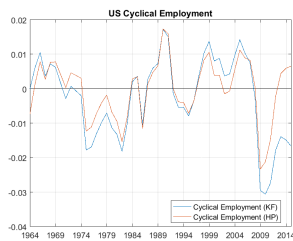
(e) 40-44 Actual and potential employment



(f) 40-44 HP confidence bands

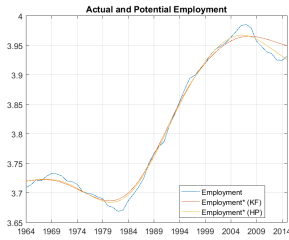


(g) 40-44 Actual and potential employment

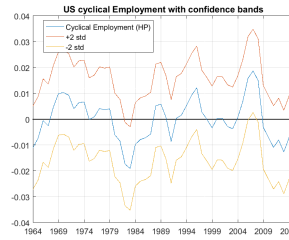


(h) 40-44 HP confidence bands

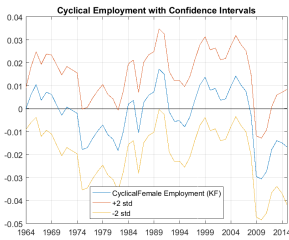
Figure 2.18: Results for males by age cohort 45-49 and 50-54



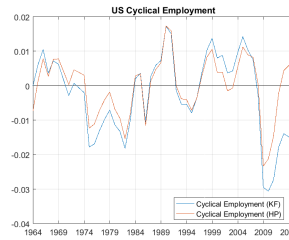
(a) 45-49 Actual and potential employment



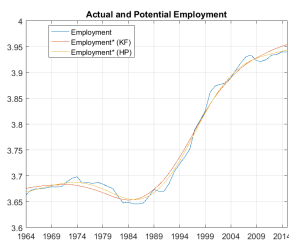
(b) 45-49 HP confidence bands



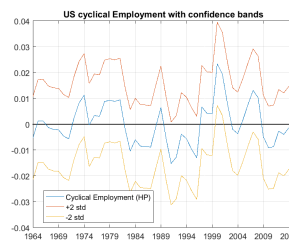
(c) 45-49 Actual and potential employment



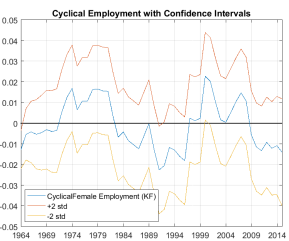
(d) 45-49 HP confidence bands



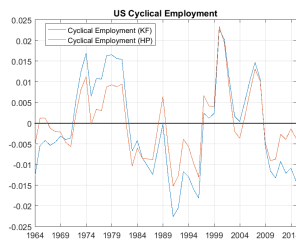
(e) 50-54 Actual and potential employment



(f) 50-54 HP confidence bands

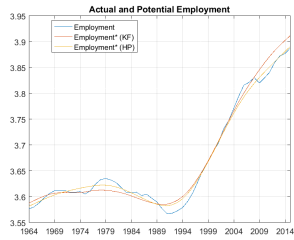


(g) 50-54 Actual and potential employment

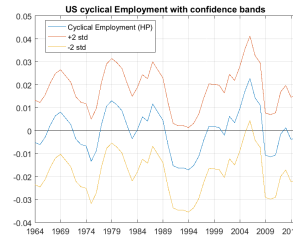


(h) 50-54 HP confidence bands

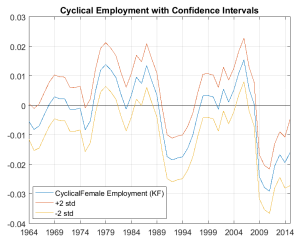
Figure 2.19: Results for males by age cohort 55-59 and 60-64



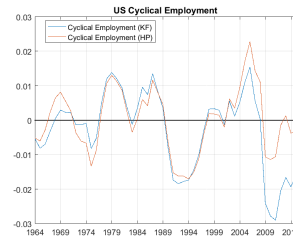
(a) 55-59 Actual and potential employment



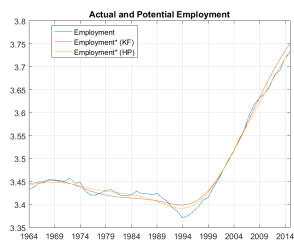
(b) 55-59 HP confidence bands



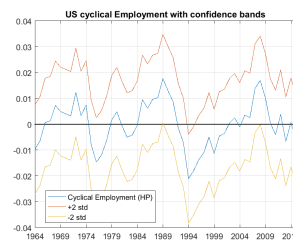
(c) 55-59 Actual and potential employment



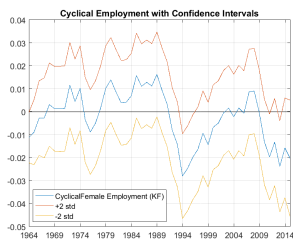
(d) 55-59 HP confidence bands



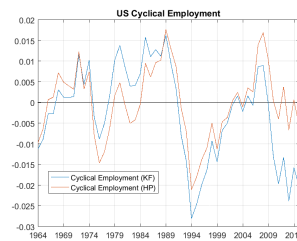
(e) 60-64 Actual and potential employment



(f) 60-64 HP confidence bands

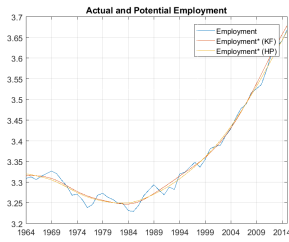


(g) 60-64 Actual and potential employment

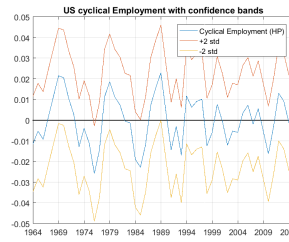


(h) 60-64 HP confidence bands

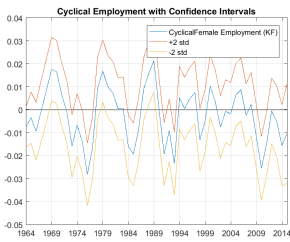
Figure 2.20: Results for males by age cohort 65+



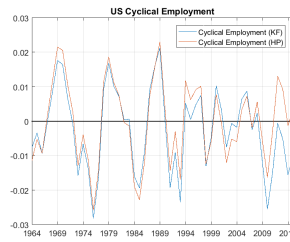
(a) 65+ Actual and potential employment



(b) 65+ HP confidence bands

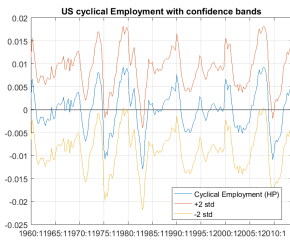


(c) 65+ Actual and potential employment

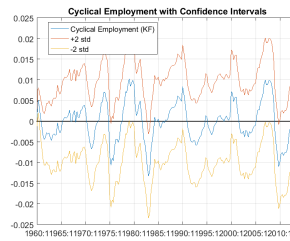


(d) 65+ HP confidence bands

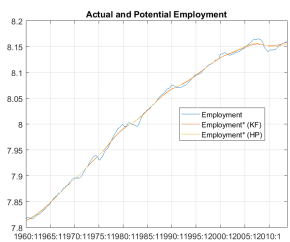
Figure 2.21: Quarterly figures, total employment



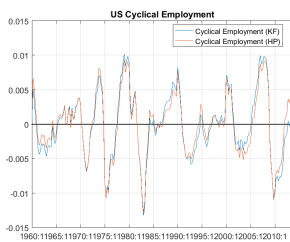
(a) Quarterly HP



(b) Quarterly KF



(c) Quarterly actual series



(d) Quarterly KF-HP

Chapter 3

Austerity Policies and the Labor Market

3.1 Introduction

When the financial crises hit the world economy, almost a decade ago, none could predict that the loss in economic growth would be so persistent. Despite the efforts of governments in stimulating the economic activity, global growth still remains moderate and trade languishes, while employment slowly recovers to pre-crisis level. In this scenario, policy makers of industrialized countries are facing two major concerns. The first is to reduce public debt, which increased during the crisis because of the introduction of a number of fiscal packages aiming at boosting the reprise. The second is to bring potential growth back on the pre-crisis path. Governments faced these challenges by implementing two sets of policies. On the one hand, they approved a number of fiscal interventions to consolidate government balance sheets - also called "consolidation" or "austerity" policies. On the other, they reformed labor market functioning to increase the matching between the demand and offer of employment (also named "liberalizations").

This two sets of policies are not independent from one another. On the one hand, a recent IMF contribution highlighted how fiscal policy can complement labor market reforms, by bringing forward their benefits and mitigating their costs (IMF 2014). On the other hand, a large theoretical literature (Campolmi, Faia,

and Winkler, 2011; Faia, Lechthaler, and Merkl 2013; Monacelli, Perotti, and Trigari, 2010; Ostbaum, 2011) argued that the transmission of fiscal policy - of which consolidation is a special case - depends on labor market frictions. In this case, current liberalizations modify the economy response to austerity, and the policies will produce effects unforeseeable by governments.

However, the empirical evidence on the role of labor market frictions in fiscal policy outcomes is still little: at the best of the author knowledge, only Auerbach and Gorodnichenko (2012) and Turrini (2013) presented empirical evidence on the relation between labor market and fiscal policy

This paper presents new empirical evidence on the dependency of consolidation effects on the level of labor market frictions. Using a panel dataset comprising 17 industrialized countries, we estimate the effects of consolidation by computing the average responses to a "consolidation shock" with the local projection technique (à la Jordà, 2005). This technique allows us to control for non-linearities in a less complex framework than a SVAR (Ramey and Zubairy, 2014). More in detail, the estimated coefficient varies according to a dummy variable signaling whether the employment protection level (EPL) is high or low.

In this paper we assume that the EPL represents a good approximation for labor market frictions. The rationale is that the higher level of employment protection consists in a larger dismissal cost for firms, this modifying the economic structure and the response to exogenous shocks. However, effect of such modification has still to be clarified.

First, the higher dismissal cost can be interpreted as an increase in the (indirect) cost of labor, this reducing the equilibrium level of employment. However, all other things equal, the higher labor cost also reduces the relative price of capital. Therefore, firms may decide to invest more, this driving the economy on a more capital-intensive production.

Second, a more protected labor market raises the labor turnover cost. According to the insider-outsider model (as Blanchard and Summers 1986), the larger turnover cost incentives unions to keep wages still during downturns, at the cost of a higher unemployment. Also, firms respond differently to shocks because of the larger turnover cost: they try to adjust hours worked and wages instead of employment. However, exogenous unanticipated negative shocks represent also the

opportunity to reorganize firms production, dismissing more workers than needed in a flexible labor market.

The paper presents three main findings. First, it estimates a strong and persistent negative effect of consolidation on both employment rate and per-capita GDP. The output fall after tax-based consolidations is significantly larger than the one estimated for spending-based actions, while the difference in employment reaction is not significant. This decoupling of the responses of employment and output contradicts the Okun's law, implying a more direct effect of spending cuts on employment.¹

Second, the results are in favor of the presence of non-linearities in tax-based consolidation effects. In fact, tax-based actions reduce employment and economic activity only temporary in high-EPL countries, while they have long-run contractionary effects in low-EPL countries. The empirical evidence for spending-based consolidations is mixed: responses are not statistically different across high- and low-EPL countries, despite contractionary effects are significant only in the high-EPL. The effect of austerity on wages seems to be crucial in explaining the different response paths across the two groups.

Third, consolidation reduces debt-to-GDP ratio only when spending-based actions are implemented in low-EPL countries. This evidence suggests that governments often underestimate the effects of tax-based consolidations on economic activity.²

The results are robust to a wide set of perturbations of the baseline model. However, when forecast and nowcast errors are employed as exogenous variable we obtain a completely different path for the responses.³ This confirms that the endogeneity that these variables present (see Chapter 1 Appendix) can seriously bias the estimations.

¹For instance, government may lower expenditure by reducing the turnover rate in public employment.

²Notable, the effects of consolidation on economic activity are still debated also in the literature, see Alesina and Ardagna(2010) and Guajardo, Leigh, and Pescatori (2014) for a review of the main findings.

³Forecast errors are computed as the difference between one-year-ahead forecast series and actual, first-release series of the government spending and revenues growth rates, while nowcast errors are computed as the difference between same year forecast series and actual, first-release series of the government spending and revenues growth rates.

The paper is organized as follows: Section 2 reviews the related literature, Section 3 presents dataset and methodology; Section 4 discusses the main results; Section 5 shows further extensions and discussion of the effects of consolidation policies and illustrates robustness checks; Section 6 concludes.

3.2 Literature Review

This paper is related to the theoretical literature on the role of labor market frictions in the transmission of fiscal policy - of which consolidation is a special case. Monacelli, Perotti, and Trigari (2010) and Obstbaum (2011) show that in a New-Keynesian (NK) framework augmented with a searching and matching model the effects of fiscal policies are magnified with respect to standard NK model. As a matter of facts, the wage rigidity introduced by the searching and matching model makes firms expected profits raising more than with flexible wages. This amplifies the labor demand effect of fiscal stimulus due to price rigidity.⁴

Bruckner and Pappa (2012) highlight that after a fiscal expansion, labor market participation increases in a model with insiders and outsiders and endogenous participation. This is mainly due to the wealth effect induced by the shock in government's absorption. Other scholars (Campolmi, Faia, and Winkler 2011; Faia, Lechthaler, and Merkl 2013) argue that hiring subsidies and short-time work deliver larger fiscal multipliers, as they stimulate job creation and employment.

Despite these theoretical contributions, there is still little empirical evidence on the role of labor market frictions in fiscal policy outcomes. The largest part of empirical studies on labor market frictions focuses on the relation between labor market flexibility and the behavior of the economy in the short- and long-run (see, among the others, Bernal-Verdugo, Furceri, Guillaume 2012; Gnocchi and Pappa 2012; Blanchard, Jaumotte, Loungani 2013). At the best of the author knowledge, only Auerbach and Gorodnichenko (2012) and Turrini (2013) assessed the relation between labor market and fiscal policy.

Turrini (2013) assesses the fiscal consolidation effects on unemployment and job

⁴This is because the more wages are rigid, the less firms' labor costs rise after an expansionary fiscal policy. Also hours worked per employee will increase more compared with flexible wages case.

market flows. His results are mixed: on the one hand the estimations for cyclical unemployment is not statistically different between low and high EPL countries. On the other hand, the effects of consolidation on job market flows (job separation rates, job finding rates, share of long-term unemployment) across different levels of EPL is significant, this suggesting an important role for labor market frictions in the transmission of fiscal policy.

Auerbach and Gorodnichenko (2012) employed two measures of labor market rigidities (Botero et al.'s 2004)⁵ to investigate non-linearities in fiscal shocks effects. According to their results, the stronger is the labor market rigidity, the larger will be both the response of output to a fiscal shock during recessions and the cyclical variation of the fiscal multiplier. Despite the paper does not contain any further investigation or suggestive interpretation of this result, it seems consistent with the theoretical results of Monacelli, Perotti, and Trigari (2010) and Obstbaum (2011).

The present paper extends the results of Auerbach and Gorodnichenko (2012) and Turrini (2013) and copes with some crucial methodological drawbacks. We can recognize three concerns in these studies: the first, and most important, is about the variable employed as proxy of a fiscal shock. The second is about the evidence provided and its completeness to discuss the non-linear effects. The third is the measure of labor market rigidity.

As a matter of facts, the variables employed in Turrini (2013) and Auerbach and Gorodnichenko (2012) as proxies for fiscal policy shocks were proven to be questionable. The one in Turrini (2013) does not disentangle the announcements on future consolidation policies from current changes in the fiscal stance (Alesina et al. 2014). The Auerbach and Gorodnichenko (2012) proxy is nothing more than the forecast error on government expenditure. This measure is hardly orthogonal to other economics shocks and it is not robust to fiscal foresight (see Chapter 1 Appendix of this dissertation). Therefore, we use a more robust proxy for fiscal shocks to guarantee a more reliable estimation of the impulse response function, which is extremely important in the local projection methodology (Ramey and Zubairy 2014).⁶ In addition, the measure employed in this paper allows us to investigate

⁵The first is a measure of protection of labor relations and the second is an index of labor market regulation.

⁶This is because Local Projection directly estimate impulse response on the basis of an MA

the effects of both expenditure and taxation. This is a crucial improvement for the completeness of the analysis, since it is likely that changes in government expenditure might produce different effects compared with adjustments in tax levels - and it may also be the case that the two are correlated (Alesina et al. 2012).

This paper gives a more complete overview on the mechanisms that can drive fiscal policy non-linearities compared to Auerbach and Gorodnichenko (2012) and Turrini (2013). In fact, it offers a rich assessment of the effects of consolidation, which gives helpful suggestions on how non-linearities can influence consolidation effects. On the contrary, Auerbach and Gorodnichenko (2012) just focus on output, while Turrini (2013) has a quite restrictive view of the variables which can drive state-dependency in the behavior of the economy, that are cyclical unemployment and the job flows. We have to highlight as the results obtained using these variables can underestimate the effect of consolidation on the labor market.⁷ Finally, this paper completes the estimations by Auerbach and Gorodnichenko (2012) using a measure of employment protection level which varies in both the cross-sectional and time-series dimensions (unlike the measures à la Botero et al. 2014 employed by Auerbach and Gorodnichenko 2012).

This paper also contributes to the literature on state-dependency in the economic system responses to fiscal shocks, in that it investigates the role of labor market frictions in producing non-linear reactions. The largest part of this literature emphasizes the role of business cycle and monetary policy in determining state-dependency of fiscal policy effects (Auerbach and Gorodnichenko 2012b and 2013; Baum, Poplawski-Ribeiro, and Weber 2012; Caggiano et al. 2015; Corsetti, Meier and Muller 2012; Michaillat 2012a/b; Bernardini and Peersman 2016). However, non-linear paths can originate from a number of market frictions, but only a few studies empirically investigate this possibility (Auerbach and Gorodnichenko 2012a).

representation of the process, which implies that variables interpreted as shocks must be a reliable approximation of innovations of the process.

⁷The estimations for job flows suggest that a fraction of frictional unemployment becomes structural. Therefore, a component of the effect of consolidation on unemployment cannot be detected by using only the variable cyclical component.

3.3 Data and Methodology

3.3.1 Data

The dataset contains yearly observations for a panel of 17 OECD countries. For 15 of them⁸ the dataset covers the period 1978 - 2013. For Germany and Ireland the observations start, respectively, in 1992 and 1991. Data on all continuous variables are from the OECD Economic Outlook n 97 (April 2015). Observations of CAPB before 2010 are from Guajardo, Leigh, and Pescatori (2014), while forecasts and public debt observations do not cover the whole period. As exogenous measure of fiscal consolidation we use the narrative measure of fiscal consolidation from Alesina et al. (2014). Data on the nature of labor market are based on a normalization of the Employment Protection Level Indicator (EPL) computed by the OECD, which covers years 1985-2013. This implies a reduction in the number of observations when state-dependency is assessed.⁹

The Consolidation Measure

The measure of fiscal consolidation builds on Alesina et al. (2014).¹⁰ These fiscal actions are based on *real-time* data and do not represent a response to past decisions:¹¹ as a result, they are unlikely to be systematically correlated with other innovations affecting the economy in the short term. Such a property avoids many concerns related to the identification of fiscal policy made by using a statistical concept such as the increase in CAPB.¹² Furthermore, the narrative measure distinguishes the share of consolidations obtained raising taxation level from the one obtained cutting government expenditure.

⁸Austria, Australia, Belgium, Canada, Denmark, Finland, France, Italy, Japan, The Netherlands, Portugal, Spain, Sweden, UK, US

⁹A detailed description of the dataset characteristics is contained in the Appendix, Table(3.1)

¹⁰The dataset is contained in the Chapter 1 Appendix. For a deep discussion on this measure characteristics, please refer to Chapter 1 of this dissertation, Alesina et al. (2014), and Devries, Guajardo, Leigh, and Pescatori (2011). A short review of the narrative measure characteristics is also contained in this Chapter Appendix.

¹¹See Chapter 1

¹²For a comparison between this dataset and the CAPB, see Guajardo Leigh and Pescatori (2014).

However, expenditure cuts and tax hikes are usually employed together to consolidate the public budget, this generating a strong correlation between the two tools. This correlation implies that a component of tax (expenditure) shock affects the economy through its effects on expenditure (taxation). In the local projection (LP) framework where the effects of fiscal policy are estimated directly through a MA representation of the interest variables (Ramey and Zubairy 2014), this correlation can produce misleading results (Alesina, Favero, and Giavazzi 2012).¹³ In this case, the use of a tax (spending)-based plan is required (Alesina, Favero, and Giavazzi 2012).

A consolidation policy is defined as tax(spending)-based when the change in taxation (spending) accounts for more than a half of the programmed total change in government fiscal stance (Guajardo, Leigh, and Pescatori 2014). In this way, tax- and spending-based fiscal consolidations result to be mutually orthogonal, as required in the LP methodology. This result is achieved at the cost of not being able to completely separate the effects of tax hikes from the expenditure cuts. Therefore, the empirical findings of the paper are not immediately comparable with those results presented in the SVARs literature - and particularly in Chapter 1 -, where tax and expenditure shocks are orthogonalized by imposing identification restrictions.

After an extensive exploration of the dataset, we observed that of the 108 spending-based consolidations, only about one fourth (28) occurred without a contemporaneous tax hike. On the contrary, almost half of tax-based intervention took place modifying only the tax levels (23 of 55 episodes). Movements in revenues account for more than one third of the GDP share of spending-based consolidations, while the expenditure components accounts for slightly more than a fourth of tax-based consolidations share of GDP.¹⁴ Therefore, on average, tax hikes in spending-based consolidations play a much larger role than the expendi-

¹³This is because when we dynamically simulate the shocks effects, we simulate the effect of a change in taxation (expenditure) keeping expenditures (taxes) constant, assuming that taxation and expenditure are orthogonal.

¹⁴The average spending-based consolidation amount to the 1.42% of GDP, where the raise of revenues is the 0.54% of GDP. Tax-based consolidations amount, on average, to a movement of 1.19% of GDP, where the average expenditure cut is the 0.33% of GDP. In this case averages are computed only on episodes where governments used both tools (the average for spending-only episodes is about 0.93% of GDP and for tax-only episodes is about 0.51% of GDP)

ture cuts in tax-based actions. This difference will be taken into account when presenting and discussing the empirical evidence.

An extensive investigation on the robustness of this narrative measure is contained in Chapter 1, where we obtain two crucial results: first, the measure is exogenous to contemporaneous business cycle movements. Second, the changes in taxation and expenditure motivated by consolidation purpose are forecasted by agents. Then, the estimation of the effects of the narrative measure may be seriously biased without accounting for fiscal foresight (Lütkepohl 2012; Leeper, Walker, and Yang 2013; Caggiano et al. 2015).

Therefore, we present in the Appendix a robustness experiment where a foresight robust residual is employed as proxy for consolidation shocks.¹⁵ The results of this experiment do not show significant differences from the benchmark specification.

The Employment Protection Level

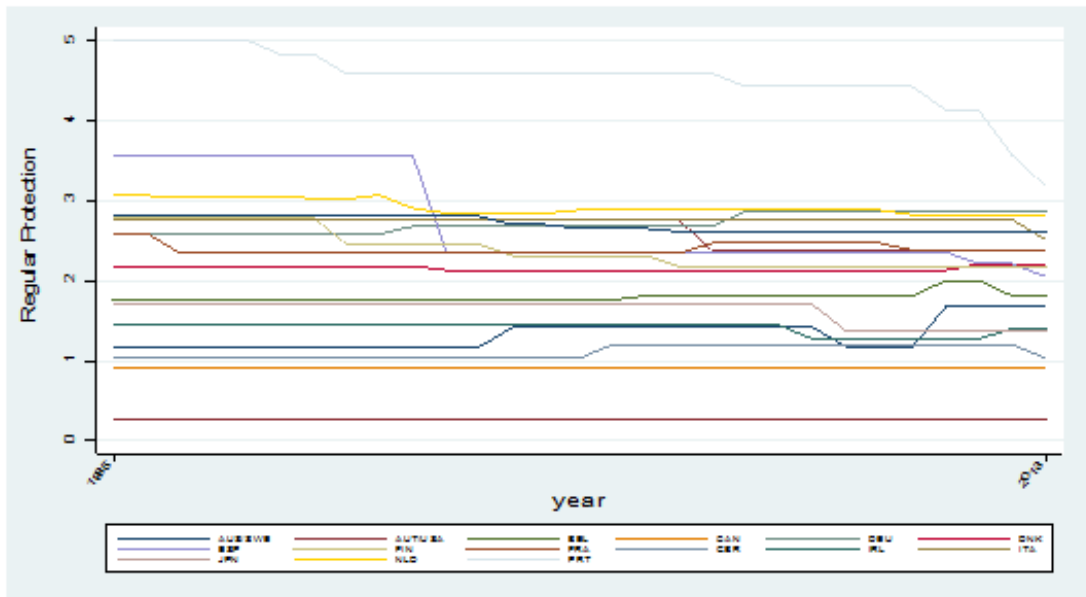
In order to assess the role of labor market frictions in the transmission of consolidation policies, we exploit the measures of employment protection level (EPL) computed by the OECD for regular and temporary contracts, which spans the period 1985-2013 for all countries.¹⁶ This measure consists of an index varying from 0 to 5, where 0 indicates that there are virtually no costs in hiring and firing, while a score of 5 suggests that workers dismissals have infinite costs for firms.

¹⁵In order to purge the estimation from forecasted components, the we take as proxy for consolidation shocks the residuals of the regression of the narrative measure on its lagged values, some lags of GDP and government debt growths, and the forecasts of agents on the future level of the CAPB as an exogenous fiscal measure. These residuals are gathered at the cost of a large reduction in the sample time dimension, due to the lack of observations for forecasts and government debt. Note that also the results obtained in the Chapter 1 using the Alesina et al.'s measure and the foresight-robust residual do not significantly differ when the sample reduction is taken into account.

¹⁶These indicators are produced by considering several qualitative variables as the notice rules, the presence of dismissal compensation, and the trial length. The OECD produces different measures of the level of employment protection to index the cost of individual dismissal with regular contracts, the cost of individual dismissal with temporary contract, the presence of additional costs for collective dismissal. Unfortunately, the latter measure is computed only from 1998, and we cannot use it without losing many observations: therefore, we focused on temporary and regular contracts protection levels. Further information are provided by OECD at <http://www.oecd.org/els/emp/EPL-Methodology.pdf> .

The behavior of this indexes in the 17 countries analyzed in this paper is showed in Figure (3.1) (regular contracts) and (3.2) (temporary contracts). The Figures (3.1) and (3.2) show three regularities: *i*) the protection of regular contracts is generally higher than the protection of temporary contracts; *ii*) the protection of regular contracts presents a lower volatility than the protection of temporary contracts; *iii*) in the considered period there is a general decline in both measures.

Figure 3.1: Regular Contracts Level of Protection



Note. The figure reports the behavior of EPL measure of all 17 countries from 1985 to 2013. Source: OECD.

In this framework (à la Jordà (2005)), non-linearities are analyzed employing an indicator variable. Therefore, we transform the two OECD indexes in a single variable with a three steps procedure: *i*) we normalize the two indexes to let them vary between 0 and 1; *ii*) we sum the new value of the indexes, computing its median value; *iii*) when the value of the sum lies above its median, the indicator variable assumes value equal 1 (high-EPL); when it lies below the median, the indicator variable assumes value equal 0 (low-EPL).¹⁷

¹⁷For reasons of space, we decided to not report the dummy variable in this Thesis. It is anyway available upon request.

Figure 3.2: Temporary Contracts Lever of Protection



Note. The figure reports the behavior of EPL measure of all 17 countries from 1985 to 2013. Source: OECD.

3.3.2 Methodology

In order to assess how the response of the economic system varies according to the EPL, this study implements the local projection technique (LP, Jordà 2005). This methodology nowadays is largely employed in studies which explores non-linear paths shocks responses and it requires that the innovations to the variable that we desire to shock are approximated by "exogenous measures" (Auerbach and Gorodnichenko 2012; Ramey and Zubairy 2015; Bernardini and Peersman 2015).

LP computes directly the response of a variable to shocks by estimating the equation:

$$z_{i,t+h} = \alpha_i + \delta_t + \sum_{s=1}^T \Phi_{t-s} Y_{i,t-s} + \beta shock_t + \gamma t + u_{i,t} \quad (3.1)$$

In (3.1) subscripts i and t index, respectively, countries and years, while h identifies the $h - th$ period ahead value of the variable of interest z . The vector of controls is $Y = [z, capb, gdp, emp, inf, int]$ where $capb$ is the deviation of CAPB in

terms of GDP, gdp is the growth rate of output per-capita, inf is the inflation, and int is the interest rate. The vector Y is lagged for s periods with coefficients Φ_{t-s} .¹⁸ α_i is the vector of fixed effects for country i , while δ_t is the vector of time dummies, and t is the time trend with coefficient γ . $u_{i,t}$ is the vector of error terms for the relative h period. $shock_t$ is the vector containing the tax- and spending-based fiscal consolidation actions with coefficient β .¹⁹

(3.1) is a Two-Way Fixed Effects (TW-FE) model, in which the estimating relation of a classical FE is enlarged with time-series dummy variables to account for cross-dependency. In Chapter 1 TW-FE were found to be sufficiently robust to the presence of common factors within the panel. Furthermore, following Auerbach and Gorodnichenko (2012), standard errors are computed using the Driscoll and Kray (1998) correction. This extends the Newey-West method (Newey and West, 1987) to a panel setting, producing robust standard errors to both serial and cross-country correlation. This is crucial to account for the serial correlation in the error term which the Jordà method induces by estimating the successive leading of the dependent variable (Ramey and Zubairy 2014).

Then we estimate the model to control for non-linearities:

$$z_{i,t+h} = \alpha_i + \delta_t + \sum_{s=1}^T \Phi_{t-s} Y_{i,t-s} + \beta^L shock_t + \beta^H shock_t + \beta^L shock_t Q_{i,t} + \rho Q_{i,t} + \gamma t + u_{i,t} \quad (3.2)$$

Where $Q_{i,t}$ is the dummy variable for high-(low-)EPL countries, ρ is the average change between high- and low-EPL countries, while the subscripts L and H of the coefficient β indicates, respectively, the marginal effect of the shock on low and high protection level in the labor market. I.e., the effect of the shocks in low-EPL countries is equal to β^L , while for high-EPL countries is $\beta^L + \beta^H$.²⁰

¹⁸Following the literature, we choose $s = 2$. Auerbach and Gorodnichenko (2012) uses only one lag for control variables. However, the high persistence of employment rate, which is often described as a AR(2) process (Turrini 2013) and the nature of consolidation shocks, which are only predetermined, suggest to add one more lag.

¹⁹Note that in this case the effects of fiscal consolidation on a variable in a certain horizon h is just the β for the $h - th$ period ahead equation. This implies that the IRF is nothing else than the β s point estimates on each horizon $[1, \dots, h]$.

²⁰This specification is equivalent to Auerbach and Gorodnichenko (2012) without including business cycle dependency.

3.4 Results

3.4.1 The Linear Model

This section discusses the results of the estimation of equation (3.1). Figure (3.3) reports the effect of a consolidation policy shock on employment rate (left panel) and per capita output (right panel). We also divided consolidation policies in tax-based (black line) and spending-based (red line), reporting the respective 90% asymptotic confidence intervals.

We have to consider that, as mentioned above, those are *based* shocks, i.e. all the shocks considered are a combination of tax increases and expenditure reductions. Therefore, the results are not immediately comparable with the estimates obtained simulating pure taxation and expenditure shocks.

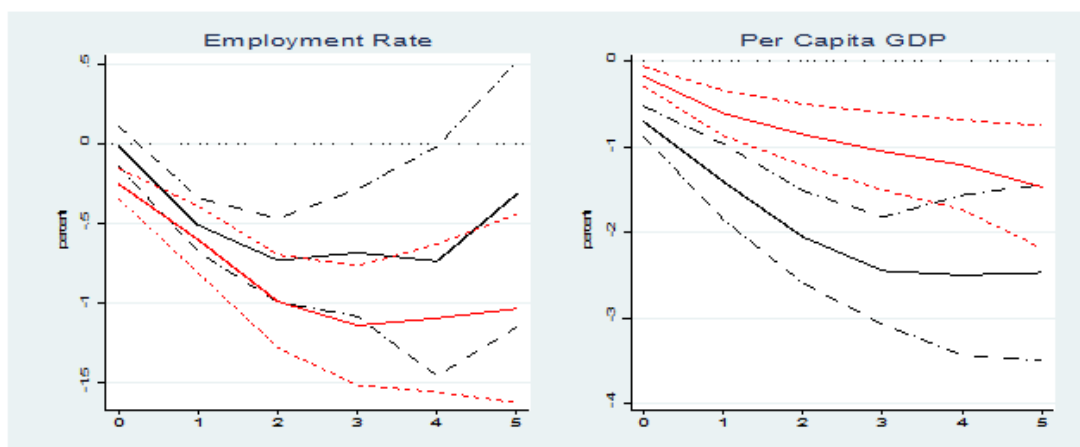
As Figure (3.3) shows, the effect of fiscal shock is always strong and negative. The effect of tax-based consolidation on per-capita output is (significantly) stronger and more persistent than the effects of spending-based consolidation. This confirms the evidence offered Chapter 1 (and also in studies as Guajardo, Leigh, and Pescatori 2014; Alesina, Favero, and Giavazzi 2012; and Barro and Redlick 2011) where the effect of taxation was larger than the expenditure one.²¹ Conversely, we observe also a (significant) negative response of per-capita output to expenditure shocks.

A possible explanation for this difference across output responses to tax- and spending-based shocks is that an expenditure cut signals a stronger commitment to fiscal discipline: in this case, agents anticipate the future gains of debt reduction in terms of lower interest rates and taxes, starting to invest and consume immediately. In addition, a change in tax level distorts agents' choice magnifying the contractionary effect of consolidation.

Also the employment rate significantly declines after a consolidation shock. However, in this case the difference in the employment response to tax-based and spending-based consolidation is not significant. This result is somehow unexpected,

²¹As these papers argue this difference depends on the tax change smaller crowding-out effect, and larger impact on the investment (and saving) decision of private agents. Moreover, according to Blanchard and Summers (1987), a tax increase should affect also the supply side, driving both the aggregate demand and supply on a lower level of output. In Blanchard and Summers (1987) this result holds in particular when the fiscal action is focused in changing the tax wedge

Figure 3.3: Effects of public expenditure cuts (red line) and tax hikes (black line)



Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (red) and tax level (black) are normalized to be 1% of GDP. The figure reports, in black dashed lines for taxation and red dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

since it contradicts the Okun's law²² (Okun 1963), and it is not related to an increase in public lay-offs. The episodes in which the decline of public expenditure is obtained by diminishing public employment are equally distributed between tax- and spending-based consolidations.²³ In addition, spending-based consolidation does not affect public employment.

3.4.2 Non-Linear Response

Figure (3.4) shows results for equation (3.2). This specification tests whether the effect of fiscal consolidation changes according to the level of employment protection (EPL). In Figure (3.4), the two upper panels report employment rate responses to tax-based consolidation (left panel) and spending-based consolidation

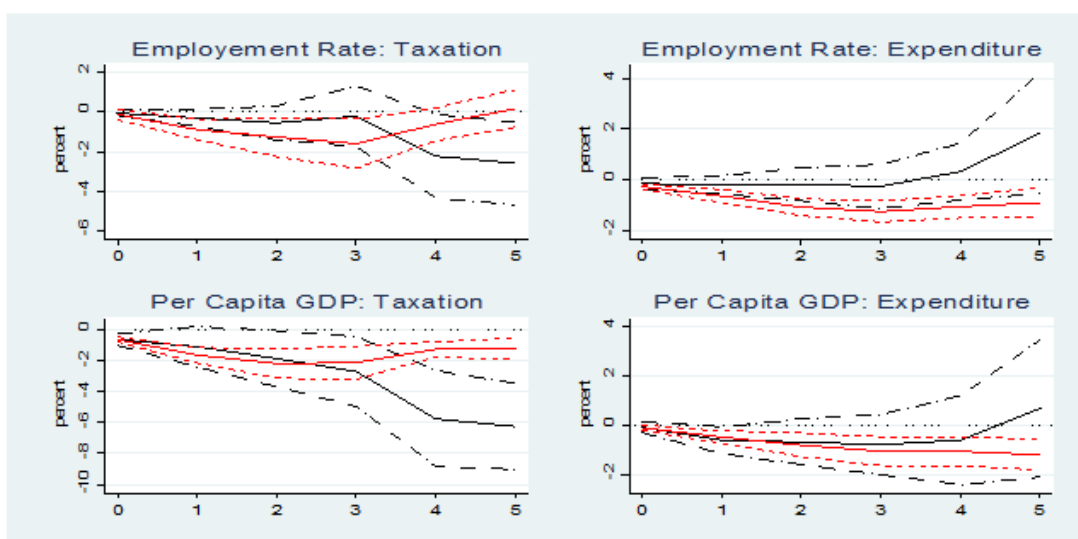
²²The Okun's law is an empirical evidence which predicts that about a half of movements in the output gap transfers to the unemployment rate cyclical component. The Okun's law is an empirical evidence which predicts that about a half of movements in the output gap transfers to the unemployment rate cyclical component.

²³The Okun's law is an empirical evidence which predicts that about a half of movements in the output gap transfers to the unemployment rate cyclical component.

(right panel), while the lower two show results for per-capita GDP (tax-based on the left and spending-based on the right).

Estimations for countries where the level of employment protection is below the median (low-EPL) are reported with a black line, while the red line identifies the average reaction of nations with a level of employment protection above the median (high-EPL). Dotted lines are 90% intervals.²⁴

Figure 3.4: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black)



Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure and tax level are normalized to be 1% of GDP. The figure reports, in black dashed lines for taxation and red dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

At a glance, we observe a striking difference in the response of the two sub-

²⁴High-EPL: Belgium, France, Italy, Portugal, Spain. Low-EPL: Australia, Canada, Ireland, Japan, UK, US. Several countries switch their position throughout the sample - in parenthesis is reported the period when the EPL is high and the index that drives: Austria (1985-2002, regular protection), Denmark (1985-1994, temporary protection), Finland (1985-1991, regular protection) Germany (1985-2003, temporary protection; 2013, change in temporary protection), Netherlands (1985-1998, temporary protection), and Sweden (1985-2007, temporary protection). It is worth noting that such changes occurred mainly in Northern-Europe countries during the 90s or early 2000s, because of changes in temporary protection - the only exception being Austria. Countries switched to a lower level, with the exception of Germany in 2013.

groups. In low-EPL countries (black line) a tax-based consolidation produces a significant contraction in economic activity only after few periods (3 years for per-capita GDP and 4 for employment rate), while spending-based consolidations do not have significant effects. On the other hand, in high-EPL countries (red line) both tax- and spending-based consolidation reduce the economic activity, with a similar peak effect in all specifications (between 1% and 2%)

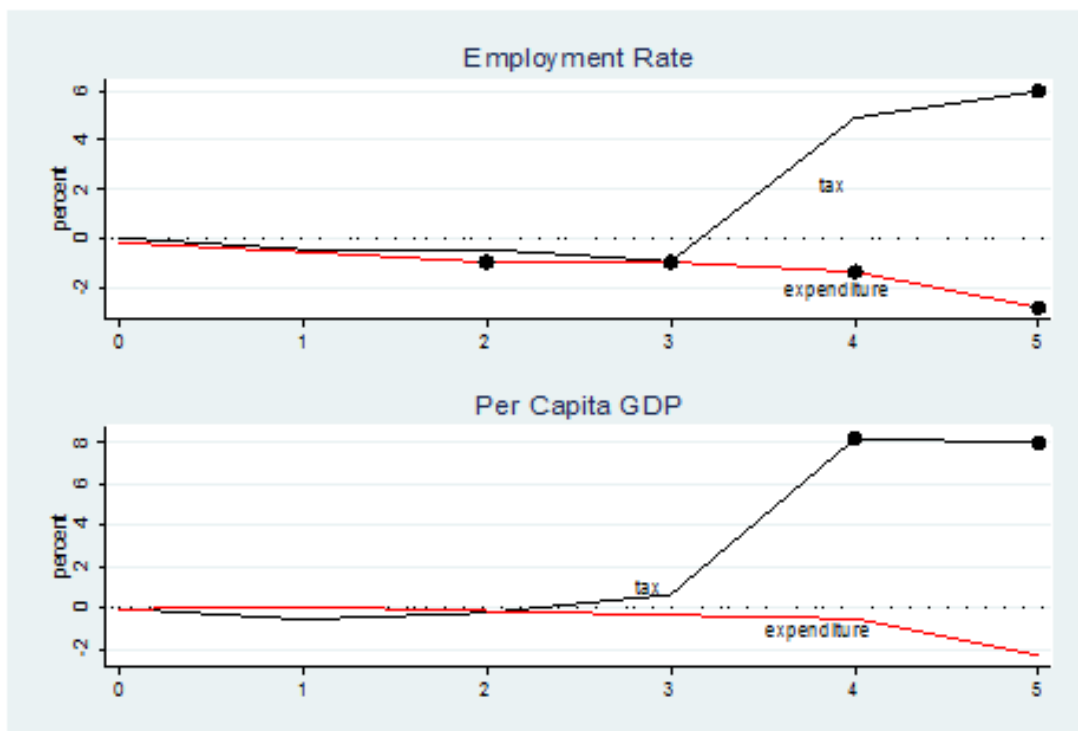
Specifically, tax-based consolidation presents a strong short-term effect and a fast recovery, while spending-based actions outcomes are milder but more persistent. For instance, the reduction of employment rate after a tax-based shock peak in high-EPL (top-left panel) is about 2%, but it recovers in 4 years, while the employment rate loss in low-EPL has a peak of about 1.2% and is still significant after 5 periods.

This evidence suggests that labor market frictions play a significant role in the transmission of fiscal policy, as in Monacelli, Perotti, and Trigari (2010), Obstbaum (2011), and Bruckner and Pappa (2012). As a matter of fact, in low-EPL countries the cost of tax-based consolidation is larger and more persistent than the cost of expenditure-based actions, both in term of jobs and output. Vice versa, in high-EPL countries the adjustment after a fiscal contraction is always costly, but employment rate and per-capita GDP recover quickly after a tax-based consolidation is employed - while the negative effect of a spending-based intervention are more persistent.

The gap between high- and low-EPL countries can originate from a different adjustment mechanism. As a matter of facts, when the level of employment protection is high, the labor market adjusts to the new (lower) aggregate demand level mainly reducing wages. Since labor is now cheaper, the economy shifts to a more labor-intensive technology, boosting the employment recovery. Since this substitution between labor and capital reduces technological investments, output shows a persistent loss. When the level of employment protection is low, wages are unaffected, while employment reduces. However, this further reduces aggregate demand, producing a larger fall in economic activity and employment. The next section will provide some evidence on these hypothesis.

Figure (3.5) reports the statistical difference between responses estimated for high- and low-EPL countries for both tax-based (black line) and spending-based

Figure 3.5: Point estimation and significance of marginal difference between high-EPL and low-EPL countries for spending-based (red line) and tax-based (black line) actions.



Note. Data are for all 17 countries, period 1978-2013. The figure reports point estimates differences in responses of high-EPL and low-EPL countries to tax-based (red) and spending-based (black) consolidation episodes. Black dots identify a difference significant at 90% based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects.

(red line) consolidation shocks. The upper panel shows the results on the employment rate, while the lower panel contains results for per-capita GDP. A significant difference is marked with a black dot. We make two considerations on this: first, regarding spending-based consolidation the difference is not significant for GDP, while it is negative and significant for the employment rate. This implies that spending-based consolidations produce a larger reduction (about 2%) of employment rate in high-EPL countries.

Second, tax-based consolidations have, on impact, a stronger negative effect on high-EPL economies, but in the long run low-EPL countries pay a higher cost

in terms of occupation and GDP. This swap between the two groups, which is statistically significant for both variables, is the result of the persistence of tax-based effect in low-EPL countries and of the recovery in the high-EPL countries.²⁵

3.5 Extensions

As we have seen, when a fiscal policy hits the economy it modifies the labor market conditions. This may consist in temporarily shifting the labor demand and supply, or in producing a new equilibrium. When the cumulative effect of the shock reverts to zero, we are observing a temporary shift, while if it does not, we are probably observing the economy approaching a new equilibrium. This new equilibrium is qualified by a new level of employment, wages, and hours worked per employee. The breadth and drivers of the movements of these three variables depend on labor market institutions. This section extends the framework presented in section 3, estimating equation (3.2) for a wide set of variables in order to understand which are the possible drivers of state-dependency in consolidation effects and their implications for other labor market variables.

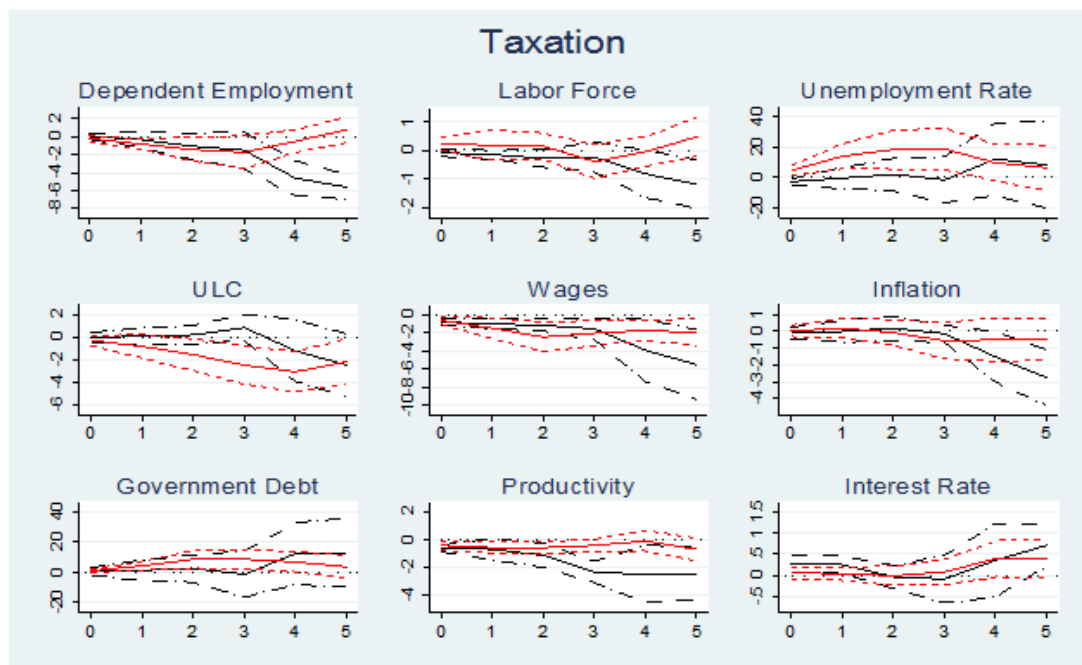
3.5.1 Tax-Based Consolidations

Figure (3.6) presents the results of the experiment for tax-based consolidation. As in the previous estimations, red lines mark high-EPL countries average response, while black lines are represents the average reaction for low-EPL nations.

The outcomes for the investigated labor market variables largely confirm the results of the benchmark specification: in high-EPL countries a tax-based consolidation reduces dependent employment and increases unemployment rate - both these effects are transitory -, while the labor force does not significantly react to this policy. On the other hand, in low-EPL countries we do not observe significant effects in the short-term, while we have a significant fall in both the variables in the long-run (after three periods for dependent employment and four periods for labor force). The effect on employment and labor force does not reflect in the

²⁵It is worth to note that LP methodology suffer of estimation concerns for the longer-run coefficients, which induce to consider carefully the significance of these differences.

Figure 3.6: Effects of Tax-Based Consolidations in high-EPL countries (red) and low-EPL countries (black)



Note. Data are for all 17 countries, period 1978-2013. Shocks on tax level are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

unemployment rate behavior: this can be due to the way in which unemployment is computed.²⁶

In low-EPL countries, tax-based consolidations increase unit labor cost (ULC) and reduce labor productivity, inflation, and nominal wage per-employee (henceforth we will refer to this variable as "wage"). Conversely, in high-EPL countries ULC and wage decrease, productivity is mainly unaffected, while the loss in inflation is not significant. It is worth noting that tax-based consolidation fails to reduce the debt-to-GDP ratio in both groups: the ratio even increases of a significant percentage (the peak being about 8.76%) in high-EPL countries: such an

²⁶The unemployment rate is computed as $\frac{L-E}{L}$ where L is the labor force and E is the employment

effect is probably due to the contraction in output following tax-based actions.

The short-term interest rate does not move in the short-run, and slightly increases in the long-run in high-EPL countries. This may signal that there are no significant differences among countries in the reaction of monetary authority to a tax-based consolidation, since often interest rate is interpreted as a proxy of monetary policy.

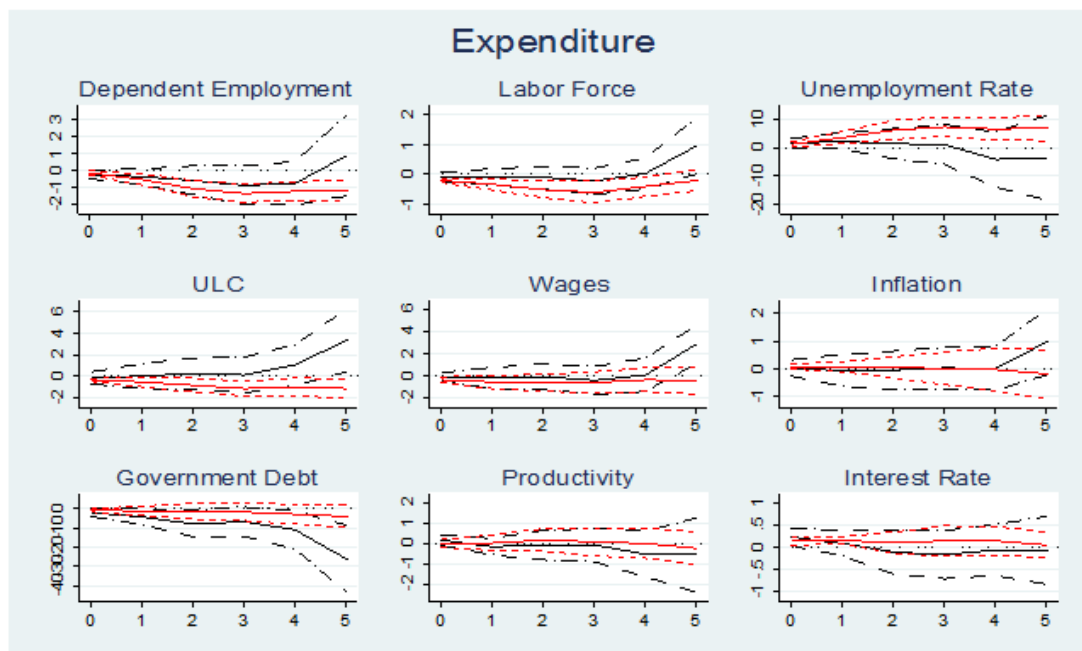
We can try to interpret the effects of tax hikes in the light of our results. When EPL is high the labor market adjusts to the lower aggregate demand due to the tax based shock by reducing wages. This has two important side effects: ULC declines and productivity does not deteriorates. When the recovery starts, the economy shifts the production towards labor-intensive technologies, since now labor is more convenient, raising the employment rate. However, this faster recovery comes at some costs: the substitution between labor and capital reduces technological investments and output does not completely restore, therefore the debt-to-GDP ratio does not reduce. In low-EPL countries tax-based consolidations do not affect wages. As a consequence, ULC increases and labor productivity deteriorates. This produces a decline in the employment rate, which further reduces output generating the long-term fall of economic activity.

3.5.2 Spending-Based Consolidations

Figure (3.7) shows outcomes for spending-based fiscal consolidations in high-EPL (red line) and low-EPL (black line) countries. Again, the evidence largely confirms the results of the benchmark specification: on the one hand, in high-EPL countries spending-based consolidations reduce dependent employment and labor force while the unemployment rate raises. On the other hand, the response of low-EPL countries is never significant - the only exception being the debt ratio -. It is remarkable that the spending-based responses in high-EPL are (when significant) more persistent than the one obtained for tax-based consolidation.

Despite the negative and persistent effect on the high-EPL countries labor market, the other variables considered in our experiment do not show a significant response to spending-based consolidation. Our intuition is that when a spending-based shock reduces output and employment, the negative effect is not strong

Figure 3.7: Effects of Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black)



Note. Data are for all 17 countries, period 1978-2013. Shocks on public expenditure are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

enough to influence wages. Therefore, the cost of labor does not reduce and the economy does not recover. This can also explain the puzzle in Figure (3.2), where the effect of tax-based shock on output was stronger compared with the fall due a spending-based consolidation, but it also recovers faster.

We can conclude that when the level of employment protection is high, the economy adjust to lower levels of aggregate demand by reducing wages. This is at odds with the insider-outsider model predictions, and in particular with studies on hysteresis as Blanchard and Summers. However, analyzing the effects of tax and expenditure separately (see the Appendix), it seems that this contrast is a byproduct of the methodology employed to obtain the tax- and spending-based consolidations: according to the new specification, a pure tax hike has permanent

effects on employment, while spending cuts have only transitory outcomes. This outcome is in line with Chapter 1 results, in which the evidence suggests that tax hikes are able to trigger a hysteresis process as in Blanchard and Summer (1986).

3.6 Robustness Checks

The benchmark specification results are robust to a wide array of further perturbations of the model, namely:

- i) dropping control variables in the estimated regression;
 - ii) a different scaling variable (total GDP and employment instead of variables in per-capita terms);
 - iii) a different specification of the shocks (pure tax and expenditure changes, tax(expenditure)-based consolidation purged of fiscal foresight²⁷);
 - iv) a shorter sample to exclude the great recession;
 - v) the use of different proxies for fiscal policy (nowcast and forecast errors);
- and
- vi) estimation obtained by considering only largest consolidations (>1% of GDP).²⁸

This battery of robustness checks are available in the Appendix.

With the exception of nowcast and forecast errors, these estimations presents only minor changes.

3.7 Conclusions

This paper analyses the dependency of consolidation effects on labor market frictions. These are approximated by the level of employment protection (EPL). Such

²⁷To purge consolidation actions for the foresight component, We regressed the tax(expenditure)-based consolidation variable on three lags of themselves, per-capita GDP, employment, inflation, CAPB, and agents forecasts on growth of revenues and public expenditure based on OECD forecasts. For a deep discussion of the methodology and the variable, the interested reader may refer to Chapter 1.

²⁸for reason of space, we did not report results obtained excluding one country at time: they are available upon request.

an investigation is crucial to understand how the economy response to consolidation packages changes after the implementation of labor market reforms, as those recently recommended by the major economic institutions (IMF 2015 and 2016, OECD 2015).

We compute impulse response functions by employing the local projection method (Jordà 2005). This methodology has been widely used in the recent literature (Auerbach and Gorodnichenko 2012; Bernardini and Peersman 2016; Ramey and Zubairy 2014), since it can easily accommodate for non-linear effects of the selected shocks. However, this improvement comes at two costs: i) at longer horizons the coefficients are unreliable (Ramey and Zubairy 2016); ii) the variables interpreted as "shocks" have to be a sufficiently good approximation of the innovations in the process generating the data.

In order to meet this condition, the paper exploits a dataset of fiscal consolidation, covering 17 developed countries in the period 1978-2013 with yearly observations. This dataset proved to be exogenous to contemporaneous business cycle movements and rather robust to fiscal foresight (see the discussion in Chapter 1). However, the use of this dataset implies that our conclusion cannot be immediately extended to a broader definition of fiscal policy shock.

The empirical evidence shows that tax-based consolidations have usually larger effects on per-capita GDP compared with spending-based actions. This confirms a wide theoretical and empirical literature which emphasizes the stronger effect of tax policy on the economy (Barro and Redlick 2011; Guajardo, Leigh, and Pescatori 2014).

In our framework the effects of consolidation depend on the EPL. In high-EPL countries both spending- and tax-based consolidation reduces output and employment, while in low-EPL countries only tax-based shocks have contractionary effects. More in detail, after a tax-based consolidation high-EPL countries show the larger short-run contraction, but low-EPL countries display stronger losses in the long-run.

The results present some differences with respect to the one obtained in Chapter 1. In Chapter 1, consolidation did not have significant effects in low-EPL countries, while in high-EPL countries we observed a negative effect of taxation and a positive effect of expenditure. This differences can be explained by recalling that the shocks

considered in the two Chapters are different: here we employ a composition of tax increases and expenditure cuts to guarantee the orthogonality of the shocks, in Chapter 1 we used pure tax and expenditure shocks. However, the two Chapters present some statistical regularities: *i*) taxation has always a negative effect; *ii*) the effect of expenditure is usually milder or not significant in low-EPL countries; *iii*) the level of EPL has a role in determining the size of the responses.

Our results on consolidation non-linear effects disagree with the literature on the role of labor market frictions in the transmission of fiscal policy (Monacelli, Perotti, and Trigari 2010; Obstbaum 2011; Bruckner and Pappa 2012; Campolmi, Faia, and Winkler 2011; Faia, Lechthaler, and Merkl 2013). As a matter of facts, we find that tax-based shocks have a more persistent effect in low-EPL countries. Therefore, further investigations are needed to better describe the role of labor market frictions on the transmission mechanism of fiscal policy.

The responses are quite homogeneous across all the labor market variables analyzed: in high-EPL countries tax- and spending-based consolidations are associated with a decline in dependent employment and labor force, and with an increase in unemployment. On the other hand, in low-EPL countries tax-based policies persistently reduce employment and labor force, whereas the cumulate effect on unemployment is null. Furthermore, in low-EPL countries spending-based actions do not produce remarkable changes. Results for unemployment and labor force appear to be in line with the conclusions in Turrini (2013), which found that consolidation has a stronger effect on cyclical employment in high-EPL countries.

The role of employment protection in the transmission of consolidation is clear: the more the employment is protected, the more the labor market adjust to the lower level of aggregate demand by modifying the wages. The fall in wages reduces ULC and generates a moderate fall of employment, therefore labor productivity does not deteriorate. The lower cost of labor leads the production to shift to more labor-intensive technologies, this inducing a recovery in employment but not (completely) in output.

Vice versa, when employment protection is low, the economy adjusts to the lower level of output reducing the employment and not the wages. This deteriorates the labor productivity and increases the ULC. The fall in labor productivity leads to a new reduction in employment, which in turn produces a further fall in output.

Spending-based consolidations do not affect the economy in low-EPL countries.

These results are in contrast with Blanchard and Summers (1986), which predicted a persistent effect of fiscal policy in countries with high turnover costs. Again, a possible explanation is that in this analysis tax- and spending-based consolidations are always a composition of spending cuts and tax hikes: when the effects of the two policy tools are investigated separately, the new evidence suggests that taxation causes permanent losses in employment in high-EPL countries, while expenditure has only transitory effect. This result is in line with the findings of a previous work of Chapter 1.

Notably, fiscal actions aiming at reducing debt-to-GDP ratio usually fail to achieve this goal, with the remarkable exception of the spending-based actions in low-EPL countries. This suggests that quite often governments overestimate the budgetary effects of consolidations, or underestimate their effects on the economic activity.

Overall, we can conclude that labor market liberalizations are likely to change the effects of consolidations. On the one hand, spending-based consolidations will be less costly in terms of output and employment losses, while they should be more effective in reducing government debt. On the other hand, tax based consolidation will be highly costly in the long-run, and they will not reduce government debt.

However, some questions are still to be investigated. First, we need to refine the methodology, to better assess the role of labor market frictions in the transmission of fiscal policy. Second, it is not clear whether consolidation can stimulate investments, triggering an expansionary austerity process. This can explain why expenditure cuts do not affect the economy in some specification. Third, the role of debt-to-GDP ratio in determining the output response has to be assessed.

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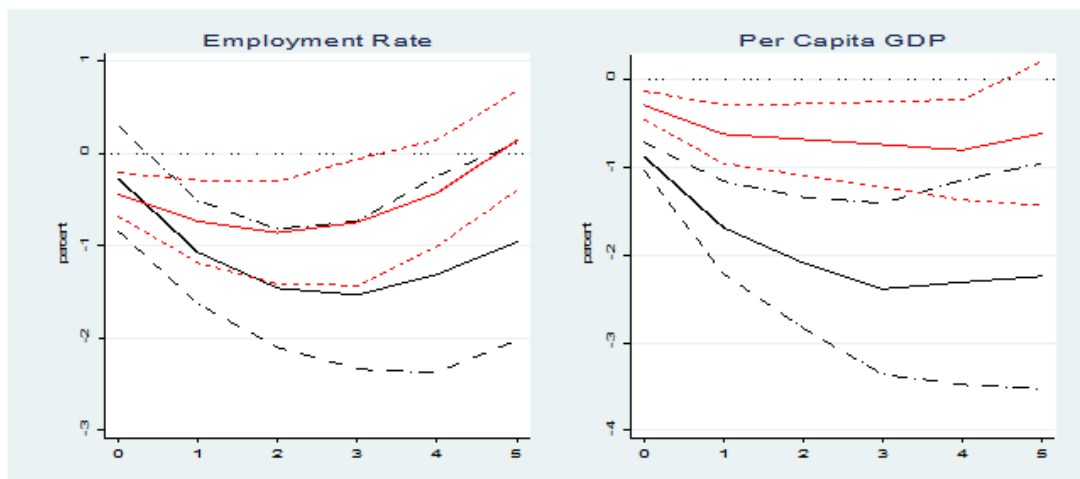
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3.8 Appendix

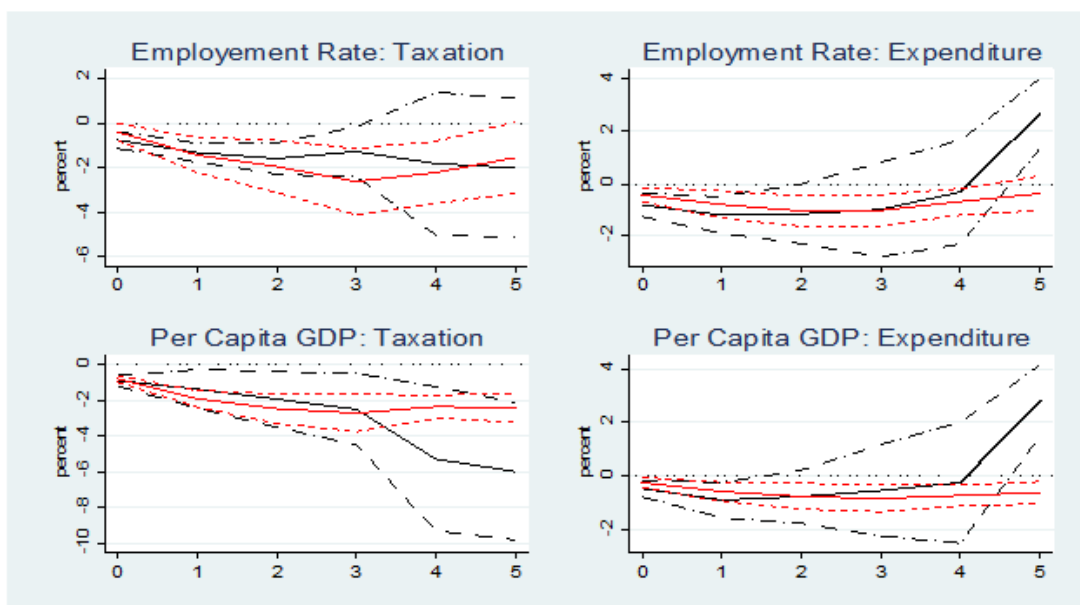
3.8.1 Robustness Checks

Figure 3.8: Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables



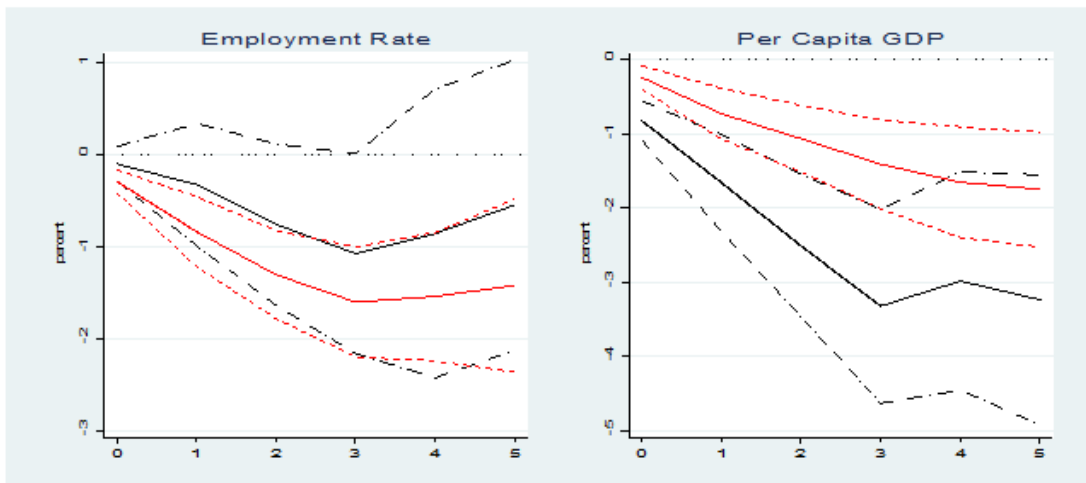
Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.9: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - no control variables



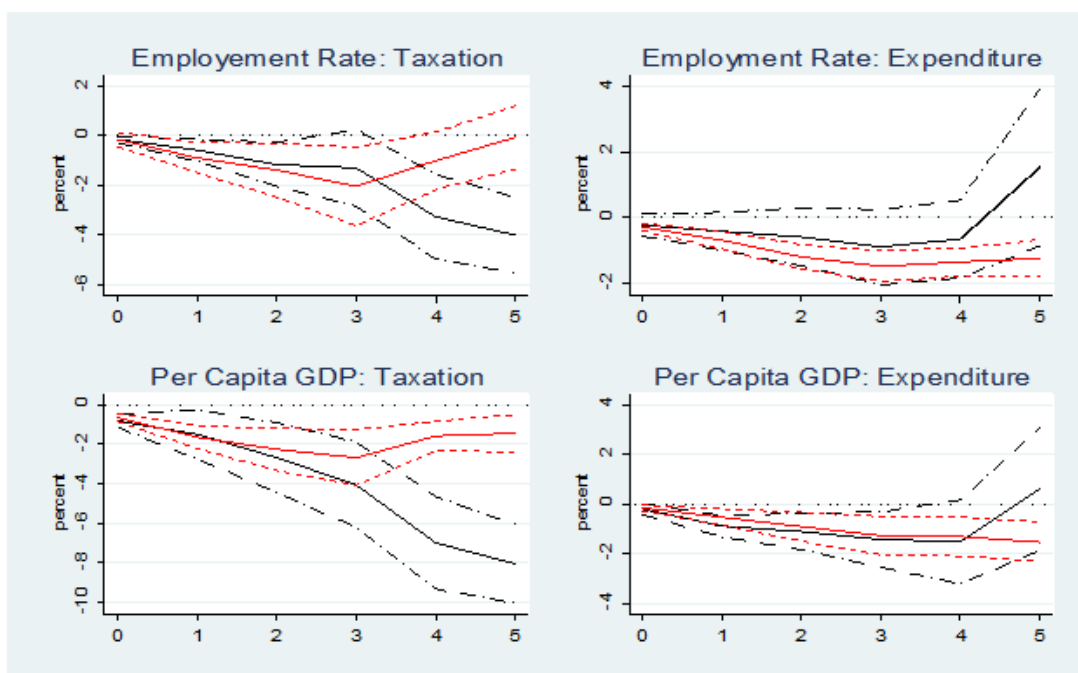
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Figure 3.10: Effects of public expenditure cuts (black line) and taxation increases (red line) - Employment and GDP



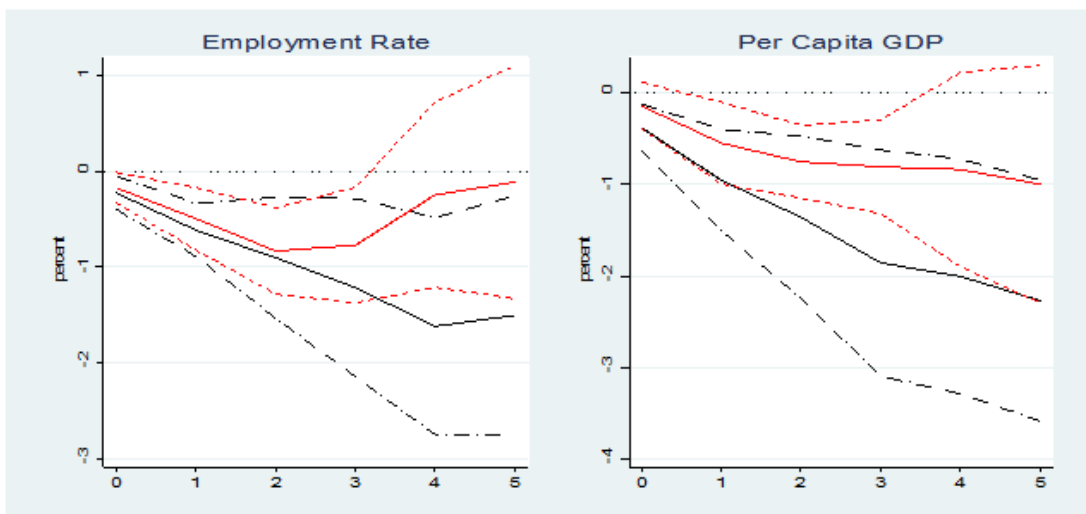
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Figure 3.11: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Employment and GDP



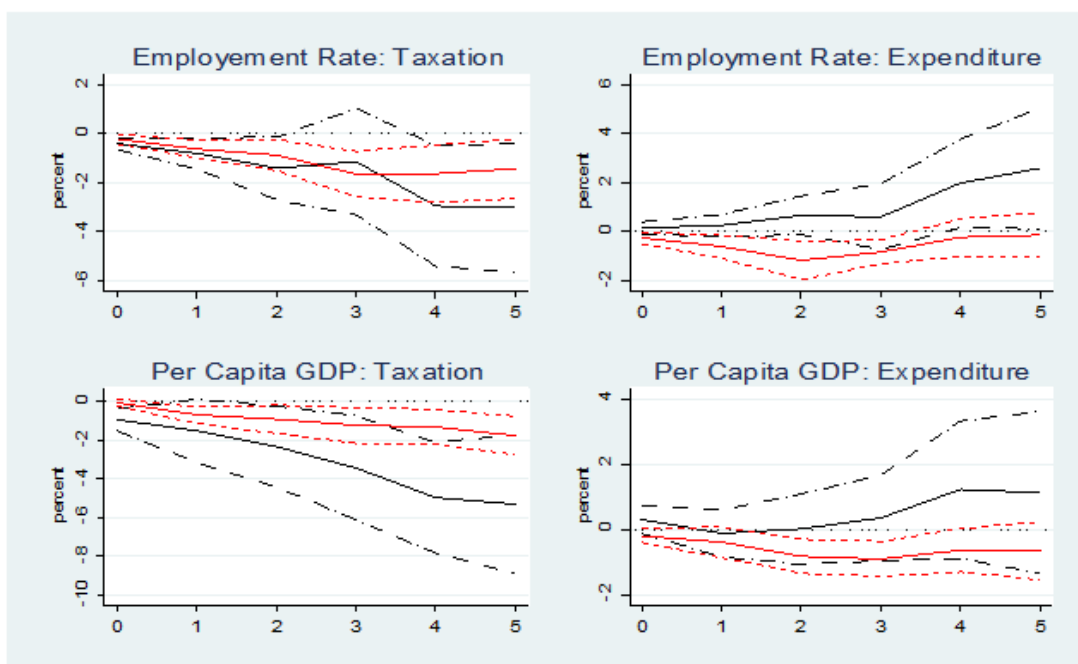
Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.12: Effects of public expenditure cuts (red line) and taxation increases (black line) - Tax and Expenditure Disentangled



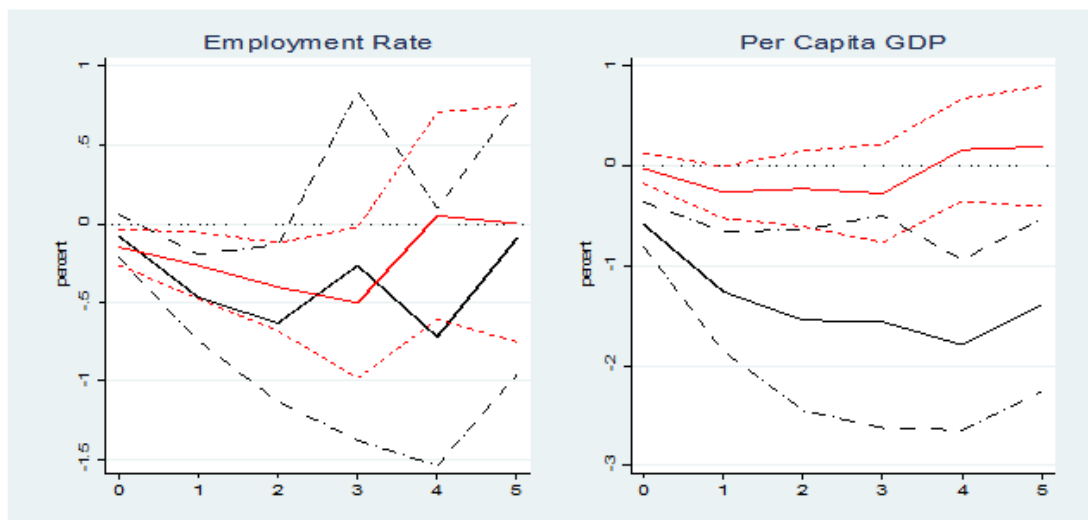
Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.13: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Tax and Expenditure Disentangled



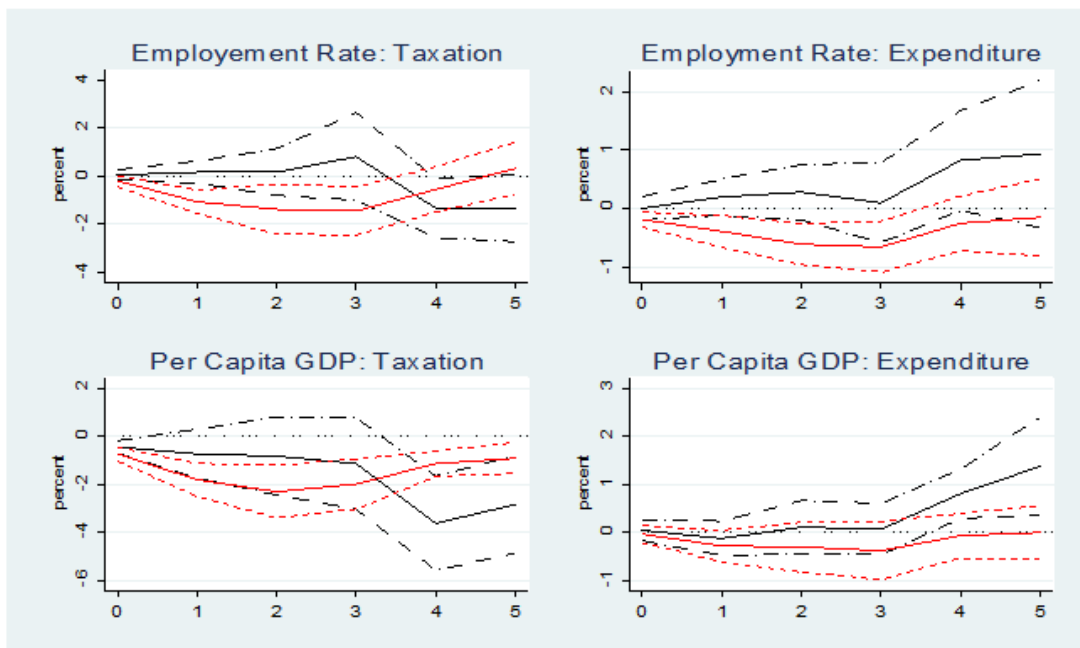
Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure and tax level are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.14: Effects of public expenditure cuts (black line) and taxation increases (red line) - Tax and Expenditure Purged for Fiscal Foresight



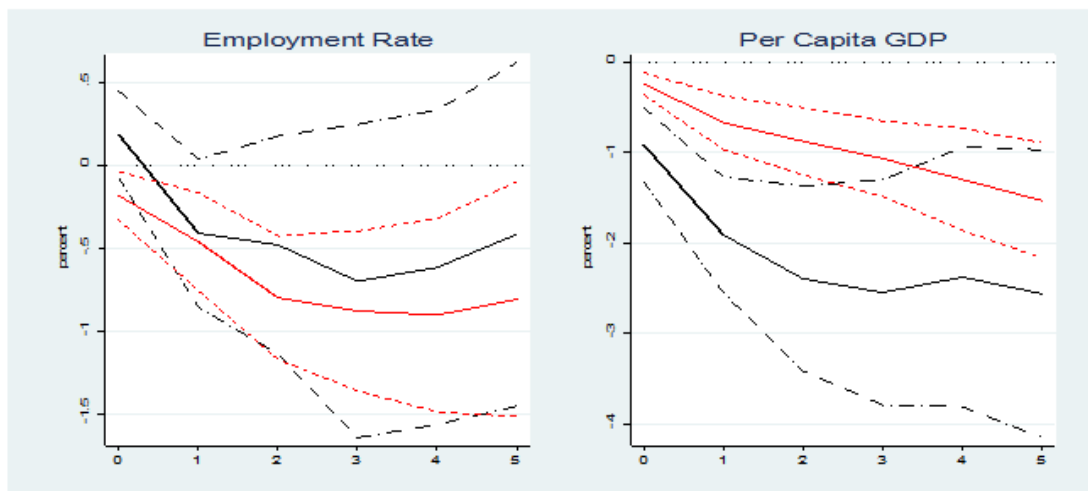
Note. Data are for all 17 countries, period 1985-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.15: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Tax and Expenditure Purged for Fiscal Foresight



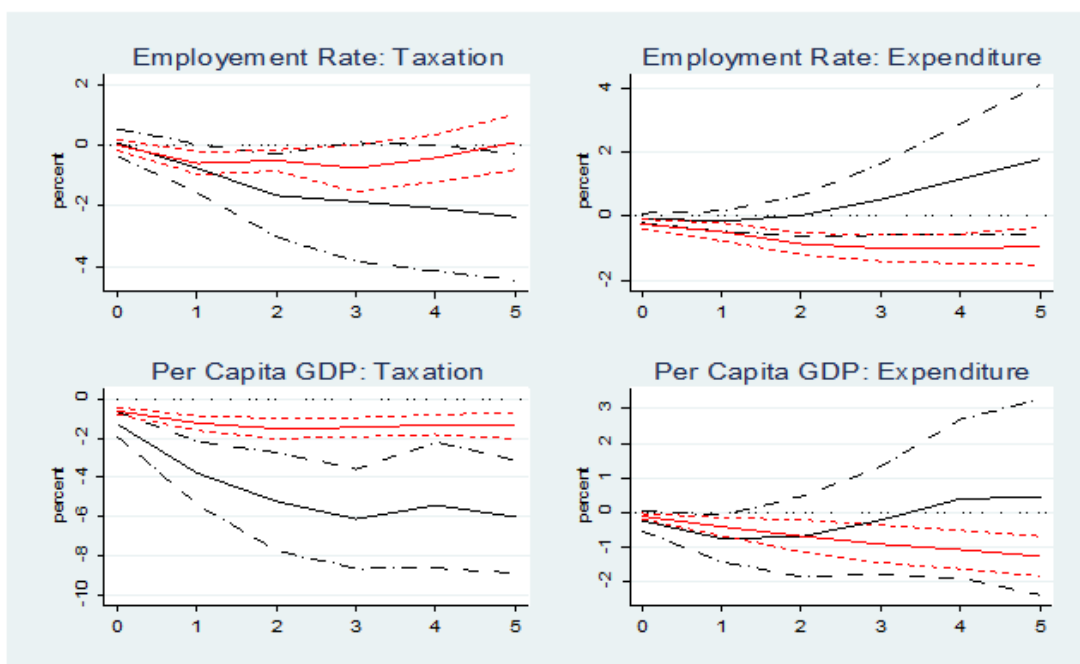
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Figure 3.16: Effects of public expenditure cuts (black line) and taxation increases (red line) - 1978-2007



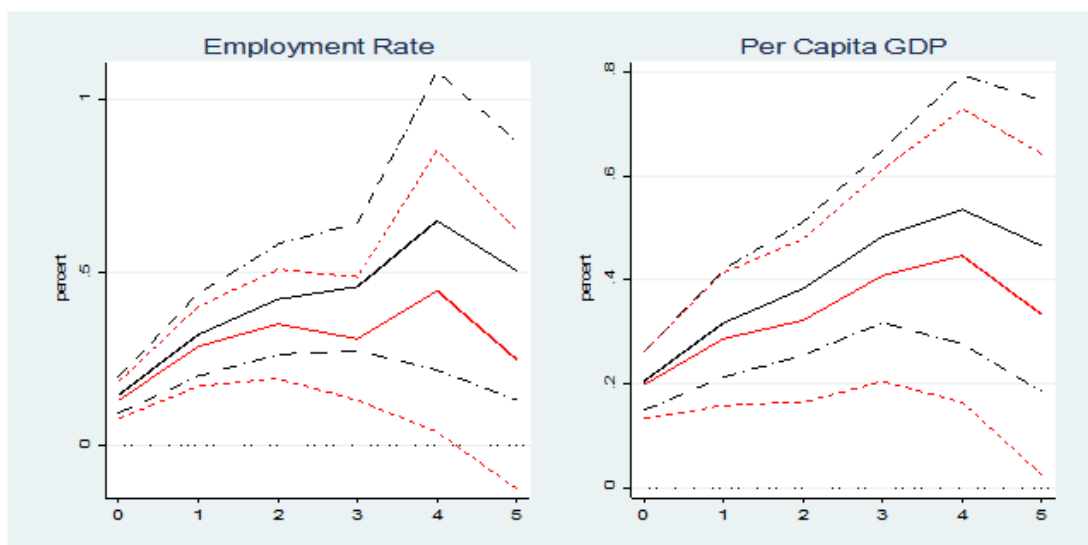
Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.17: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - 1978-2007



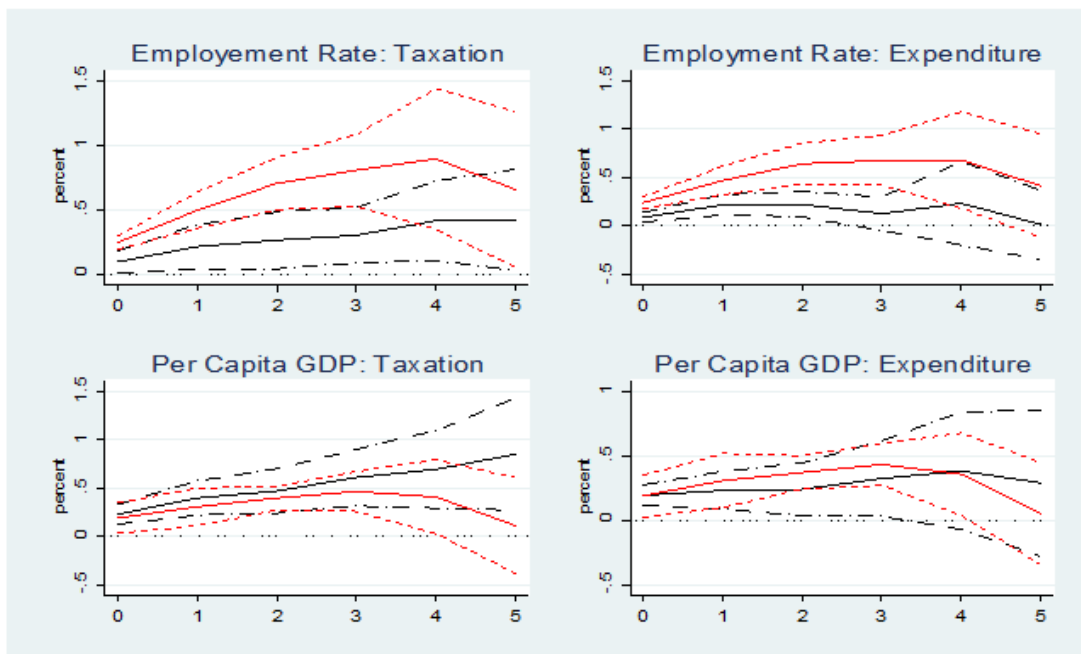
Note. Data are for all 17 countries, period 1978-2007. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.18: Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables - Forecast Errors



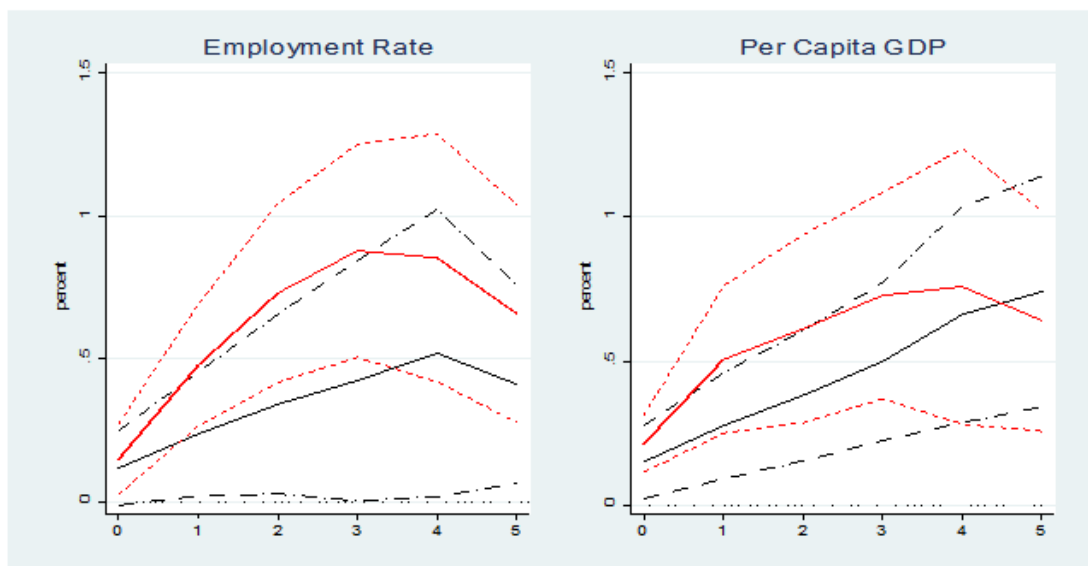
Note. Data are for all 17 countries, period 1985-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.19: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Forecast Errors



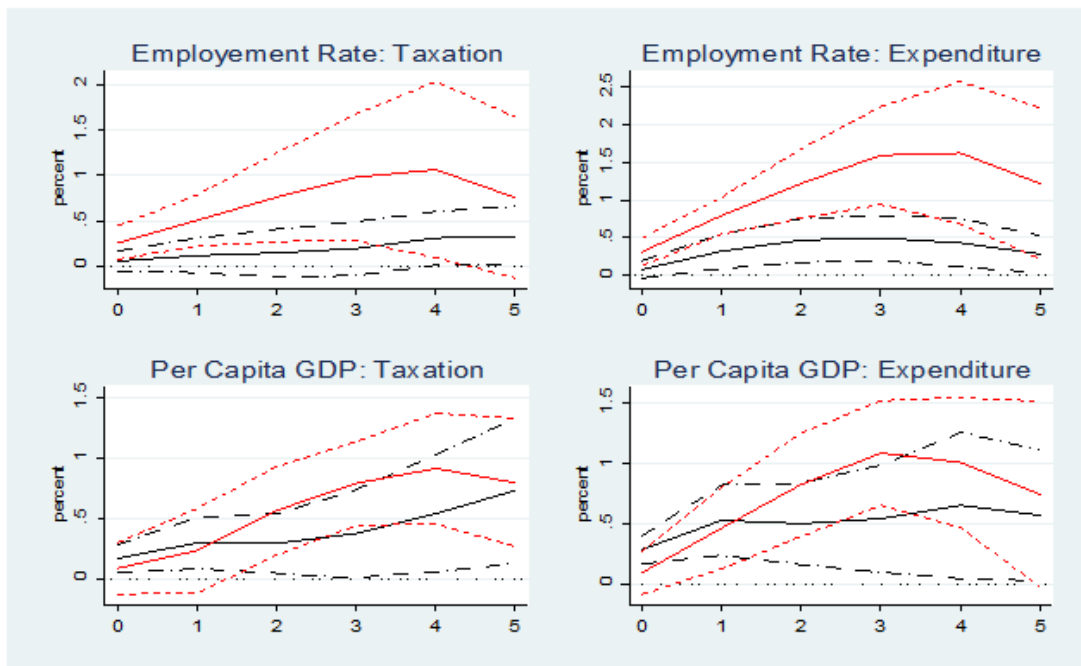
Note. Data are for all 17 countries, period 1985-2013. Shocks on both public expenditure and tax level are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.20: Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables - Nowcast Errors



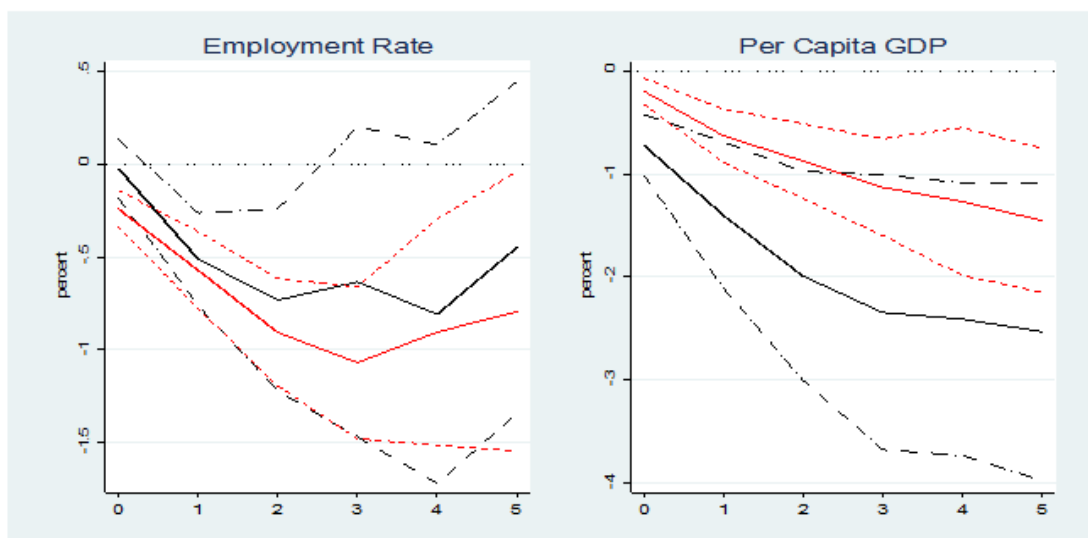
Note. Data are for all 17 countries, period 1985-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.21: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Nowcast Errors



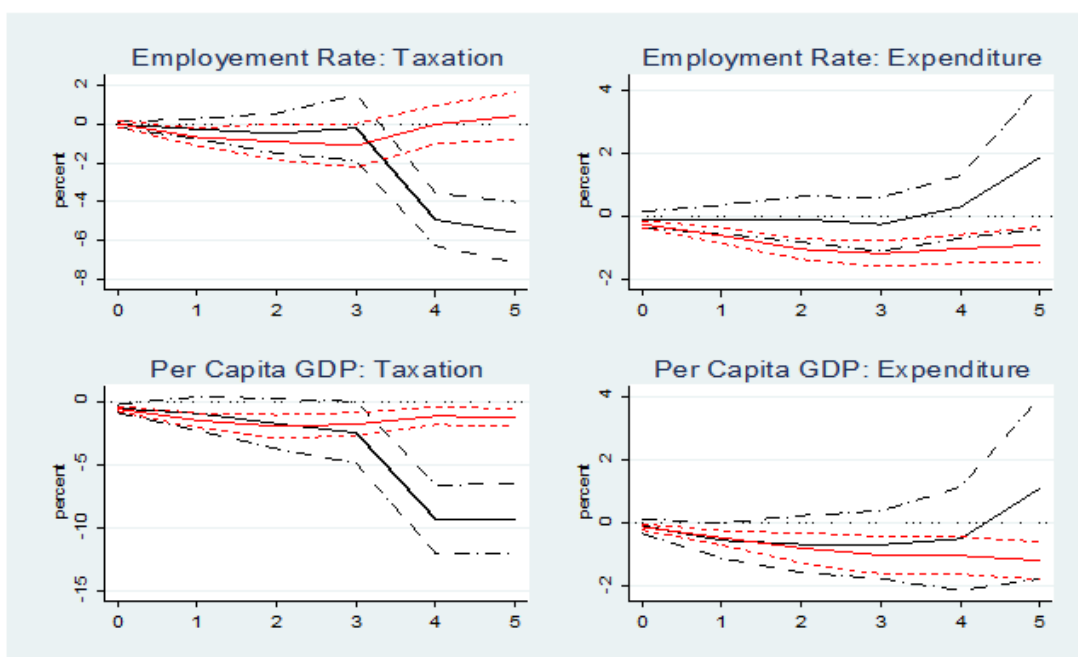
Note. Data are for all 17 countries, period 1985-2013. Shocks on both public expenditure and tax level are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.22: Effects of public expenditure cuts (black line) and taxation increases (red line) - no control variables - Large adjustments ($>1\%$)



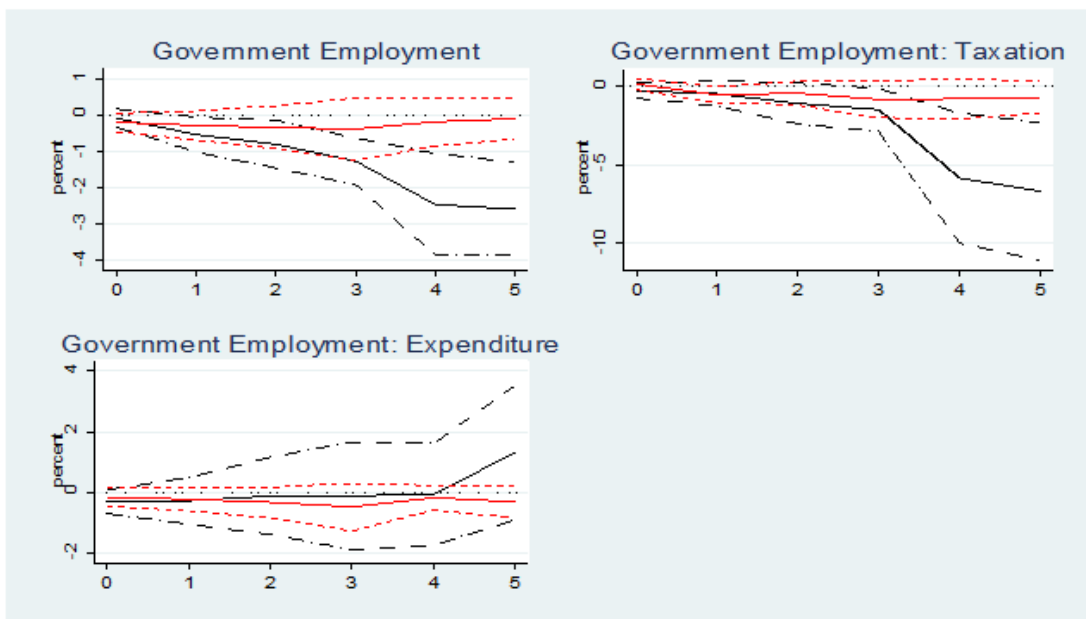
Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.23: Effects of Tax-Based and Spending-Based Consolidations in high-EPL countries (red) and low-EPL countries (black) - Large adjustments ($>1\%$)



Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure and tax level are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Figure 3.24: Effects of public expenditure cuts (black line) and taxation increases (red line) on Government Employment



Note. Data are for all 17 countries, period 1978-2013. Shocks on both public expenditure (black) and tax level (red) are normalized to be 1% of GDP. The figure reports, in red dashed lines for taxation and black dash-point lines for expenditure, point estimates and 90% confidence intervals based on Driscoll-Kraay standard errors. All specifications contain full set of country and time fixed effects. The shocks are identified with the narrative change in fiscal policy.

Table 3.1: Variables

Variable	Extended Name	Source	Original Label	Sample Size
EMP	Employment Rate	OECD Economic Outlook n. 97	ET = Total Employment	1978-2013 With exception of Germany (1991-2013)
GDP	Per-capita GDP	OECD Economic Outlook n. 97	POP1574 = Working-Age Population GDPV = Gross Domestic Product, volume	1978-2013 With exception of Germany (1991-2013)
CAPB	Cyclically Adjusted Primary Balance	Gujarado, Leigh, and Pescatori (2014) (1978-2010) and OECD Economic Outlook n. 97 (2011-2013)	NGXA = Cyclically Adjusted Primary Balance, value GDPV = Gross Domestic Product, value	1978-2013 With exception of Germany (1980-2013) and Portugal (1981-2013)
GGD	General Government Debt	OECD Economic Outlook n. 97 (1978-2013)	PGC = Government final consumption expenditures, deflator	1978-2013 With exception of Australia (1985-2013), Austria (1991-2013), Denmark (1980-2013), Germany (1991-2013), Portugal (1985-2013), and Spain (1980-2013), and
CPI	Consumer Price Index	Gujarado, Leigh, and Pescatori (2014) (1978-2010), OECD 97th (2011-2013)	CFI = Consumer Price Index for non-euro area OECD countries and CPHI = Harmonized Consumer Price Index for euro area countries	1978-2013 With exception of Germany (1991-2013)
INT	Real Interest Rate	OECD Economic Outlook n. 97 (1978-2013)	RIS = Short-term interest rate	1978-2013 With exception of Germany (1991-2013) and Portugal (1981-2013)
WAG	Nominal Wages	OECD Economic Outlook n. 97 (1978-2013)	PGDP = Gross domestic product	1978-2013 With exception of Canada (1980-2013) Germany (1991-2013) and Portugal (1981-2013)
HOU	Hours Worked Per-Employee	OECD Economic Outlook n. 97 (1978-2013)	WAGE = Wages, value	1978-2013 With exception of Austria (1991-2013) Germany (1991-2013) and Portugal (1992-2013)
DEP	Dependent Employment	OECD Economic Outlook n. 97 (1978-2013)	RHS = Hours worked per worker, total economy	1978-2013 With exception of Germany (1991-2013)
ULC	Unit Labor Cost	OECD Economic Outlook n. 97 (1978-2013)	EE = Dependent employment, total economy	1978-2013 With exception of Germany (1991-2013)
LAB	Labor Force	OECD Economic Outlook n. 97 (1978-2013)	LLC Unit labour cost, overall economy	1978-2013 With exception of Germany (1991-2013) and Portugal (no observations)
PROD	Labor Productivity	OECD Economic Outlook n. 97 (1978-2013)	LFP1574 = Labour force participation rate, 15-64	1978-2013 With exception of Germany (1991-2013)
UN	Unemployment Rate	OECD Economic Outlook n. 97 (1978-2013)	PTV = Labour productivity of the total economy	1978-2013 With exception of Germany (1991-2013)
REV	Government Revenues forecasts	OECD Economic Outlook n. 36 to 93	UNR = Unemployment rate	1982-2013 With exception of Germany (1991-2013)
EXP	Government Expenditure Forecasts	OECD Economic Outlooks n. 36 to 93	YRGT = Total receipts general government	1982-2013 With exception of Germany (1991-2013), and Portugal (1991-2013)
EPL	Index of Employment Protection	OECD States	YRGT = Total receipts general government	1982-2013 With exception of Germany (1991-2013), and Portugal (1991-2013)
g	Consolidated Tax Effort Consolidated Expenditure Cut	Alesina et al. (2014) Alesina et al. (2014)		1978-2013

Final Considerations

The three Chapters presented several results.

The evidences discussed in Chapter 1 are in favor of a persistent negative effect of tax hikes on employment (actual and potential) and potential output. The paths of our estimated impulse response functions are similar to the theoretical responses of Galí (2015)'s New-Keynesians model with hysteresis: this suggests that movements in taxation stimulate a hysteresis effect in the economy.

Spending cuts do not have a significant effect on employment rate and per-capita output. These results are in line with the theoretical background of expansionary austerity, in that a decline of public demand does not produce a decline in output. The different effects on the economy of the two tools show that they may affect the economy through different transmission mechanisms.

Our estimates suggest that consolidation policies implemented after 2010 might contribute to the low performance of employment and potential output in industrialized countries. Vice versa, expansionary fiscal policy can contribute to boost recovery and potential growth. In addition, policy makers should take into account the long-run effects of fiscal shocks when designing their policies. Assuming that only supply-side shocks matter in the long-run may lead to suboptimal policy decisions.

However, the results leave some open questions. The major one concerns the reason why taxation and expenditure have so different effects, in particular in the long run. One hypothesis is that consolidations obtained reducing expenditure are perceived as a signal of commitment to future fiscal discipline. This, in a rational agent framework, can lead households and investors to positively react to expenditure cuts, anticipating the future savings on debt interests and taxes.

A second hypothesis is that governments have a higher bargaining power than

firms. In this case, unions have to respond differently to dismissals in the two sectors, and dismissals do not have the same effects on the labor market. As a consequence, only when consolidation is implemented directly affecting the private sector, it does produce hysteresis. This happens only through tax changes. Both these hypotheses need to be tested in future investigations.

In Chapter 2 we show that traditional methodologies used to obtain the employment trend components can be outperformed by our cohort-by-cohort-technique. Our results also support a recent theoretical literature (Monacelli et al. 2011; Petrosky-Nadeau 2014; and Garín 2015) which suggests that the financial cycle can directly influence the labor market, and job creation in particular.

Despite their robustness, the results can be extended in two directions. First, the estimation technique is time-consuming: a computational improvement is needed to apply the methodology on a wider set of problems. Second, the fact that prime-aged are more sensible to credit conditions needs to be further investigated in future researches both from a theoretical and an empirical perspective.

Chapter 3 shows that consolidation has different effects depending on the level of labor market frictions, approximated by the level of employment protection (EPL). The role of employment protection in the transmission of consolidation is clear: the more employment is protected, the more the labor market will adjust to the new level of aggregate demand by adjusting wages. This reduces unit labor cost (ULC) and produces a moderate fall of employment, while labor productivity does not deteriorate. The lower cost of labor shifts the production to more labor-intensive technologies, this inducing a recovery in employment but not completely in output.

The results suggest that labor market liberalizations are likely to change the effects of consolidations. However, we need to refine the methodology, to better assess the role of labor market frictions in the transmission of fiscal policy.

Another possible extension of the results presented in Chapter 1 and Chapter 3 concerns the improvement of the dataset. The use of yearly data, together with the general lack of observations for particular countries or variables, reduces the set of available methodological tools. With a quarterly dataset the researcher would be able to estimate the model country-by-country, testing the dependency of impulse responses on a larger set of variables, as the debt-to-GDP ratio.

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Titolo della tesi: **Three Essays on Employment and Fiscal Policy**

Abstract:

The thesis is devoted to study some aspects related to the dynamics of the labor market, and is composed by three chapters. Chapter 1 verifies whether fiscal policy triggers hysteresis in the labor market, influencing the economy equilibrium. To this aim, we employ a panel structural VAR (P-SVAR) where the identification of fiscal shocks is achieved using a narrative measure of consolidation policy. The narrative measure builds on the Devries et al. (2011) dataset and successive extensions (Alesina et al 2014), which recollects all the consolidation actions in 16 OECD countries in the period 1978-2013. The results suggest that while tax hikes reduce economic activity and its potential levels persistently, spending cuts have not significant effects. This implies that only taxation is able to trigger a hysteresis process. Chapter 2 (coauthored with Stefano Scalone, University of Verona) presents an innovative method to estimate trend employment. As a matter of facts, the long-term dynamic of employment is highly influenced by demographic and social factors, as aging and schooling. In order to incorporate directly these factors in the trend estimation, we perform a two-step estimation process in a state-space framework: first, we conduct the analysis separately by age cohort and gender, second, we aggregate the estimated series to obtain the population values. This procedure allows us to shape and customize the estimation method depending on the segment of the population. Chapter 3 sheds some light on the role of labor market frictions, summarized by the level of protection of employment (EPL), in the transmission of consolidation shocks to the economy. This is crucial to understand how the effects of consolidation packages may change when a labor market reform is implemented, as the major economic institutions recently recommended. This Chapter extends the results presented in Chapter 1, estimating the effects of fiscal policy with the local projection methodology (Jordà 2005) which can easily introduce and accommodate for non-linear effects. The results suggest a different behavior of tax- and spending-based consolidation in high- and low-EPL countries. This difference seems to depend on a different effect of consolidation on wages across the two regions.

Firma dello studente

