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Titolo:

**Quantitative Easing, Net Basis
and Liquidity in the US Treasury
Market**

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INTRODUCTION

This thesis aims at studying and investigating the impact of Quantitative Easing in the Government Bond Market of U.S.A.

The first chapter explains what is a bond, how it is structured and it will be listed the different bonds that we can find in the US and in the Italian bond markets.

Then, it will be explained what is a government bond and how Central Banks can implement their monetary policy using those securities and how market liquidity is affected and measured.

Chapter three focuses on monetary policy implemented by the FED during the last two-three years (Quantitative Easing) while chapter number four explains what is a future contract on government bonds. In chapter number four it is also introduced the concept of “net basis”.

In the last two chapters the results of the graphical and empirical analysis on the net basis are provided.

The attention of the work is focused on the behaviour of the net basis of a bond, trying to understand, at the same time, the trends of prices and yields; the principal aim is to understand how the purchases of a Treasury influence the value of its net basis, trying to understand if it decreases or increases and if the effects are perceived immediately or after a little period of time.

CHAPTER 1: BOND MARKETS

Frank J. Fabozzi in his book “bond markets, analysis and strategies” defines a bond as “a debt instrument which requires the issuer (also called the debtor or borrower) to repay the lender/investor the amount borrowed plus interest over a specified period of time”. A typical “plain vanilla” bond issued in the United States, specifies (1) a fixed date when the amount borrowed (the principal) is due, and (2) the contractual amount of interest, which is typically paid every six months.

The date on which the debtor has to repay the principal is called the “maturity date”.

In general, bonds with a maturity from one to five years are considered short-term bonds; bonds with a maturity from five to 12 years are viewed as intermediate term, and long term bonds are those with a maturity of more than 12 years.

The maturity is important not only because it indicates the period of time over which the creditor expect to receive the coupon payments and the number of years before the debt will be repaid in full, but also because the yield of the bond depends on it. The shape of the yield curve determines how term to maturity affects the yield.

The price of a bond will fluctuate over its life as yields in the market change; the volatility of the price of a bond depends on its maturity. More specifically, with all other factors constant, the longer the time to maturity of a bond, the greater the price volatility resulting from a change in market yields and so, the greater the risk and the higher the interest rate that has to be paid.

The price of a bond, like the price of any financial instrument, is equal to the present value of the expected cash flows and the required yield reflects the yield for financial instruments with comparable risks or alternative investments.

There is a relationship between coupon rate, required yield and price. As yields in the market place change, the price of the bond changes in order to compensate an investor for the new required yield in the market. When the coupon rate is the same as the required yield, the price of the bond will equalize its par value. When yields in the market rise above the coupon rate, the price of the asset becomes lower; when the required yield of the market instead, is below the coupon rate, the bond must be sold above its par value.

There is also a relationship between the price of a bond and its time to maturity (if interest rates are unchanged): the price of a bond will not remain constant for a bond selling at a premium or a discount; the price of a discount increases as the asset approaches maturity, assuming unchanged interest rates. For a premium bond, the opposite occurs. For both bonds, the price will equal the par value at the maturity date.

There are 3 main reasons for the change in a price of a Bond.

1. There is a change in the required yield owing to changes in the credit quality of a issuer.
2. There is a change in the price of the bond selling at a premium or a discount, without any change in the required yield, simply because the bond is approaching to maturity (as seen above).
3. There is a change in the required yield owing to a change in the yield on comparable bonds (i.e., a change in the yield required by the market as seen above).

Talking about movements in a bond's price, it is important to introduce the risks that can affect the yield and the price of a bond .

- Interest rate risk: as interest rates in the market place rise, the price of a bond will fall and vice versa.
- Reinvestment risk: occurs when cash flows received are reinvested and depends on the interest rate levels at the time of reinvestment, as well as on the reinvestment strategy.
- Credit risk: as the risk that the issuer of a bond will not be able to satisfy the terms of the obligation and so the timely payment of interest and repayment of the amount borrowed (default risk). It also refers to the upgrade or downgrade of the issuer (downgrade risk).
- Inflation risk: measured in terms of purchasing power. An investor is exposed to the inflation risk because the interest rate the issuer promises is fixed when the inflation rate instead, generally rises.
- Currency risk and exchange rate risk: when an investor purchases a bond in a different currency

- Liquidity Risk: depends on the ease with which an issue can be sold at or near its value.
- Volatility risk: the risk that a change in the volatility of the market will affect the price of a bond adversely.

There are two main measures to evaluate the volatility of the price of a bond: the duration and the convexity.

The first one is a measure of the change in the value of a bond when rates in the market place change; it is the approximate percentage change in a price for a small change in interest rates. When yields in the market place rise, the duration/price of the bond decreases. We don't have to think of duration as a measure of time: "Unfortunately, market participants often confuse the main purpose of duration by constantly referring to it as some measure of weighted average life of a bond. This is because of the original use of duration by Macaulay. [...] The answer to this puzzle is that duration is the approximate percentage change in price for a small change in interest rates" (Frank J. Fabozzi).

While duration is a good measure for a small change in interest rates, it does not capture the effect of the convexity of a bond on its price performance when yields change but more than a small amount. Let's take as an example two bonds (A and B) with the same duration and the same yield, but with a difference in the convexity: bond B is more convex than bond A as figure 1 shows.

What does it mean if bond B has a greater convexity? Whether the market interest rate rises or falls, B will have a higher price. It means that if the required yield rises, the capital loss on bond B will be lower than the capital loss in bond A.

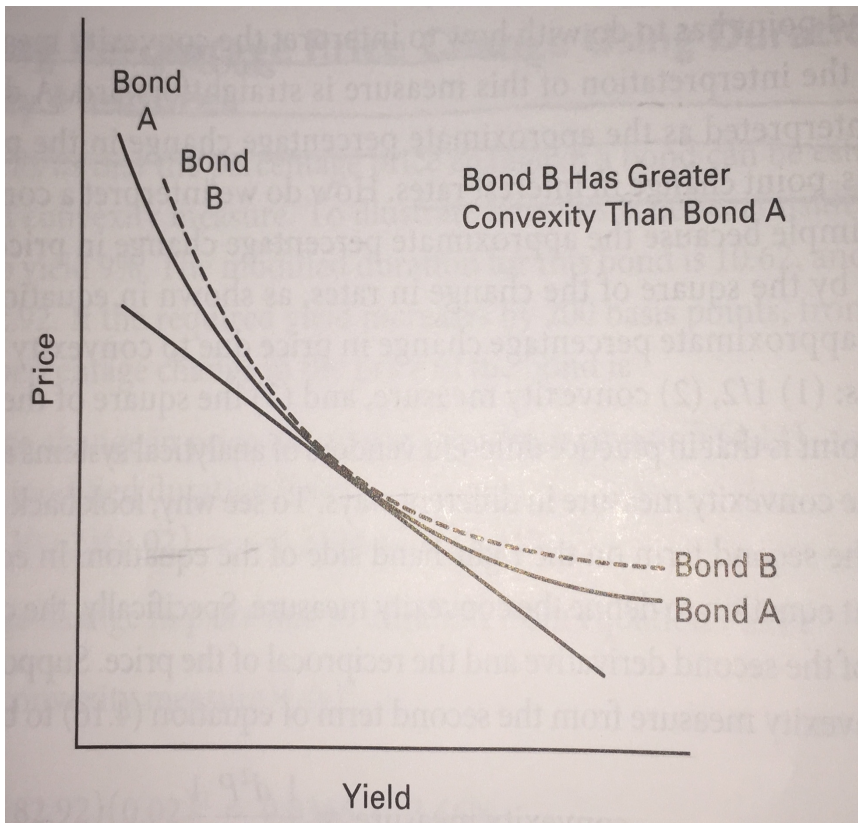


Figure 1: Exhibit 4-16: Comparison of Convexity of Two Bonds
 Bond Markets, Analysis and Strategies (Frank J. Fabozzi)

After this little introduction to bonds we should ask ourselves: Why invest in Bonds?

“A balanced portfolio generally includes a combination of cash, equities (stocks) and bonds. For many, a properly structured portfolio will include a significant proportion of bonds. Even for investors who do not need safety or current income, bonds provide an important element of diversification and risk management. Table 1 summarizes the benefits of holding bonds in a portfolio from 1953 to 2003. As we can see, the return of a portfolio with both stocks and bonds is a little lower than a pure equity portfolio, but the volatility –measured by standard deviation of annual returns- is dramatically lower”.

[“The fundamentals of Bond Market”, RBC Dominion Securities]

Table 1: The Benefits of Diversification

The Benefits of Diversification (1953 - 2003)				
	100%Equities Portfolio	100%Bonds Portfolio	Simple Average 50/50 Portfolio	Rebalanced Annually 50/50 Portfolio
Return	10.14%	7.13%	8.64%	9.04%
Volatility	16.42%	10.29%	13.36%	9.82%
Largest Loss	(25.93%)	(10.46%)	(18.20%)	(13.81%)
Average Loss	(8.62%)	(3.67%)		(5.05%)
# of Losses	14	12		10
# of Losses > 10%	6	1		1

Table 1: The Benefits of Diversification.
RBC Investments Fundamentals of the Bond Market

1.1: THE BOND MARKET IN THE U.S.A.

Taking as an example the U.S. Bond Market, we could find different sectors in it. It is the largest bond market in the world and it is divided into six sectors: agency sector, municipal sector, corporate sector, asset backed securities sector, mortgage sector and the one we are interested in, the U.S. Treasury sector.

The agency sector includes securities issued by federal institutions and government-sponsored enterprises; this sector is the smallest one of the bond market.

The municipal sector is the one where state, local governments and their authorities raise funds.

The corporate sector includes securities issued by U.S. corporations and securities issued in the United States by non-US corporations.

The mortgage sector is the sector where the securities are guaranteed by mortgage loans and finally, the Treasury sector includes securities issued by the US government. These securities are Treasury bills, notes and bonds. This sector plays a key role in the valuation of securities and the determination of interest rates throughout the world.

The market for U.S. Treasury securities is the second largest sector of the bond market (after the mortgage market).

Treasury securities are issued by the U.S. Department of the Treasury and are backed by the full faith and credit of the U.S. government. Consequently, market participants

believe that they have minimal credit risk, although in recent years there have been some problems due to the growth of the US federal deficit. Interest rates on Treasury securities are the benchmark yield in the US economy as well as throughout international capital markets.

Two factors determine the principal role of US Treasury securities: volume (in terms of dollars) and liquidity. The Department of the Treasury is the largest single issuer of debt in the world and the Treasury market the most active and the most liquid market in the world. The dealer spread between bid and ask price is considerably smaller than in other sectors of the bond market.

The Treasury issues marketable and non-marketable securities. In this work the focus is on marketable securities: those are categorized as fixed principal securities or inflation-indexed securities.

Fixed-income principal securities include Treasury bills, Treasury notes and Treasury bonds.

Treasury bills are issued at a discount to par value, have no coupons, and mature at par value. The current practice is to issue all securities with a maturity lower or equal to one year as discount securities. T bills have no coupons and they are issued at discounted price so, the return to the investor is the difference between the maturity value and the purchase price.

All securities with an initial maturity of two years or more are issued as coupon securities at approximately par value. Treasury coupon securities issued with original maturities from one to 10 years are called Treasury notes. Treasury coupon securities with original maturities greater than 10 years are called treasury bonds.

The U.S. Department of the Treasury issues also securities that adjust for inflation referred to as Treasury inflation protection securities, or TIPS.

Marketable securities are sold at first in the primary market through sealed-bid auction. Auctions are announced several days in advance through Treasury Department press release or press conference. The details of the amount, term and type of securities are provided with the announcement. All entities can access to treasury auctions.

While the primary market is accessible for everyone, the primary dealers for government securities are only firms with which the Federal Reserve Bank of New York directly deals during its open market operations. They include specialized

securities firms, investment banks, large diversified securities firms, and are foreign as well as U.S. owned.

Primary dealers play a very important and specific role, participating meaningfully in Treasury auctions, making reasonably good markets to the Federal Reserve Bank, and supplying market information and commentary to the Fed.

Trading for Treasury securities in the secondary market happens in a multiple-dealer over-the-counter platform rather than through an organized exchange. Trading takes place throughout the week, among the three main trading centers of Tokyo, London, and New York. The majority of trading happens during New York trading hours and primary dealers are the principal market makers.

The Federal Reserve is an important participant in the secondary market for Treasury securities buying and selling Treasuries through open market operations in order to implement the monetary policy directives of the Federal Open Market Committee (FOMC).

Despite the vast volume of trading, the transparency of the secondary market for government securities is very near to the level of that for common stocks.

The Treasury market is very active and liquid and the mayor part of the trading is concentrated in a small number of the 200 issues outstanding. The most recently issued securities of a given maturity, called on-the-run or current securities, are particularly traded and analysis from GovPX reveals that on-the-run issues accounted for 64% of the overall trading activity. Older issues of a given maturity are called off- the-run securities. While almost all Treasury securities are off-the-run, they accounted for just 29% of interdealer trading.

There are also visible differences in trading activity by issue type; analysis from Gov PX state that the on-the-run Treasury notes are the most actively traded securities.

According to the TMPG (Treasury Maarket Practices Group), that recognizes the importance of maintaining the integrity and efficiency of the over-the-counter U.S. government securities (Treasury), agency debt, and agency mortgage-backed securities (MBS) markets, “the smooth and efficient functioning of the Treasury, agency debt, and agency MBS markets relies on the integrity, honesty, good faith, and mutual trust

shown by all participants. An efficient market fosters liquidity, which helps all market participants to find buyers and sellers more effectively. It is important that both buyers and sellers promote market liquidity”. [Best Practices, TMPG]

All market participants should behave in a manner that will support market liquidity. Dealers, in particular, should promote market making, and all market participants should avoid trading strategies that hinder market clearance .

1.2: THE BOND MARKET IN ITALY

The italian market for Government Bonds is pretty different from the american market for Treasury securities. First of all, talking about the italian one, we are facing such a smaller reality that sometimes it seems impossible to make comparison between the two market described.

The italian “Titoli di Stato” are issued by the italian republic through the MEF (“Ministero dell’Economia e delle Finanze”), in collaboration the italian Central Bank for the organization of the activity.

Seven different types of securities are offered and they differ essentially for their different maturities. Those different typologies are collected into three main groups: zero coupon, fixed rate and variable rate.

The “Titoli di Stato zero coupon” are those that do not offer a periodic coupon; the return is simply the difference between the initial price and the par value of the bond.

- “Buoni Ordinari del Tesoro” BOT: issued through auction, present a maturity of 3, 6 and 12 month.
- “Certificati del Tesoro Zero Coupon” CTZ: with a maturity of 24 months.

Variable rate Bonds:

- “Certificati di Credito del Tesoro” CCT: with a maturity of 7 years, the semestral coupon is calculated taking the yield of the semestral BOT, times 0,5 and adding a spread ad 15 basis points. The total yield of this particular security is made also from the little difference between the price and the par value.

- “Certificati di Credito del Tesoro” (CCTeu): they have the same characteristics of the CCT, with the only difference in the computation of the coupons, made from the Euribor 6 months plus a spread, times a specific calculation base ACT/360.
- “Buoni del Tesoro Poliennali indicizzati all’inflazione Europea”: medium-long term securities with a maturity of 5, 10, 15 or 30 years. Both coupons and par value change as inflation in the Eurozone fluctuates in order to guarantee a protection against the decreasing purchasing power.
- “BTP Italia”: they are the same as the “Buoni del Tesoro Poliennali indicizzati all’inflazione Europea” but related to the Italian inflation and with just one maturity of 4 years.

There is instead just one typology of fixed rate Bonds: the BTP (“Buoni del Tesoro Poliennali”) that it’s probably the most important Italian Government Bond, and also the most used for computing spreads between different countries and other statistics. The BTP is a medium-long term bond with a maturity of 3, 5, 10 or 15 years.

CHAPTER 2: MEASURING TREASURY MARKET LIQUIDITY

“Many important uses of U.S. Treasury securities come from the securities’ immense liquidity. Market investors, for example, use Treasuries to hedge positions in other fixed income securities and to speculate on the course of interest rates because they can buy and sell Treasuries quickly and with low transaction costs. The huge volume of trading and narrow bid-ask spreads also help to make Treasury rates reliable reference rates for pricing and analyzing other securities. The liquidity of the Treasury market has received particular attention in recent years. This heightened focus is partly attributable to the financial market turmoil in the fall of 2007, when liquidity was disrupted across markets and investors sought the safety and liquidity of Treasuries.

A comprehensive set of liquidity measures are available for the U.S. Treasury securities market. [...] High-frequency data from the interdealer market allow for an analysis of trading volume, trading frequency, bid-ask spreads, quote sizes, trade sizes, price impact coefficients, and on-the-run/off-the-run yield spreads. The variables are analyzed relative to one another, across securities, and over time in an effort to assess how liquidity can best be measured and tracked.

[...] The analysis reveals that the simple bid-ask spread, that it’s the difference between bid and offer prices, is a useful measure for assessing and tracking Treasury market liquidity. The bid-ask spread can be computed quickly and easily with data that are widely available on a real-time basis. Nonetheless, the spread is highly correlated with the more sophisticated price impact measure and it is correlated with episodes of reported poor liquidity in the expected manner. The bid-ask spread thus increases sharply with equity market declines and with the financial market turmoil in the fall of 2007.

[...] The vast volume of trading in the Treasury market and the absence of rules that limit price changes or bid-ask spreads to specified minimums or maximums make it relatively easy to estimate measures of liquidity precisely. Correlation coefficients across Treasuries are in fact found to be quite high for the various measures, indicating that the liquidity of one security can serve as a reasonable proxy for the market as a whole.

[...]”A liquid market is defined as one in which trades can be executed with no cost”(O’Hara 1995; Engle and Lange 1997). In practice, a market with very low transaction costs is characterized as liquid and one with high transaction costs as illiquid. Measuring these costs is not simple, however, as they depend on the size of a trade, its timing, the trading venue, and the counterparties. Furthermore, the information needed to calculate transaction costs is often not available. As a consequence, a variety of measures are employed to evaluate a market’s liquidity.

[...]The bid-ask spread is a commonly used measure of market liquidity. It directly measures the cost of executing a small trade, with the cost typically calculated as the difference between the bid or offer price and the bid-ask midpoint (or one-half of the bid-ask spread). The measure can thus quickly and easily be calculated with data that are widely available on a real-time basis. However, a drawback of the bid-ask spread is that bid and offer quotes are good only for limited quantities and periods of time. The spread therefore only measures the cost of executing a single trade of limited size.

The quantity of securities that can be traded at the bid and offer prices helps account for the depth of the market and complements the bid-ask spread as a measure of market liquidity. A simple estimate of this quantity is the quote size, or the quantity of securities that is explicitly bid for or offered for sale at the posted bid and offer prices. A drawback of this estimate, however, is that market makers often do not reveal the full quantities they are willing to transact at a given price, so the measured depth underestimates the true depth.

[...]An alternative measure of market depth is trade size. Trade size is an ex-post measure of the quantity of securities that can be traded at the bid or offer price, reflecting any negotiation over quantity that takes place. Trade size also underestimates market depth, however, as the quantity traded is often less than the quantity that could have been traded at a given price.

A popular measure of liquidity, suggested by Kyle (1985), considers the rise (fall) in price that typically occurs with a buyer-initiated (seller-initiated) trade.

The measure is relevant to those executing large trades or a series of trades, and together with the bid-ask spread and depth measures provides a fairly complete picture of market liquidity. A drawback of this measure, though, is that the data required for estimation, including the side initiating a trade, are often difficult to obtain, particularly on a real-time basis.

A liquidity measure used in the Treasury market is the “liquidity” spread between more and less liquid securities, often calculated as the difference between the yield of an on-the-run security and that of an off-the-run security with similar cash flow characteristics. Since liquidity has value, more liquid securities tend to have higher prices (lower yields) than less liquid securities, as shown by Amihud and Mendelson (1991) and Kamara (1994). A nice feature of the liquidity spread is that it can be calculated without high-frequency data. Moreover, because the spread reflects both the price of liquidity as well as differences in liquidity between securities, it provides insight into the value of liquidity not provided by the other measures.

[...]Trading volume is an indirect but widely cited measure of market liquidity. Its popularity may stem from the fact that more active markets, such as the Treasury market, tend to be more liquid, and from theoretical studies that link increased trading activity with improved liquidity. The measure’s popularity may also reflect its simplicity and availability, with volume figures regularly reported in the press and released by the Federal Reserve. A drawback of trading volume, however, is that it is also associated with volatility (Karpoff 1987), which is thought to impede market liquidity. The implications of changes in trading activity for market liquidity are therefore not always clear.

A closely related measure of market liquidity is trading frequency. Trading frequency equals the number of trades executed within a specified interval, without regard to trade size. Like trading volume, high trading frequency may reflect a more liquid market, but it is also associated with volatility and lower liquidity. In fact, Jones, Kaul, and Lipson (1994) show that the positive volume-volatility relationship found in many equity market studies reflects the positive relationship between the number of trades and volatility, and that trade size has little incremental information content”.

Which measures are the best to use?

“An evaluation of the various liquidity measures is somewhat problematic because there is no single gauge of liquidity against which the measures can be definitively judged. That being said, there are ways in which the measures can be assessed. First, a liquidity measure that directly quantifies the cost of transacting is, a priori, likely a better measure of liquidity. Second, a liquidity measure should probably behave in a manner consistent with market participants’ views about liquidity. Finally, a good liquidity measure should be easy to calculate and understand, and available to market participants

on a real-time basis.

[...]By the first two criteria, the bid-ask spread and price impact coefficient are superior liquidity measures. Both measures directly quantify the costs of transacting, with the bid-ask spread measuring the cost of executing a single trade of limited size and the price impact coefficient measuring the price effects of a trade. Both measures also correlate with episodes of reported poor liquidity in the expected manner, rising sharply during the market disruptions of October 1997, October 1998, and February 2000. On the last criterion, the bid-ask spread dominates the price impact coefficient. The spread is easy to calculate and understand, and available on a real-time basis. In contrast, estimating the price impact coefficient requires significant data and regression analysis, and it may not be estimable on a timely basis because of data limitations.

[...]The other liquidity measures may be less informative than the bid-ask spread and price impact coefficient, yet may still contain useful information about liquidity. In particular, the other measures may serve as good proxies for liquidity and/or contain information about liquidity not present in the other measures”.

[Michael J. Fleming, “Measuring Treasury Market Liquidity”].

CHAPTER 3: TREASURY SECURITIES AND OPEN MARKET OPERATIONS

We have already introduced the so called “Open Market operations”. The Central Bank of a country (in our case the Federal Reserve Bank -FED-), buys and sells Government Bond (Treasury securities) through open market operations as one of the tools used to implement the monetary policy directives of the Federal Open Market Committee (FOMC). The execution of the FOMC’s policy directives required the Desk to conduct an intensive schedule of permanent open market operations

The Bank implements monetary policy primarily by conducting temporary and permanent open market operations. By buying and selling government securities, the Bank affects the aggregate level of balances available in the banking system, and thus impacts the federal funds rate.

Temporary open market operations consist in repurchase and reverse repurchase agreements which goal is to temporarily add or drain reserves available to the banking system.

Permanent open market operations involve the buying and selling of securities outright to permanently add or drain reserves available to the banking system.

The Federal Reserve held an amount of about \$800 billion of treasury notes on its balance sheet before the crisis. At the end of November 2008, the FED started buying \$600 billion in mortgage-backed securities (MBS).

By June 2010, the FED held \$2.1 trillion of MBS, bank debt and Treasury notes. Further purchases have been halted as the economy started to improve, but then started again in August 2010 when the Fed revealed that the economy was not growing enough. After the halt in June 2010, holdings started falling as securities matured and were projected to fall until \$1.7 trillion by 2012

On the “Domestic Market Operations” report of the FED it is possible to read that during the 2013, The FOMC continued to implement a policy accommodation in order to support a stronger recovery and the price stability, trying to keep inflation down. The FOMC maintained the target range for the federal funds rate at 0 to 1/4 percent during

the year, and provided accommodation to the market through two tools: it changed the size and composition of the FED's balance sheet, and keep guiding the short term interest rates. Throughout 2013, the FOMC purchased an additional amount of 45 billion dollars per month of longer term U.S. Treasuries and 40 billion dollars per month of agency mortgage-backed securities (MBS), and also continuing to reinvest returns from agency debt and MBS in MBS.

The FOMC's balance sheet changes resulted in additional purchase amount of 1,020 billion dollars of longer-term securities in 2013. The total amount of the domestic securities portfolio of the System Open Market Account (SOMA) rose to about 3.8 trillion dollars. Figure 1 shows size and composition of SOMA domestic securities holdings from 2009 to 2013.



Source: Federal Reserve Bank of New York.

Notes: Figures are weekly averages of daily figures. They include unsettled holdings.

Figure 1: Size and Composition of SOMA Domestic Securities Holdings

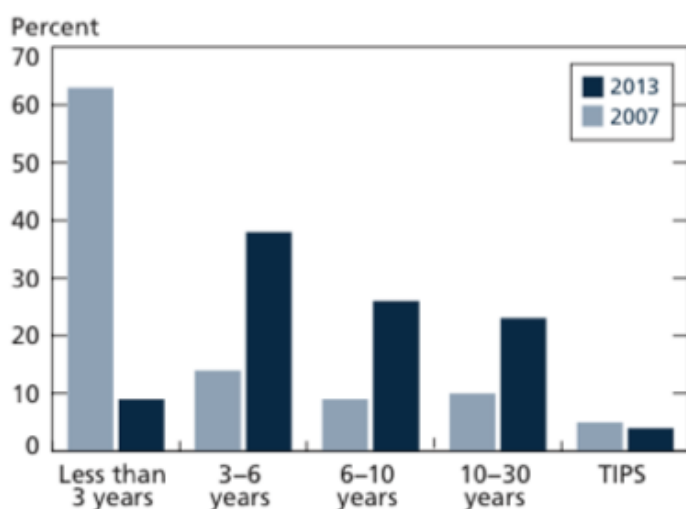
The portfolio's allocation of holdings between Treasury securities and non-Treasury securities changed a bit, on balance, throughout 2013. Since the FOMC had sold almost all its shorter maturity Treasury holdings in late 2011 and 2012 during the Maturity Extension Program (MEP) the maturity of Treasuries hold by the FED remained longer-term.

The long duration of Treasury holdings in the portfolio should, by removing duration risk from the market, maintain a low pressure on longer-term interest rates and reduce

the private sector’s costs of borrowing; the big size of agency MBS holdings also reduce the duration risk from the market. SOMA’s purchases of agency MBS should also reduce pressure on long-term rates and keep down MBS rates, reducing primary mortgage rates, diminishing broader financial conditions, and stimulating demand for housing.

Throughout 2013, SOMA Treasury securities holdings grew by 543 billion dollars, to a total amount of 2.2 trillion dollars at the end of the year; the total value of holdings represented the 58 percent of the domestic securities portfolio.

As illustrated in Chart 2, Treasuries’ holdings in 2013 were in mayor part in intermediate and longer dated maturities, in deep contrast to the maturity that prevailed before the financial crisis, when more than 60 percentof security holdings had less than three years to maturity.

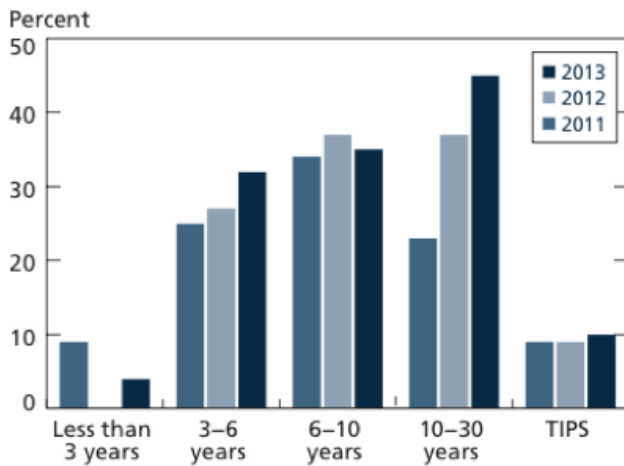


Source: Federal Reserve Bank of New York.

Notes: Figures are as of year-end. Maturity buckets apply to nominal Treasury securities.

Figure 2: Maturity Distribution of SOMA Treasury Holdings

The FED, as notable in Figure 3, held almost 19 percent of all marketable Treasury securities at the end of 2013, compared with 15 percent by the end of 2012 and 17 percent by the end of 2011. The increase was caused by the Federal Reserve’s purchases of longer maturity securities. This action, raised SOMA holdings to more than one third of the total supply of longer dated securities.



Sources: Federal Reserve Bank of New York; U.S. Treasury Department.

Figure 3: SOMA Treasury Holdings as a Share of Outstanding Treasury Supply

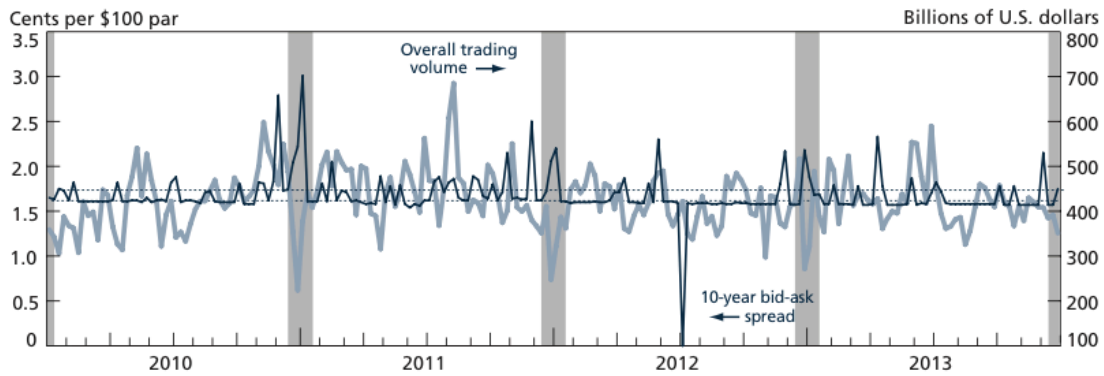
The SOMA portfolio was composed of almost 45 percent of all market securities from 10 to 30 years to maturity.

The level of agency MBS holdings increased by 509 billion dollars in 2013, until a total amount of 1.5 trillion dollars at the end of the year, representing 41 percent of the domestic securities portfolio.

The SOMA agency debt holdings decreased of 20 billion dollars in 2013, to a total amount of \$57 billion at the end of the year. About 2 billion dollars of the agency debt portfolio were in securities with a maturity of less than five years.

During 2013 bid-ask spreads, quote sizes, and trading volumes remained at historical levels. Figure 4 shows how the value of market liquidity measures has changed from 2010 to 2013.

TREASURY MARKET LIQUIDITY MEASURES



Source: Federal Reserve Bank of New York, based on non-unattributed data from BrokerTec.

Notes: The chart shows the one-week average of the on-the-run 10-year Treasury bid-ask spread and the two-week moving average of primary dealer Treasury transaction volume (excluding TIPS). Dotted horizontal lines represent average levels since 2010. Shaded areas represent periods around year-ends.

Figure 4: Treasury Market Liquidity Measures

Due to the progress of employment and the positive the outlook for labor market conditions, the Federal Open Market Committee (FOMC) decided to lower the level of its purchases at the December 2013 and January 2014 meetings.

During the December 2013 meeting, the Committee members spoke about the cumulative improvement in labor market conditions about inflation that would move back to 2 percent as the economy strengthened. Therefore, almost all the committee agreed that the FED could begin to diminish its asset purchases.

According to what has just being said, the FED announced at the December meeting that it would diminish its purchases of agency MBS from 40 billion dollars to 35 billion dollars per month and diminish its asset purchases of longer-term Treasury securities from 45 billion dollars to 40 billion dollars per month.

Due to the continue improvements in labour market and in economic conditions, at the January meeting, The FED announced that it would further lower the size of its asset purchases to 30 billion dollars per month for agency MBS and 35 billion dollars per month for longer-term Treasury securities.

While announcing to slightly reduce its purchases, the FED affirm that its holdings of longer term securities were considerable and would be getting bigger, promoting the economic recovery thanks to the low pressure on longer term interest rates and support mortgage markets.

On June 18th, 2014, the FOMC announced that due to the cumulative progress of labour

market conditions since the begin of the asset purchase program, the Committee decided to further reduce its asset purchases.

Beginning in July, the Committee announced that the FED would reduce its purchase of agency MBS to an amount of 15 billion dollars per month rather than 20 billion dollars per month, and would reduce the purchase of longer-term Treasuries of \$20 billion per month rather than \$25 billion per month. A further reduction of asset purchases was announced on July 30, 2014, by the FOMC: the FED started to purchase 10 billion dollars per month of agency MBS and \$15 billion per month of longer-term Treasury securities.

Being more specific, the table below (table 2) shows the assets and liabilities level of the FED on July 30 2014 and what has changed from April 30 2014 and July 31 2013. It is possible to notice the assets' purchase reduction in the treasury market: the decrease of the purchases, again, was caused by the improving of the US economy since the program started to take place.

Item	Current July 30, 2014	Change from April 30, 2014	Change from July 31, 2013
Total assets	4,407	+111	+835
Selected assets			
Securities held outright	4,137	+110	+841
U.S. Treasury securities ¹	2,420	+70	+438
Federal agency debt securities ¹	42	-3	-24
Mortgage-backed securities ²	1,674	+42	+427
Memo: Overnight securities lending ³	8	-4	+*
Memo: Net commitments to purchase mortgage-backed securities ⁴	62	+12	-27
Unamortized premiums on securities held outright ⁵	209	-1	+5
Unamortized discounts on securities held outright ⁵	-19	-1	-15
Lending to depository institutions ⁶	*	+*	+*
Central bank liquidity swaps ⁷	*	-*	-1
Lending through the Term Asset-Backed Securities Loan Facility (TALF) ⁸	*	-*	-*
Net portfolio holdings of TALF LLC ⁹	*	-*	-*
Support for specific institutions ¹⁰	2	+*	+*
Net portfolio holdings of Maiden Lane LLC ¹⁰	2	+*	+*
Net portfolio holdings of Maiden Lane II LLC ¹⁰	*	-*	-*
Net portfolio holdings of Maiden Lane III LLC ¹⁰	*	-*	-*
Foreign currency denominated assets ¹¹	24	-1	-*
Total liabilities	4,350	+110	+834
Selected liabilities			
Federal Reserve notes in circulation	1,242	+13	+88
Reverse repurchase agreements ¹²	229	-97	+138
Foreign official and international accounts ¹²	113	-4	+22
Others ¹²	116	-92	+116
Term deposits held by depository institutions	0	0	-12
Other deposits held by depository institutions	2,786	+271	+665
U.S. Treasury, general account	70	-78	-40
Other deposits ¹³	10	+3	+1
Total capital	56	+*	+1

Table 2: Asset, liabilities and capital of the Federal Reserve System.

Source: Quarterly Report on Federal Reserve Balance Sheets Developments, August 2014-11-17

“Note: Unaudited. Components may not sum to totals because of rounding. *Less than \$500 million.

1 Face value.

2 Guaranteed by Fannie Mae, Freddie Mac, and Ginnie Mae. The current face value shown is the remaining principal balance of the securities.

3 Securities loans under the overnight facility are off-balance-sheet transactions. These loans are shown here as a memo item to indicate the portion of securities held outright that have been lent through this program.

4 Current face value. Includes commitments associated with outright purchases, dollar rolls, and coupon swaps.

5 Reflects the premium or discount, which is the difference between the purchase price and the face value of the securities that has not been amortized. For U.S. Treasury and Federal agency debt securities, amortization is on a straight-line basis. For mortgage-backed securities, amortization is on an effective-interest basis.

6 Total of primary, secondary, and seasonal credit.

- 7 Dollar value of the foreign currency held under these agreements valued at the exchange rate to be used when the foreign currency is returned to the foreign central bank.
- 8 Book value.
- 9 As of July 30, 2014, TALF LLC had purchased no assets from the Federal Reserve Bank of New York.
- 10 Fair value reflecting value as of June 30, 2014. Fair value reflects an estimate of the price that would be received upon selling an asset if the transaction were to be conducted in an orderly market on the measurement date. Fair values are updated quarterly.
- 11 Revalued daily at current foreign currency exchange rates.
- 12 Cash value of agreements, which are collateralized by U.S. Treasury securities, federal agency debt securities, and mortgage-backed securities.
- 13 Includes deposits held at the Reserve Banks by international and multilateral organizations, government-sponsored enterprises, and designated financial market utilities.”

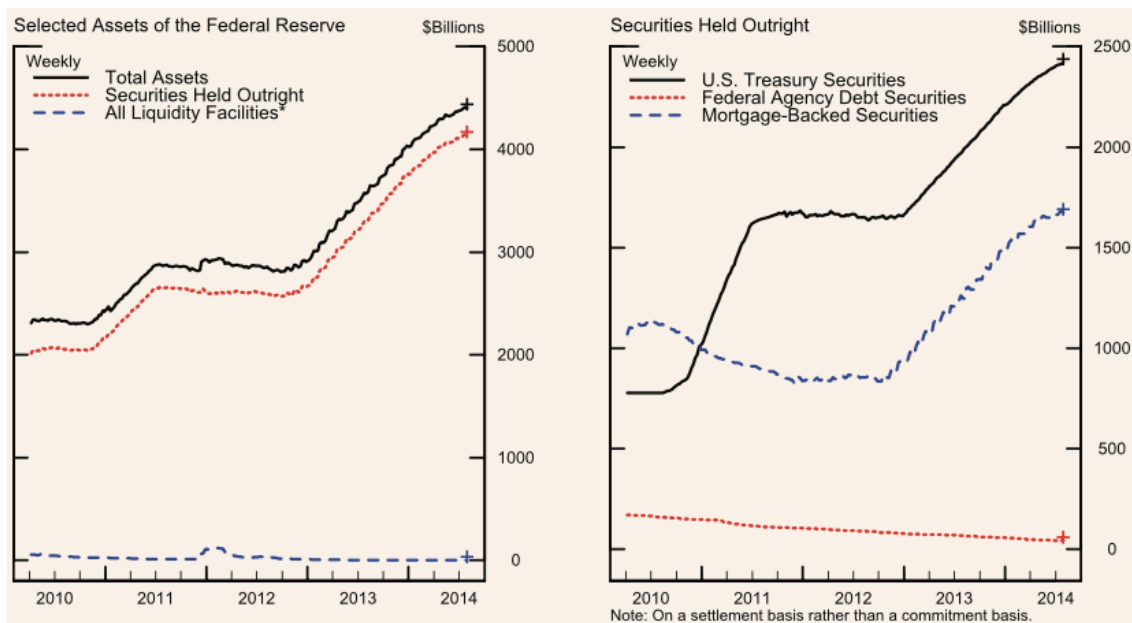


Figure 5: Credit and Liquidity programs.

Source: Quarterly Report on Federal Reserve Balance Sheets Developments, August 2014-11-17

The figure on the left of figure 5, shows the levels of “Selected Assets of the Federal Reserve”, while the second one shows the level of the specific securities from April 2010 to October 2014.

The assets’ purchase program implemented by the Fed, had been remaining the same from August 2014 until October 29th of 2014 when the Federal Open Market Committee (FOMC) directed the Open Market Trading Desk (the Desk) at the Federal Reserve Bank of New York decided to conclude the current asset purchase program by the end of October. “The FOMC decided also to maintain the existing policy of

reinvesting principal payments from the Federal Reserve's holdings and keeping the Committee's holdings of longer-term securities at a considerable level, helping to maintain accommodative financial conditions".

CHAPTER 4: FUTURE CONTRACTS ON GOVERNMENT BOND

The government bond futures contract is a widely used risk management and trading instrument in bond markets. A definition of this contract is given by Moorad Choudhry in the “Future Bond Basis”: “it is an exchange traded standardised contract that fixes the price today at which a specified quantity and quality of a bond will be delivered at a date during the expiry month of the futures contract”. While short-term interest rate futures only require cash settlement, the physical delivery of a bond is required for future contracts on government bond.

The maturity date of the bonds that compose a bond future contract falls in the period settled in the contract.

During the delivery month the party of the contract that is short, or the seller, can choose which bond to deliver and when to deliver it; these options are called respectively the quality and the timing option. The delivery must take place between the first delivery date and the last delivery date decided in the contract.

The person that is long, or the buyer, commits to take delivery of the bond chosen by the short at the time chosen by the seller.

Futures contracts on U.S. government bonds do not have just one underlying asset, but there is a basket of underlying assets.

Throughout the trading day, the prices of the future are determined by market forces. And at the end of each day, the exchange platform determines a settlement price that represents the price of the last trade of the day.

The price at which the party that is short delivers the bond to the party that is long, is determined by the settlement price of the futures contract and by the conversion factor of the bond delivered. The conversion factor equalizes the price of each deliverable bond to the price of the futures. Every bond that compose the delivery basket have its own conversion factor; the conversion factors are different because they compensate for the differences of the bonds in coupon and timing.

Let represent the settlement price of the futures at time t with F_t and the conversion

factor of bond i with cf^i . The delivery price is $cf^i \times F_t$ while the price for delivery is this delivery price plus accrued interest: $cf^i \times F_t + Ai_t$

The last trade date is the expiration date for any contract. The final settlement price is the settlement price at the end of the day and it is used for any deliveries that have not yet been made and for the daily settlement payment

The cost faced by the short in order to deliver a bond of the futures contract is called the cost of delivery. When the short chooses which bond to deliver, he has to buy the bond in the market, at its market price, and then deliver it at the futures price to the long. If the price of bond i at time t is p_t^i , then the cost of delivery is:

$$p_t^i + Ai_t^i - cf^i \times F_t + Ai_t^i = p_t^i - cf^i \times F_t$$

The seller obviously will try to minimize the cost by delivering the bond with the lowest cost from among the bonds in the basket of the future. The cheapest to deliver (CTD) is the bond that minimizes the cost of delivery. The CTD is the bond that provides the greatest return for the buyer and at the same time for the seller of the futures contract.

The determination of the final settlement price is the following:

$$F_T = \frac{p_T^{CTD}}{cf^{CTD}}$$

T denotes the last delivery date.

Table 2 provides an example of what has been written.

TABLE 14.3 Cost of Delivery Calculations Using a September 30, 2010, Realization of Prices from a Vasicek-Style Model Calibrated as of May 28, 2010

Futures Price: 121.2039					
Coupon	Maturity	Price	Conv. Factor	Cost of Delivery	Price ÷ Factor
3 $\frac{1}{4}$	3/31/17	103.4967	.8538	.013	121.2189
4 $\frac{1}{2}$	5/15/17	111.5318	.9202	.000	121.2039
3 $\frac{1}{8}$	4/30/17	102.7042	.8471	.032	121.2421
2 $\frac{3}{4}$	5/31/17	100.3229	.8272	.063	121.2802
4 $\frac{3}{4}$	8/15/17	113.0395	.9314	.150	121.3651
4 $\frac{1}{4}$	11/15/17	109.7547	.9012	.526	121.7873
3 $\frac{7}{8}$	5/15/18	106.5626	.8732	.727	122.0369
4	8/15/18	107.1652	.8774	.821	122.1395
3 $\frac{1}{2}$	2/15/18	104.3789	.8547	.786	122.1234
3 $\frac{3}{4}$	11/15/18	105.0173	.8587	.940	122.2981
3 $\frac{5}{8}$	8/15/19	103.1007	.8401	1.277	122.7243
3 $\frac{1}{8}$	5/15/19	99.5649	.8107	1.305	122.8135
2 $\frac{3}{4}$	2/15/19	97.2761	.7909	1.416	122.9941
3 $\frac{3}{8}$	11/15/19	101.0901	.8195	1.763	123.3558
3 $\frac{5}{8}$	2/15/20	102.9906	.8332	2.003	123.6084
3 $\frac{1}{2}$	5/15/20	102.0509	.8210	2.543	123.3008

Table 2: Source: Fixed income securities, Third Edition, Bruce Tuckman and Angel Serrat (pag 377)

After having computing the final settlement price, the future price, the CTD and the relationships between all the bonds in the basket, it follows that:

$$P_t^{CTD} - c_{ft}^{CTD} \times F = 0$$

In words, zero is the cost for delivering the CTD on the last delivery date.

Now it is possible to introduce the concept of “Basis” that will be useful for later analysis. The gross basis is difference between the clean spot price of a bond and its forward clean price at which the bond is purchased through a futures contract; this is the bond basis to which the market refers.

For bond futures contracts, the basis is the following:

$$\text{Basis} = P_{\text{bond}} - (P_{\text{fut}} \times \text{CF})$$

where the basis is the gross basis and CF is the conversion factor.

The size of the gross basis is the cost of carry of the bond from today to the delivery date. As already seen before, the bond with the lowest basis is known as the cheapest to deliver bond (CTD). There is a basis risk because the size of the basis changes continuously.

In general, the value of the basis declines as time passes, as we get closer to the maturity of the contract and its value is zero on the expiry date.

The basis could be positive or negative; usually, a positive basis is common in precious metals markets while a negative one is usually common in oil contracts and foreign currency markets.

There is a difference between the “Gross Basis” and the “Net Basis”. The “Gross Basis” is the one seen above and it measures the carry on a bond during the futures contract. But it is not the actual carry that would be incurred; the measure we need in this case is the net basis: the net basis causes a lot of confusion among market participants, but it is an essential and very clear concept. Burghardt states that “the net basis is the difference between a bond’s gross basis and its total carry to delivery”. Plona defines net basis as “the difference between the implied repo rate and the general collateral repo rate”.

Both the descriptions above are good in order to consider the net basis. Essentially the net basis is the gross basis adjusted for net carry and it is the real “economic basis” since it measures the “net gain from a simultaneous position in the cash bond and the futures contract”.

A positive net basis represents a loss or net cost for the long cash/short futures party, while it represents the expected profit for the short cash/long futures position. The opposite is true for a negative net basis.

CHAPTER 5: THE EMPIRICAL ANALYSIS

The aim of this work is to analyze how the net basis moves in relation with other factors like the spot price of a Bond (“cash price”), the “Treasury Constant Maturity Rate” and the most important factor: the total purchase amount of the bond purchased by the FED. We also want to see the behaviour of a bond’s price when it is purchased and, at the same time, the behaviour of the yield, that should move in the opposite way of the price. The primary effect when the FED purchases a bond, should be on the risk premium of the asset that has been purchased. By purchasing an asset, the Federal Reserve, reduces the amount of the bond held by the private sector, increasing the amount of short term, risk free bank reserves held by the private sector. The purchase of an asset should increase the price, lowering, at the same time, its yield; the expected return on the purchased Treasury has to fall. This phenomenon has been described by Tobin (1958) and it is known as the “portfolio balance effect”.

The Fed, buying Treasuries in the market for implementing its monetary policy, is a strong protagonist of the Government Bond Market. However, the Fed can only operate in the spot market, never operating in the future one. This is the reason why in this work we particularly aim at studying the movements and the different values of the Net Basis when a Bond is purchased by the FED.

Another factor that has been considered for the analysis and for the movements of the NB and especially for the movement of price and yield, are the FED’s Announcements. Obviously, there is a list of many announcements of the Federal Reserve, but not all of them can influence the trend of the price or the NB, or the yield of a bond. This is the reason why only the most three important QE Announcements are considered.

On November 25th of 2008 the first important Fed’s Announcements regarding the QE took place: the Federal Reserve announced that a maximum amount of \$600 billion was available for purchasing mortgage-backed securities (MBS) and agency debt; further details have been provided in a speech on December 1st and on December 16, the program was definitively launched by the Federal Open Market Committee (FOMC).

A new announcement on March 18, 2009, revealed that the program would have been

expanded by an additional amount of \$750 billion of agency MBS and agency debt, and and by an additional amount of \$300 in Treasuries.

Those first announcements are known as “Quantitative Easing 1 (QE1)”.

On November 25, 2008, the Federal Reserve announced that a new amount of \$600 billion was available for purchasing longer data Treasuries, at a rate of \$75 billion per month. This program, concluded in June 2011 is known as “QE2”.

The 13th September of 2012, the “QE3” has been announced. This round provided to purchase \$40 billion agency MBS per month until a substantial improvement of the labour market.

On December 12, 2012, the FOMC decided to expand the quantitative easing program continuing to authorize the purchase of \$40 billion of agency MBS per month and adding \$45 billion of longer Treasury securities.

On December 18 the FOMC announced that the program would have been tapered back at a rate of \$10 billion at each meeting; and finally, in October 2014, ten months after the beginning of the tapering process, the FED ended its monthly purchases program.

The data used for the analysis are daily data. They have been downloaded from Bloomberg and they cover a period that goes from December the 18th of 2008 to June the 19th of 2014; this period of time then is divided into 22 futures with different maturities. For each year there are four different futures with a periodic date of delivery every 3 months.

As already explained, every futures is composed of different bonds (basket of bonds) and the most significant one is CTD; the futures used for this analysis are composed of 20 bonds and, for sure, in every futures there is always a CTD.

Almost all the Government Bonds that compose the futures are 10 years Bonds (from the issue of the asset to its maturity) that are also the most purchased by the FED. However, the futures are sometimes composed of other bonds too with a different maturity of 7 years. No other bonds with different maturities stand in the data and all the assets have semestral coupons.

Having a look at the data available and making a little analysis, it is possible to notice that the FED mostly purchases bonds with a maturity (from the date of purchase to

maturity) of 6, 7, 8 and 9 years and a couple of times it purchases bonds with 10 years to maturity, holding them until the expiration date; the different maturities of the purchases do not deal with particular periods of time but they refer to all the period of the available data, in the sense that the maturity related to the purchases of the FED does not follow a particular trend as time passes. However, the FED never purchases bonds with a maturity lower than 6 years.

The work is divided into two different analysis: the first one is a graphic analysis while the second one looks at describing from a numerical point of view, the results shown by the graphic trends of the first analysis. For the second part, as it will be illustrated more specifically later, the tool used for the analysis is the linear regression where the “y”, the dependent variable, is obviously the net basis.

5.1: THE GRAPHIC ANALYSIS

This part of the work, has been divided into two different analysis: the first one looks at understanding how the NB and the price of a bond, in a single future, are influenced by the total purchase amount and the Quantitative Easing Announcements of the FED.

At the end, a final analysis summarizes the result of the single futures analysis trying to make an unique final assumption.

The second part instead studies the single entire bonds; also this part tries to understand the behaviour of the price and the behaviour of net basis of a bond related to the purchase amount of the asset bought by the FED. The difference now is that the analysis has been applied to the single entire bond and no more to the single future.

5.1.1: SINGLE FUTURE ANALYSIS

The data have been sorted by “delivery of future” in the excel file, in order to find the single futures.

Twelve futures, over a total of 22, have been analysed: they contain the most purchased bonds inside, and they cover all the period of the QEs program.

The analysed futures, in order of delivery are the following:

30-Jun-2009, 30-Sept 2010, 31-Dec-2010, 31-Mar-2011, 30-Sept-2011, 30-Mar-2012, 29-Jun-2012, 31-Dec-2012, 29-Mar-2013, 28-Jun-2013, 31-Dec-2013 and 30-Jun-2014.

At the end, a final analysis summarizes the results obtained by looking at the single futures.

We are going now to see the analysis' results of some futures listed above and the final commentary.

The first future analysed, have a delivery date settle for the 30th June of 2009; the dates of the single bonds that compose the futures go from 19-Mar-2009 to 19-June-2009.

This future could be pretty interesting to see because it starts just the day after the first QE announcement that took place on the 18th of March of 2009, as already said.

The most purchased bonds of the future and the CTD have been analyzed. As a general comment, it is possible to affirm that the price of all the bonds that compose the future are decrising: this is because, at that time, the overall economy of the USA was living a

pretty bad period, with just seeing the first shy signals of recovery.

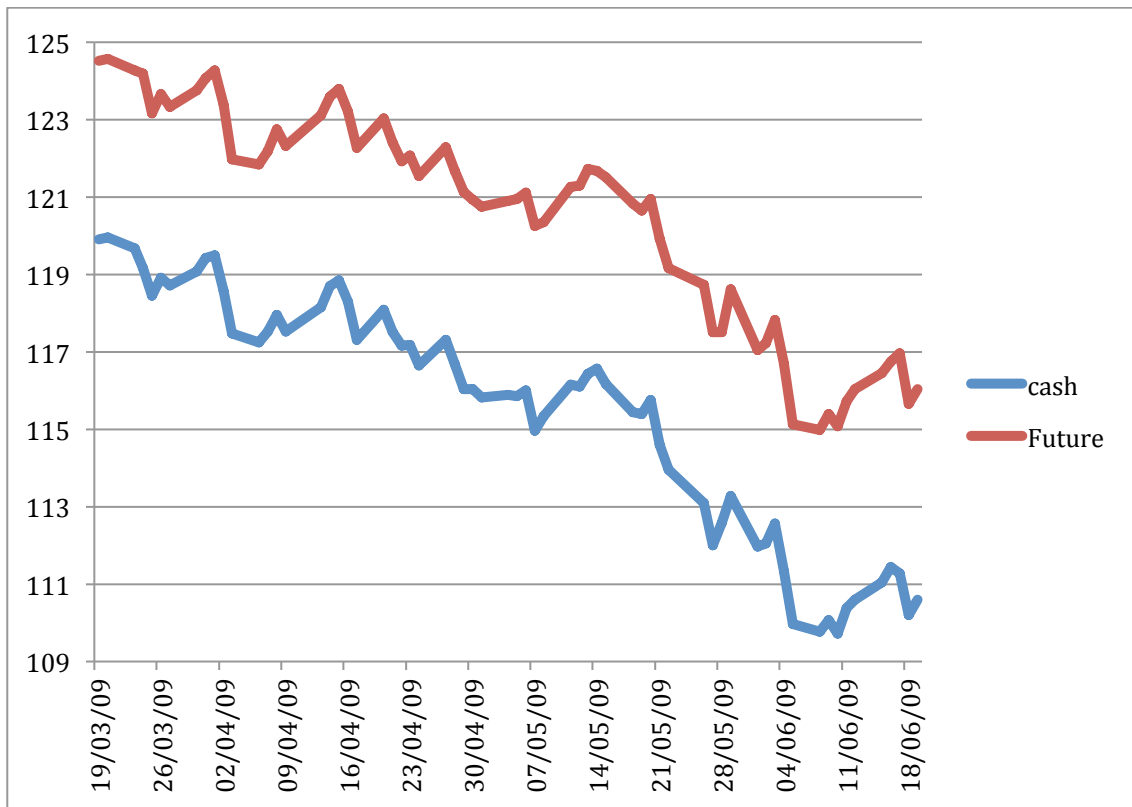


Figure 6: Cash and future price of the CTD (30-Jun-2009)

Figure 6 illustrates the cash and the future price of the CTD bond of the first future analyzed. Both prices (that always moves in a very similar way), are decreasing.

The Net Basis of the CTD, as written above, is always the one with the lowest value of the NBs of all the bonds that compose the futures. Its value should be as more as possible near to zero, and in this case its medium value is 0,03.

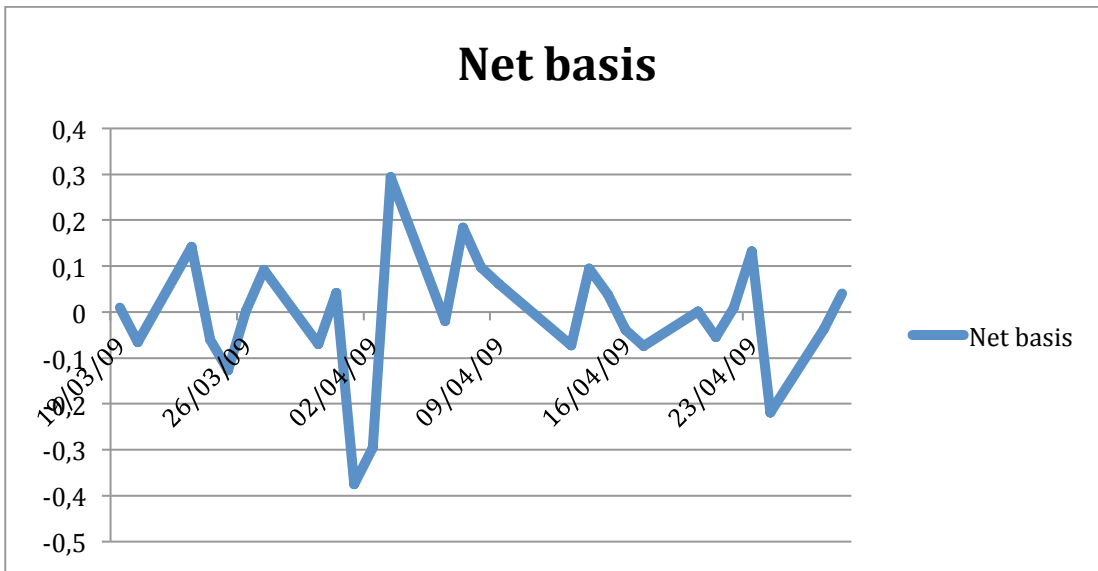


Figure 7: Net Basis' trend of the CTD bond (futures 30-June-2009)

Looking at figure 7, it is clear that, differently from the price, the NB does not follow a specific trend and it is very volatile with both high and low peaks and its value is always very near to zero.

Passing to 912828FQ8 Bond of the future, we see that here the prices are decreasing too.

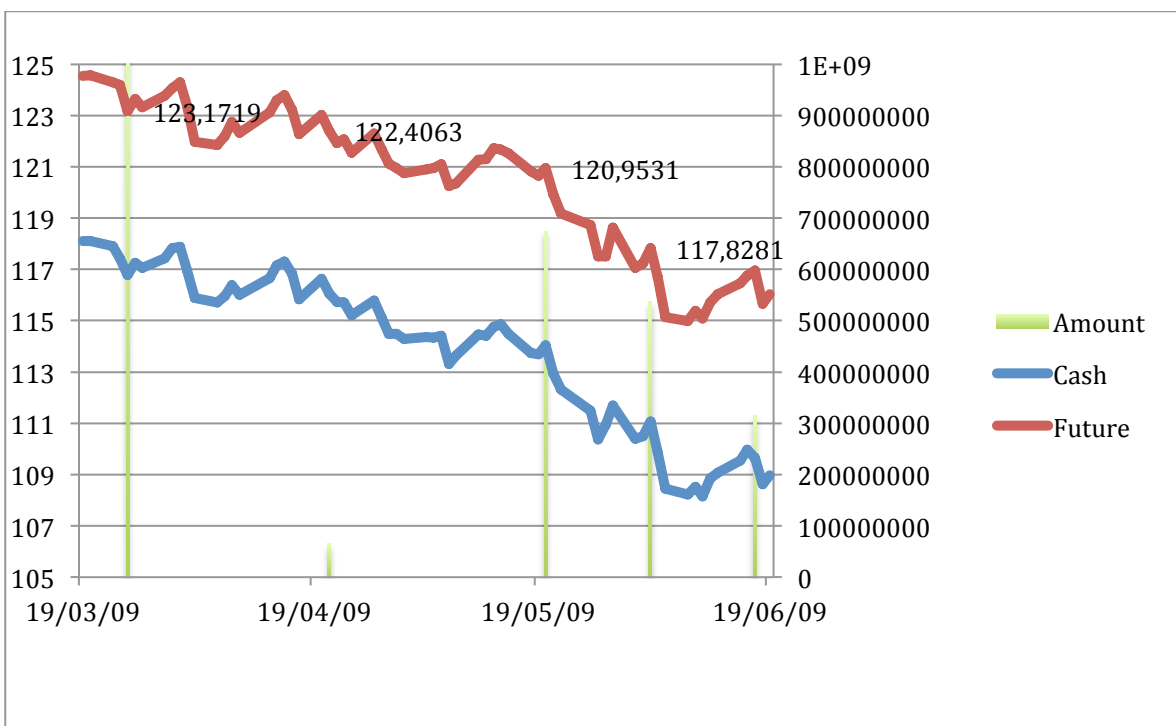


Figure 8: Future and Cash prices and purchase amount of 912828FQ8 bond (futures 30-June-2009)

Looking at figure 8, on the first vertical axis (on the left) there is the value of the prices while on the left one there is the value of the purchase amount of the asset. The green line of the purchase amount stands for the value of the purchase but also for the date on which the FED purchased the asset (horizontal axis)

Looking at this last feature, the purchase of the asset by the FED does not change the trend of the asset which decreases for all the period of time.

The Net Basis of this bond, as figure 9 shows, does not follow a particular trend: it is just decreasing a bit as time passes. As the NB of the CTD, in here as well it is very volatile presenting both very high and low peaks.

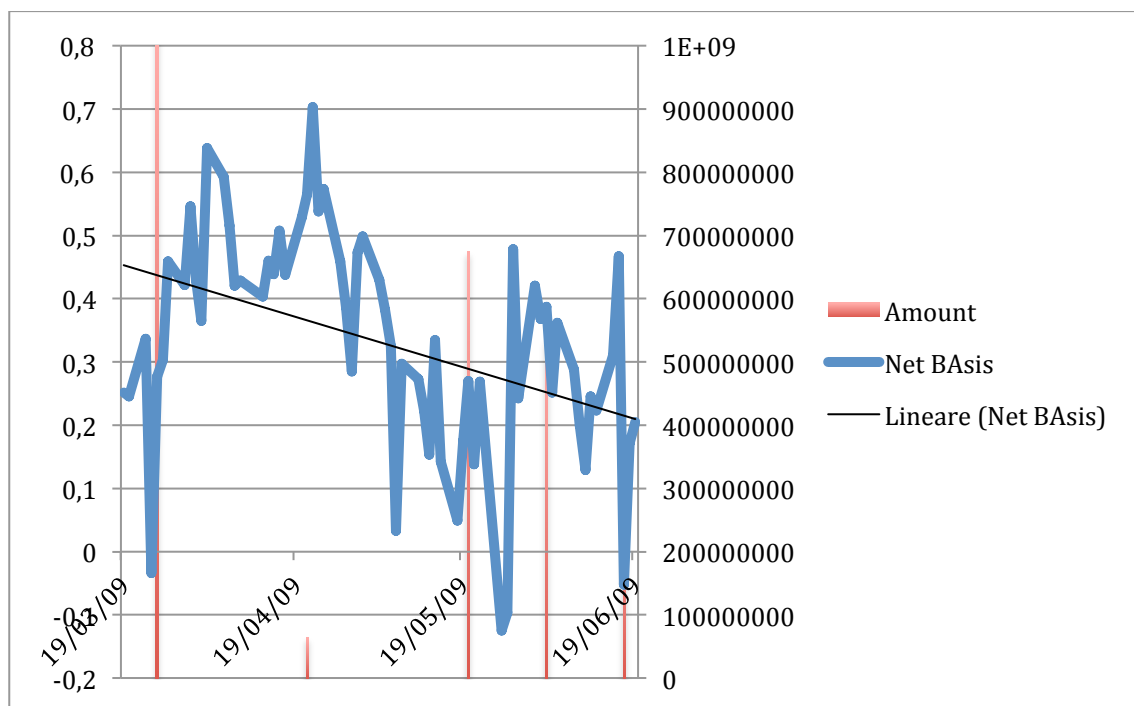


Figure 9: Net Basis' trend of 912828FQ8 bond (futures 30-June-2009)

As the price of an asset decreases, its yield to maturity increases. With a Matlab's program, the behaviour of the yield of the CTD has been analyzed and it is very clear that the yield follows a completely opposite trend of the price as shown in figure 10.

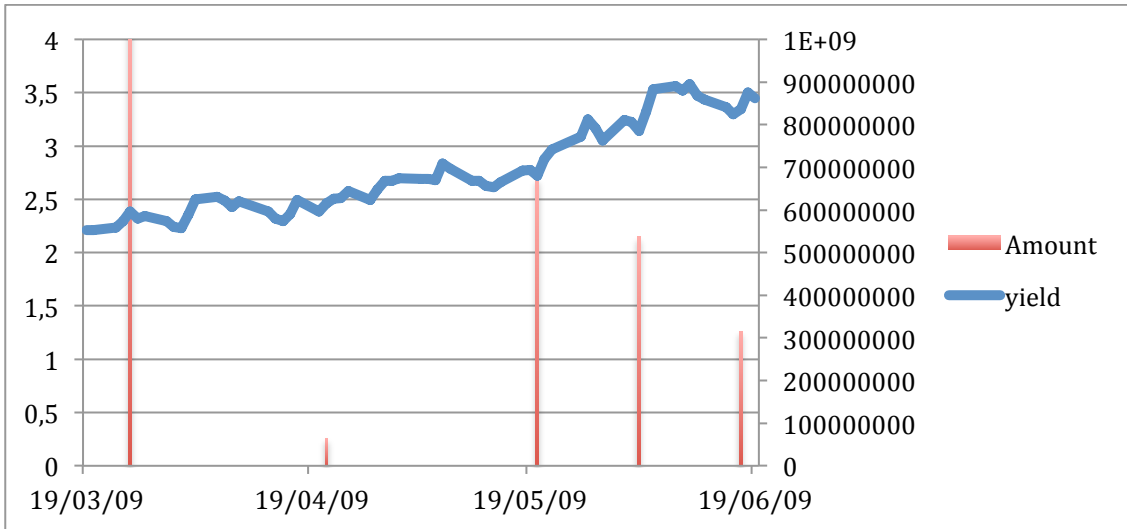


Figure 10: Yield's trend of 912828FQ8 bond (futures 30-June-2009)

Looking at the graphic analysis of the other bonds that compose the futures, the result are always very similar (negative trends of prices, positive trend of the yields and very volatile net basis with slightly decreasing trend). Let's take as an other example the bond 912828KT6:

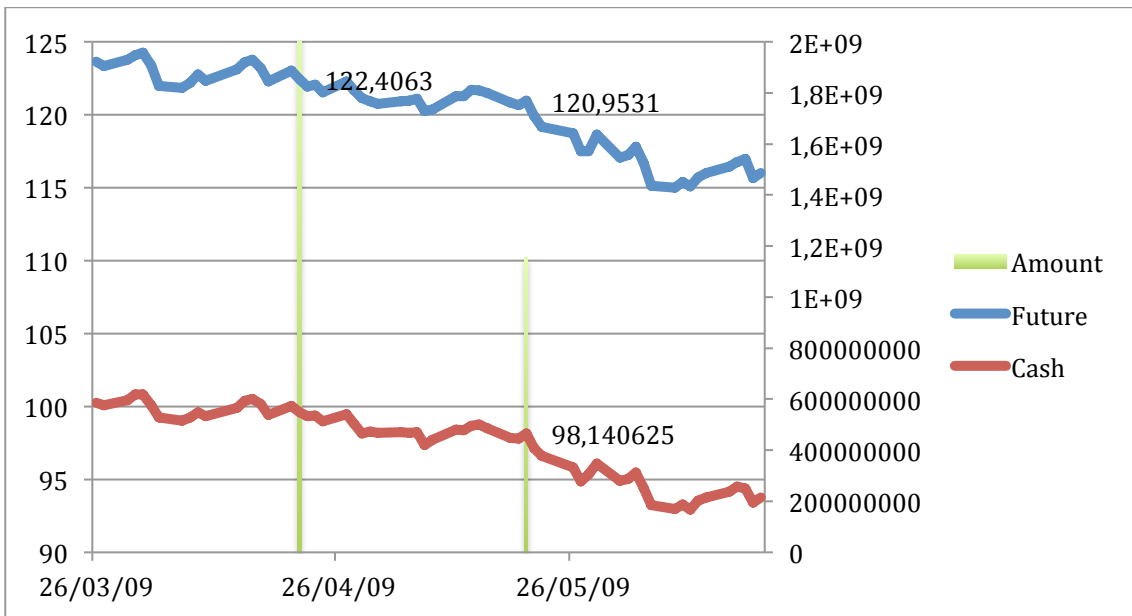


Figure 11: Future and cash price and purchase amount of 912828KT6 bond (futures 30-June-2009).

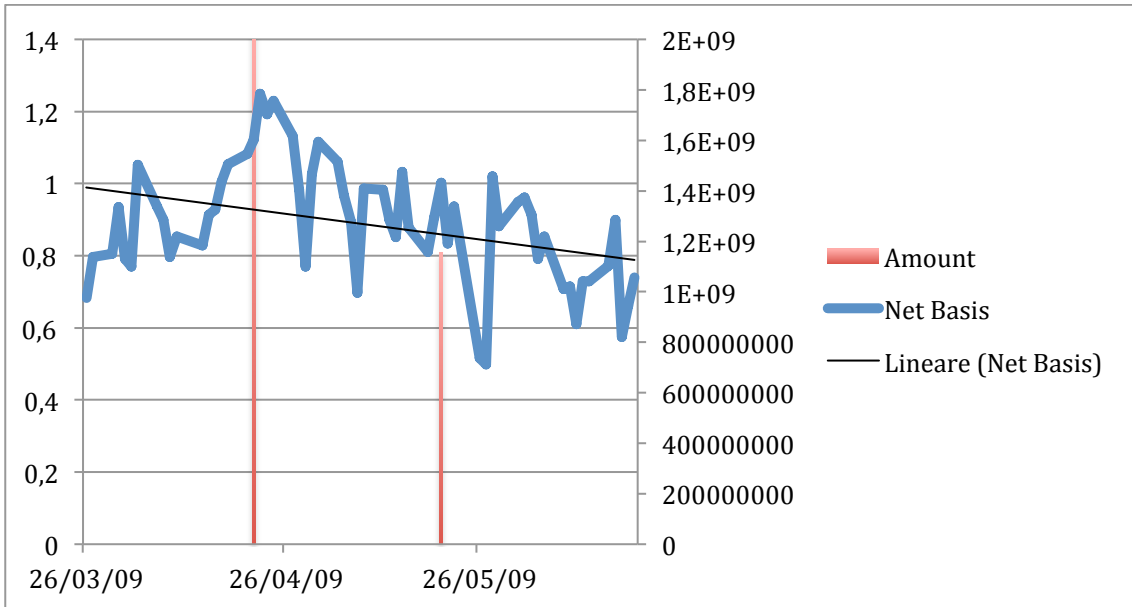


Figure 12: Net Basis trend of 912828KT6 Bond (futures 30-June-2009).

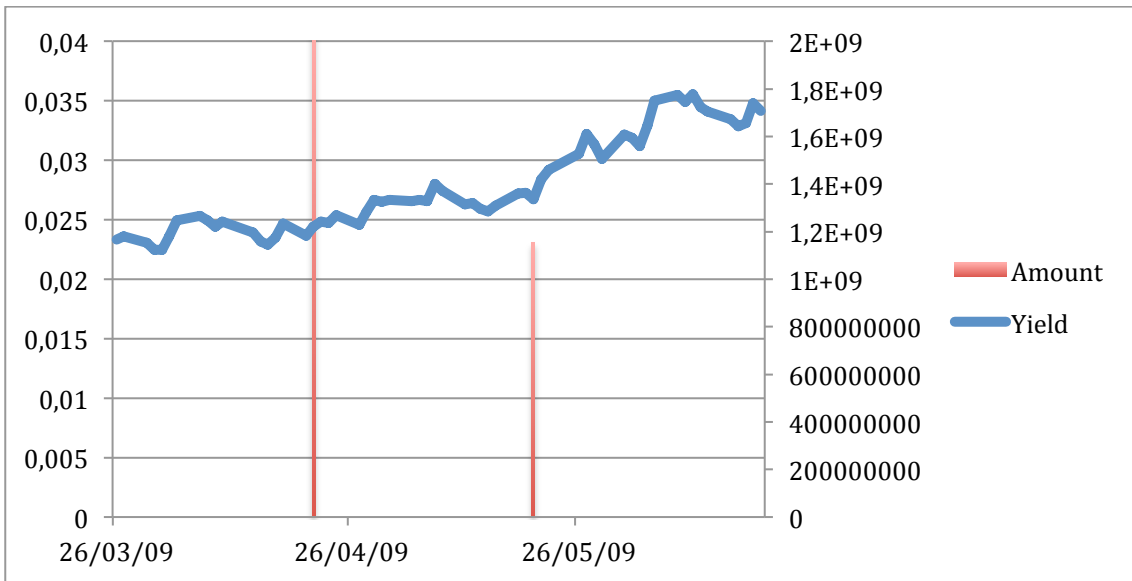


Figure 13: Yield's trend of 912828KT6 bond (futures 30-June-2009).

As it is possible to understand looking at figures 11,12 and 13, the results of this second bond are the same of the first one.

The most interesting part of a single futures analysis is probably the final one.

In this section, the purchase amount of any single bond that compose the future has been summed up and for any single bond it has been computed the medium net basis too. Then, the standard deviation of the net basis of any single bond has been calculated too.

The data have been sorted by the total purchase amount's column (from the lower to the highest one) in order to understand the net basis behaviour as the purchase amount of the asset increases.

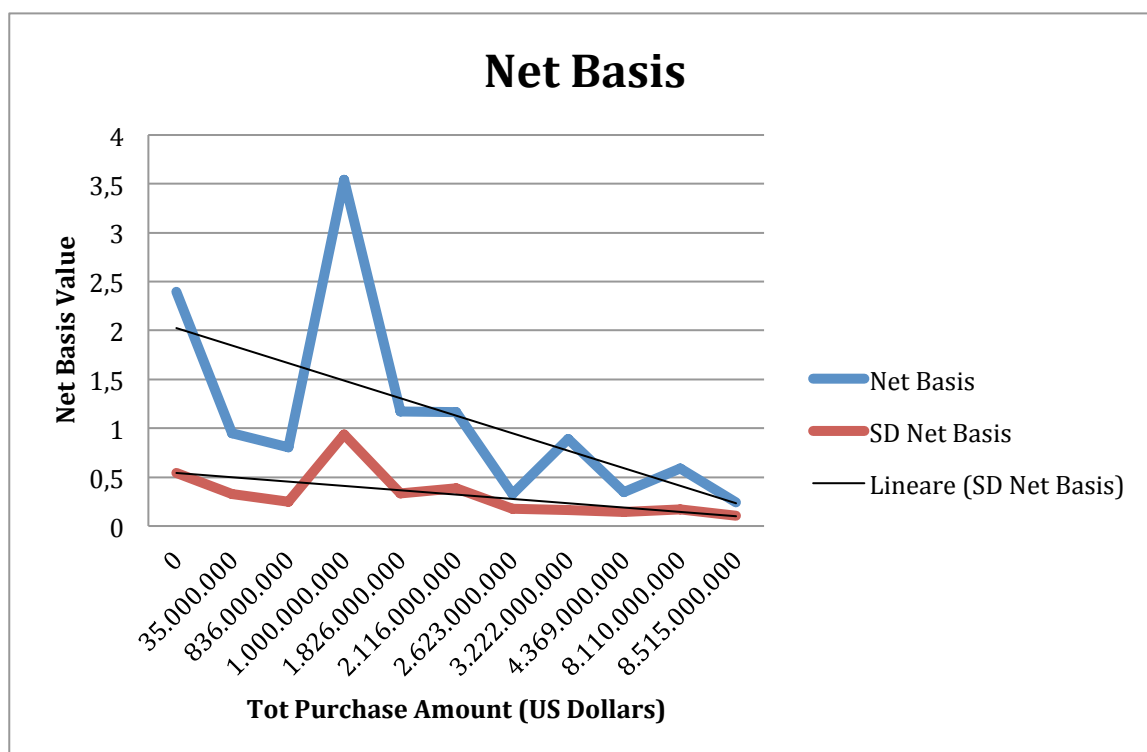


Figure 14: final analysis (futures 30-June-2009)

Looking at figure 14, for this first future, it is possible to understand that there is a sort of negative relationship between the "Net Basis" of a particular bond and the total purchase amount of that single bond purchased by the FED.

As the Total Amount decreases, the NB increases, and the opposite too it's true: as the tot amount increases, the NB decreases; this is proved by the fact that the bonds that have not been purchased by the FED (tot amount = 0), present a very high Net Basis.

The correlation between all the net basis and the total purchase amount values proves what has been said: it is in fact negative and its value is -0,541.

There are just two exceptions to what has been said above: The "912828KD1" bond that, with a tot purchase amount of a trillion dollars, has an exceptional high NB which then started to decrease considerably after the purchase of the asset. The second exception is the "912828FF2" bond that, with no purchases by the FED, presents a very

low NB: but the "912828FF2" bond, is the CTD of the future's basket of bond and the CTDs always have a very low NB.

Having a look at the Standard Deviation of the NB, we can affirm that it follows the shape of the NB's value and its characteristics, concluding that, the higher the NB, the higher its SD, and the higher the total purchase amount of a bond, the lower the SD of its NB. The correlation between the SD and the NB of a single asset is almost one.

Analyzing the future with the delivery date settle for September the 30th of 2011, it is possible to understand that both prices and yields have different behaviors compared to the first future analyzed above.

Looking at the single bonds that compose the future in fact, we see that the prices now are not decreasing, but instead they show a positive trend.

Figure 15 shows the trend of the spot price of the CTD bond of the future:

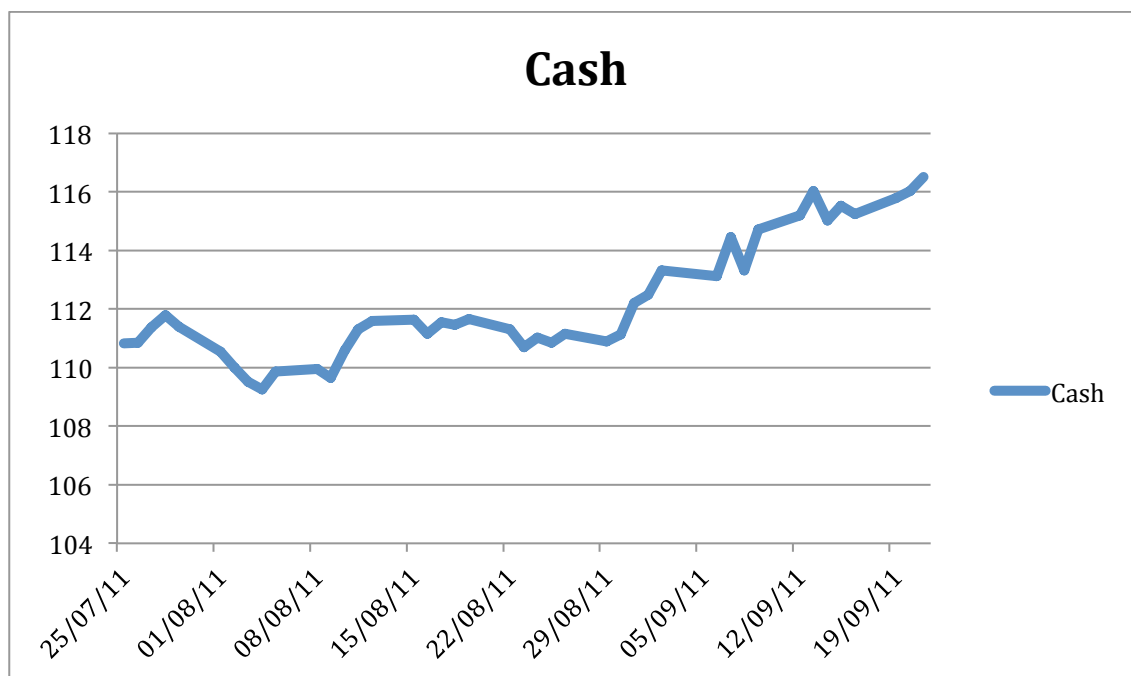


Figure 15: CTD's spot price trend (futures 30-Sept-2011)

Differently from the graphs seen before, the spot price of the bond here is increasing, probably due to the QE program's effects started more than two years before.

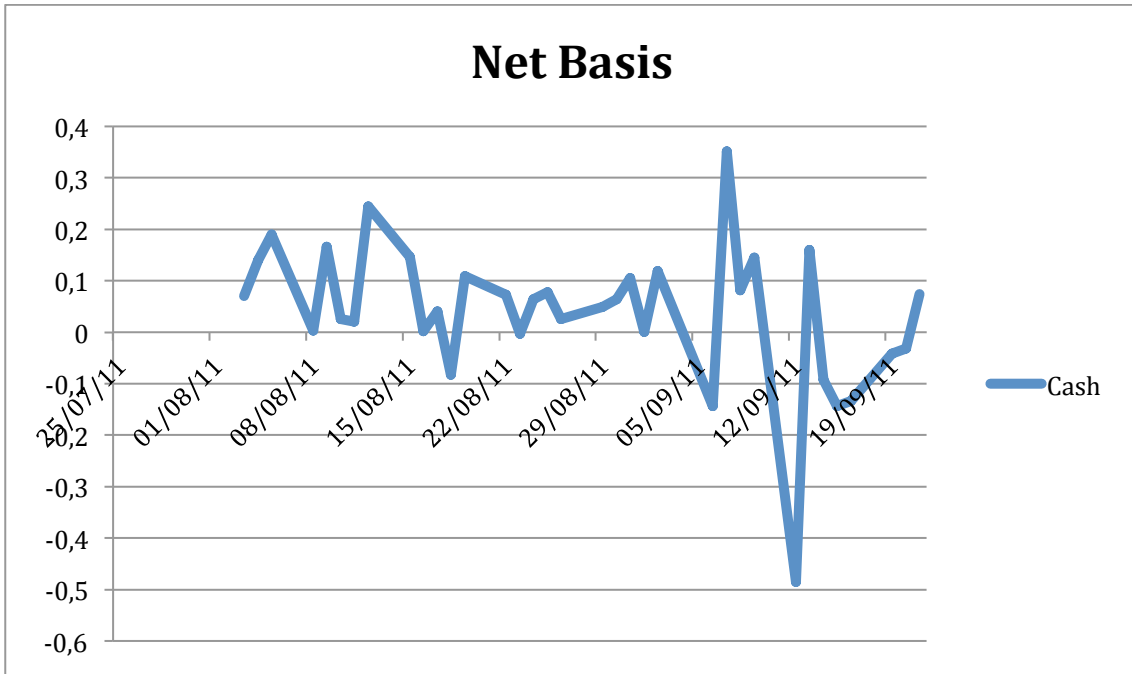


Figure 16: CTD's net basis (futures 30-Sept-2011)

The Net Basis of the CTD as figure 16 shows, is always the nearest to zero of all the bonds that compose the futures. Here its value is 0,018 and it is possible to see that it presents both high and low peaks.

Looking at 912828JH4 bond we see that its price increases, as shown in figure 17, like the price of the CTD and the purchases of the asset seem to change a bit the trend of it.

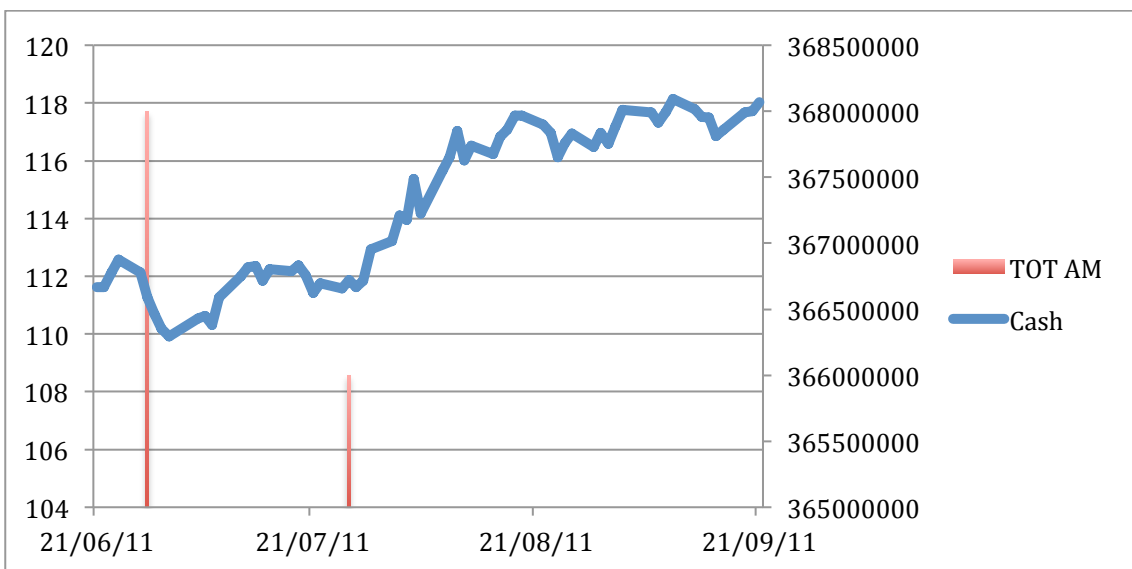


Figure 17: Cash price's trend of 912828JH4 bond (futures 30-Sept-2011)

Figure 18 shows, as always, that the net basis of the bond has very high and low peaks and its value increases as time goes by, showing a positive trend (black line)

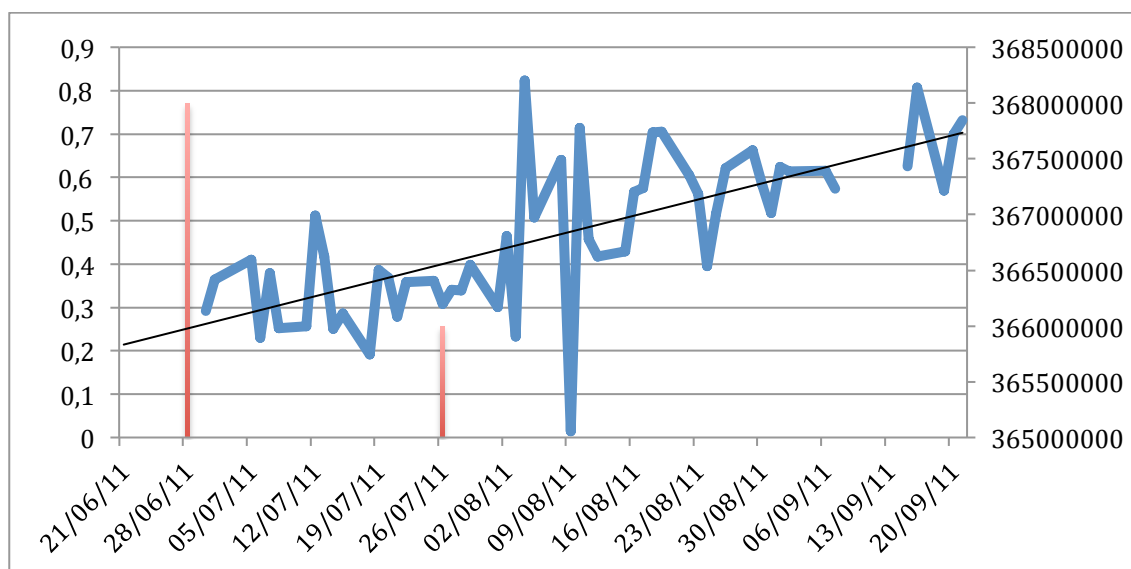


Figure 18: NB's trend of 912828JH4 bond (futures 30-Sept-2011)

The same thing happens for all the rest of the bonds of the future (prices increase, yields decrease and very volatile, but with positive trends, net basis).

The final analysis of this particular future is provided by figure 19: as the final analysis for the future seen before, here all the purchases amount of any single bond that compose the futures have been summed up and the medium NB of any single bond has been computed too.

The data have been sorted by the total purchase amount column (from the lower to the highest one) in order to understand the net net basis behaviour as the purchase amount increases.

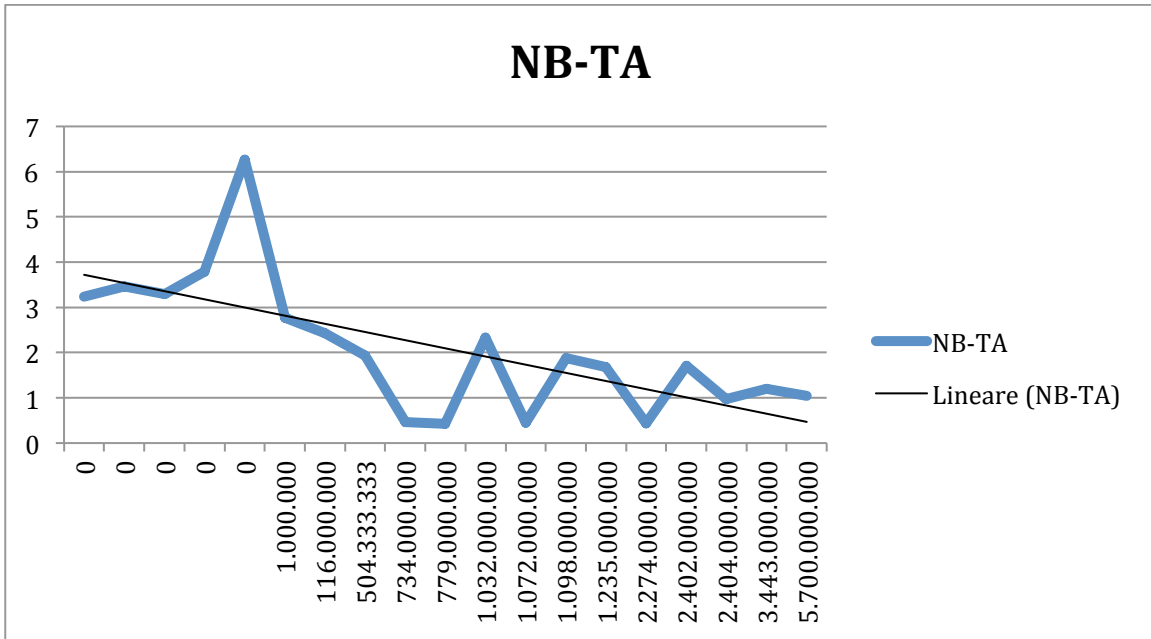


Figure 19: final analysis (futures 30-Sept-2011)

The Correlation between the total purchase amount of a bond and its medium NB is again negative, meaning that, for this single future, the higher the amount of purchase, the lower the NB.

Let see now the behaviour of the following future with the delivery date settle for June 29, 2012.

The graphical results for the single bonds are the same of the future above, and so: CTD with the lowest net basis, increasing spot and future prices of the single bonds while the yields are obviously decreasing.

The final analysis of the future instead, as figure 20 shows, provide a different result. While for the futures above, the higher the amount of purchase, the lower the NB was, here, for this future the result is the opposite:

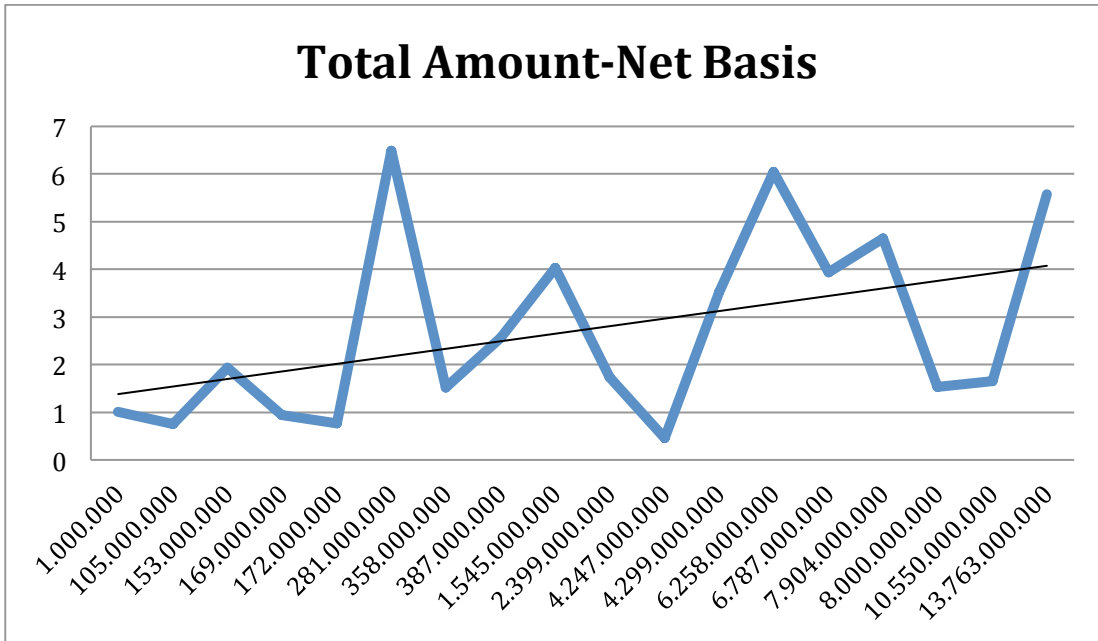


Figure 20: final analysis (futures 29-June-2012)

It is very clear that for this particular future, the relationship between the total purchase amount of a single bond, purchased by the FED and its net basis is positive.

As the total purchase amount increases in fact, the net basis increases too; the correlation between the two values (net basis and purchase amount) of the single bonds is positive (0,39), confirming what the graph is showing.

Figure 21 provides the result of the most interesting part of this first analysis of the single futures: this final analysis, collects together the results of the analysis of all the single futures.

The futures are sorted by date from the less to the most recent. The total amount of purchase of all the bonds of a single future has been computed, and the Medium NB of all the bonds of the single future has been calculated too.

The graph is pretty clear and it confirms the positive relationship, shown by the last futures analyzed, between the total purchase amount (red lines) of the bonds that compose the futures and the medium NBs (blu line); in this case the asset is represented by the entire future, composed of different bonds.

In the horizontal axis there are, in order of time, the futures (the dates stand for the day of delivery of future), while the vertical axis stand, on the left for the value of the net basis and on the right for the value of the purchase amount of the asset purchased by the FED.

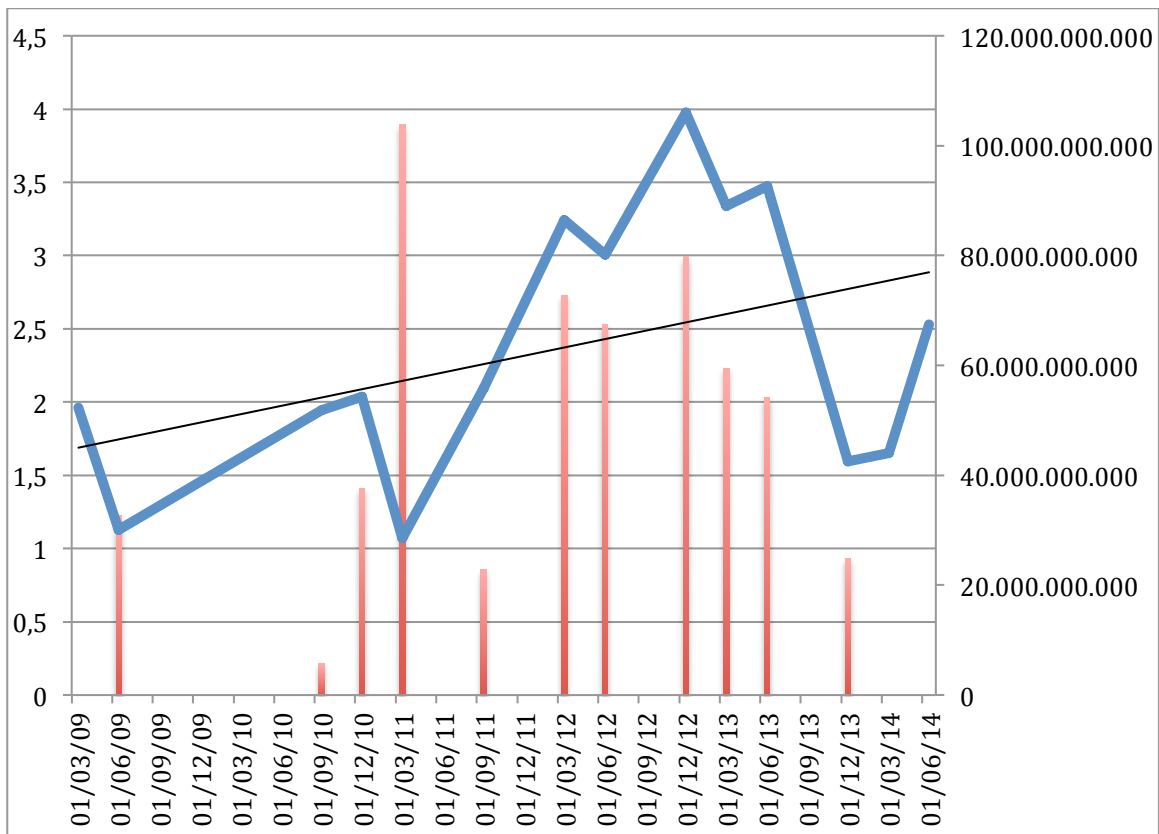


Figure 21: Final relationship between nb and purchase amount, futures analysis

The correlation between the NB and the total purchase amount is positive (0,354). Looking at the graph it is possible to understand that when there is an increase of the purchase amount, there is an increase of the NB too. The only case is the future "31-03-11" that has a very high purchase amount with a low value of its NB: this particular exception could be seen as a point from which the value of the NB starts to increase a lot, and from here the trend of the purchase amount and the trend NB are very correlated. The future "31-03-11" can possibly be interpreted as a starting point. The last future that has been purchased by the FED is the "31-12-13" and from this date the NB starts to increase again, meaning that probably the support of the FED for the market was not necessary anymore.

Another very important result that confirms the good result of the monetary policy implemented by the FED, is the overall positive trend of the NB, which shows an increment of its value as time passes (as it is shown by the black trend line).

5.1.2: SINGLE BOND ANALYSIS

As already explained in the graphical analysis introduction, this second part of the graphical analysis studies the single entire bonds and no more the single future; also this part tries to understand the behaviour of the price and the behaviour of net basis of a bond related to the purchase amount of the asset bought by the FED. The difference now is that the analysis has been applied to the single entire bond and no more to the single future.

Not all the bonds have been analyzed, but just the ones most purchased by the FED because, as already explained, the aim of this work is to study the effects of the purchases of the FED on the market.

For each bond there is a graphical trend analysis of the price, of the net basis and of the yield to maturity. It will be possible to see the positive effects of the QE program on prices: the graphical trends of prices in fact are positive and they increase a lot after a bond's purchase by the FED. Yields instead follow the opposite trends of prices and they decrease after a bond purchase buy the FED. The net basis finally, follows pretty different trends but the purchase of the asset has generally a positive effect on it.

Let start having a look at the bond 912828JH4:

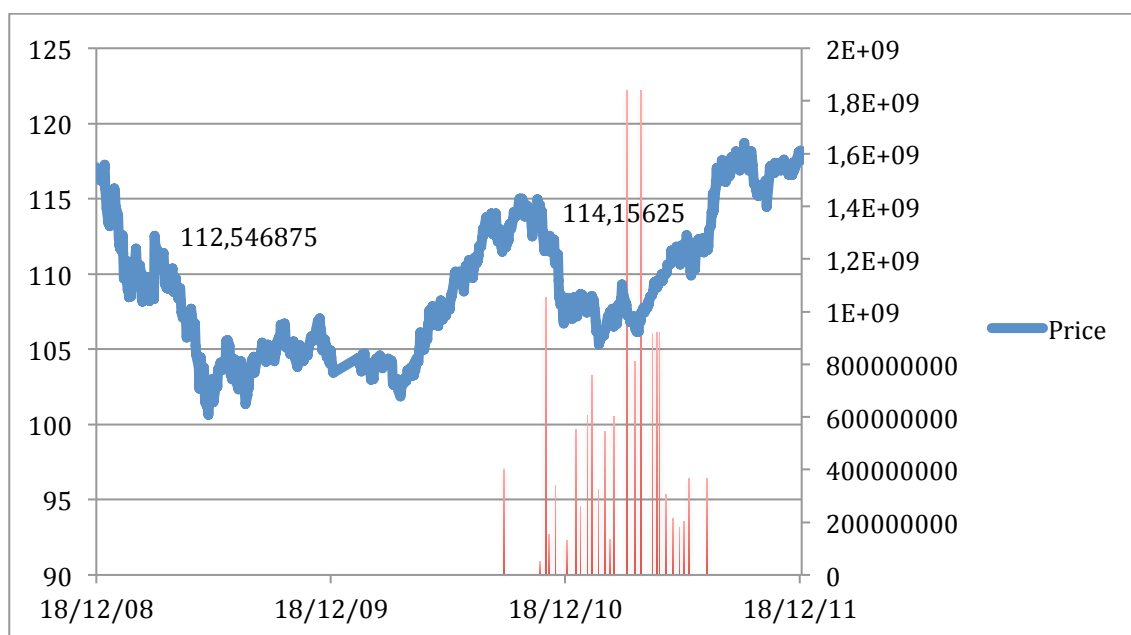


Figure 22: Price trend of 912828JH4 bond

Looking at figure 22, as always, the blue line is the factor we need to analyze (in this case the factor is the price) and the left vertical axis represents its value. The red lines represent the amount of the asset purchased by the FED which value stands on the right vertical axis. The horizontal axis instead stands for the time. It is possible to understand that the purchases of the bond by the FED have a positive effect on the price's trend since it increases a lot after the purchases.

The opposite effect happens for the yield: it in fact decreases after the purchases of the bond as it is possible to notice looking at figure 23:

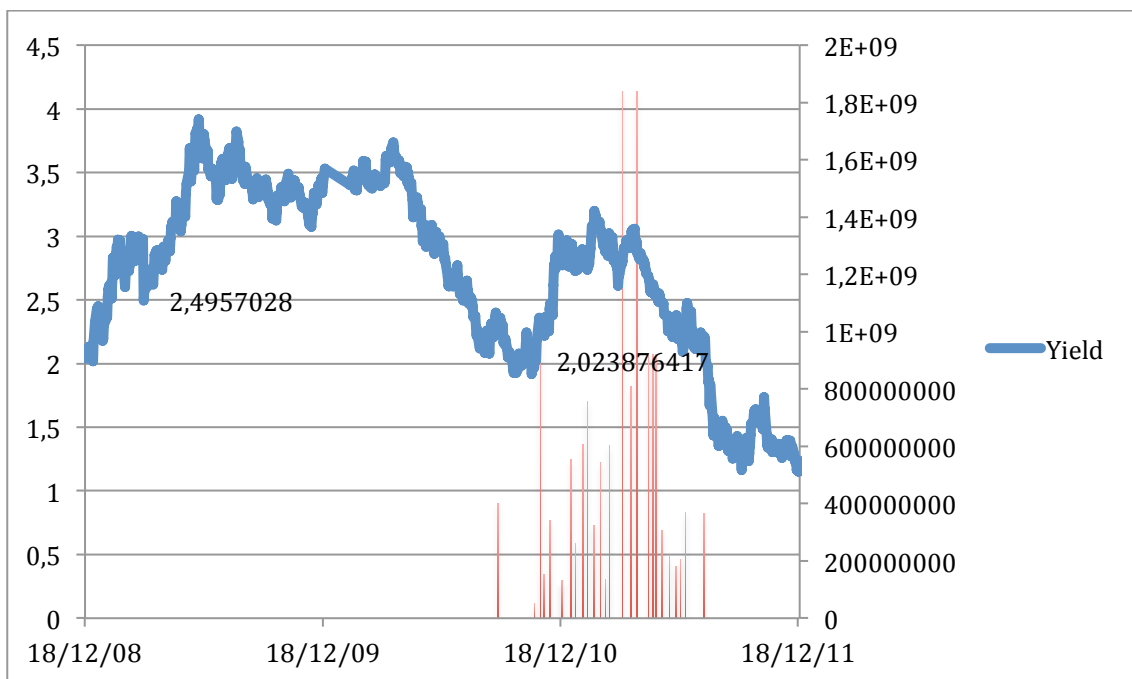


Figure 23: Yield trend of 912828JH4 bond

The net basis of the bond instead, shows a pretty different trend. It decreases a lot at the beginning, remaining stable and closer to zero after the asset's purchase as shown by figure 24:

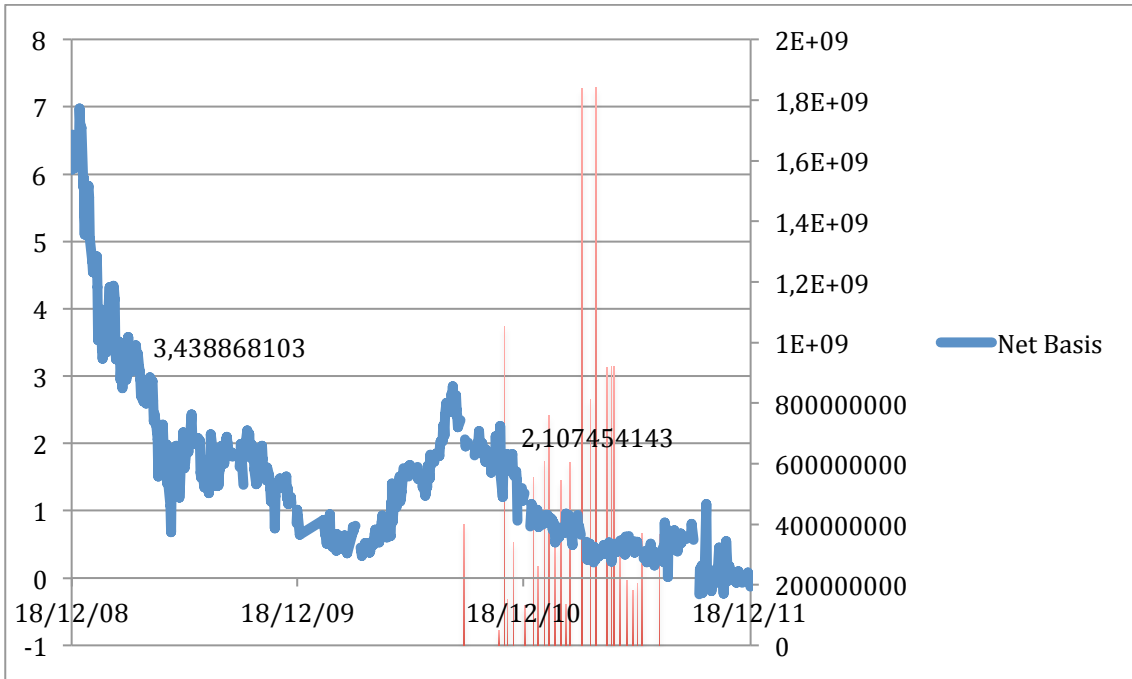


Figure 24: Net basis trend of 912828HJ4 bond

Bond 912828LJ7 has, for price and yield, the same characteristics of the bond seen above as it is possible to see looking at figure 25 and figure 26:

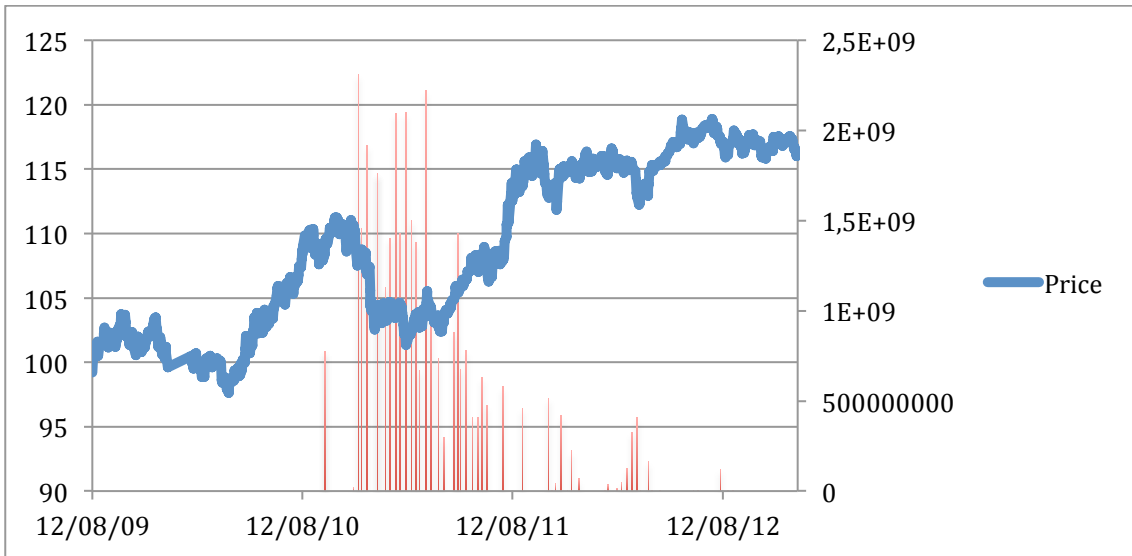


Figure 25: Price trend of 912828LJ7

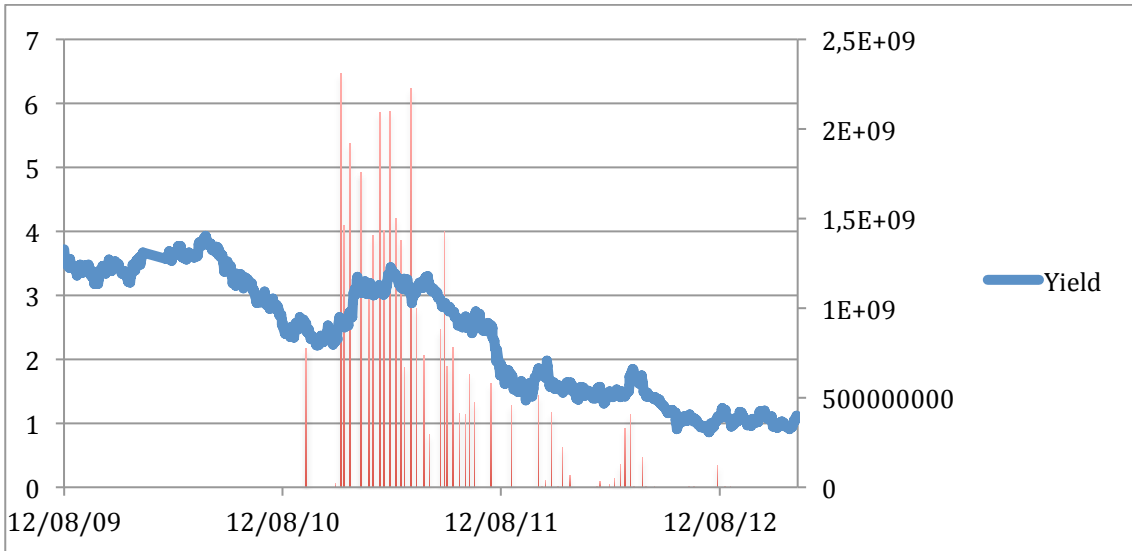


Figure 26: Yield trend of 912828 LJ7 bond

The net basis of this bond still shows a pretty different trend from price and yield; now in fact it seems to positively react to the huge central purchase amount of the asset. Its trend in fact increase after the big purchase of the bond, decreasing instead at the end of the graph where no purchases have been made, as shown by figure 27:

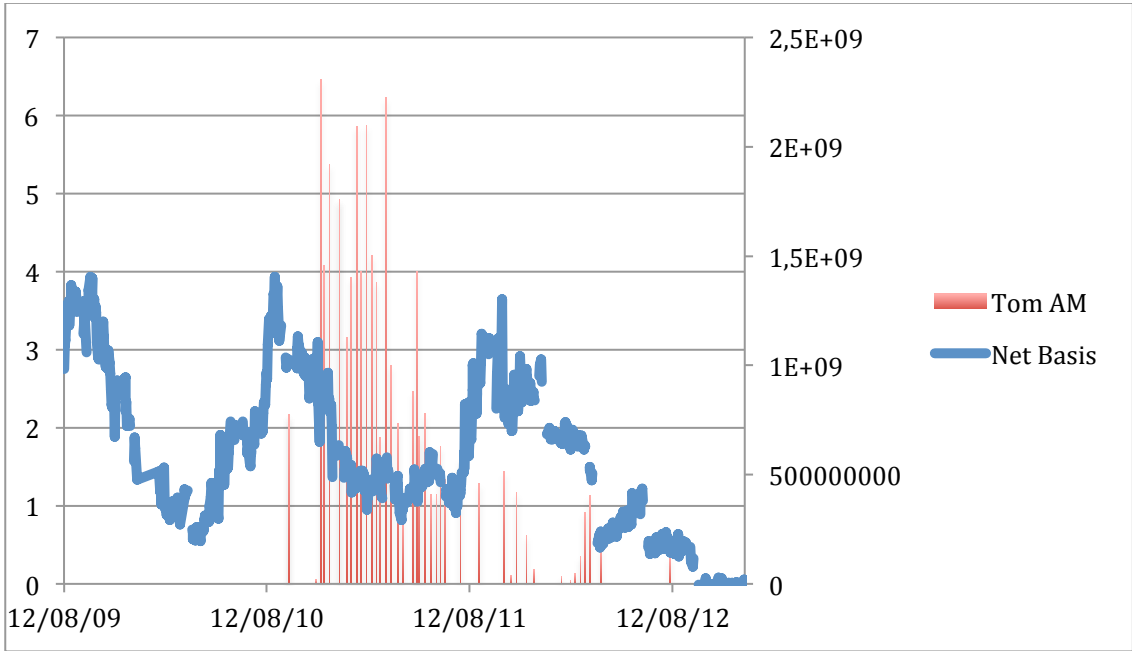


Figure 27: Net basis trend of 912828LJ7 bond

The rest of the bonds analyzed generally have the same characteristics of the two bonds seen above. The prices of the bonds start to rise after the FED's purchase of the asset while obviously the yields decrease (yield and price of a single bond have always

opposite trends).

Is it also possible to understand that, generally, prices decrease after a FED's QE announcement: the most significant are the first two and most important announcements (18/3/2009, 3/11/2010), while the last two on September and December 2012 did not bring to such a big change in prices and yields' trends.

In most of the cases, the total purchase amount has the same effect on the price and on the NB; the latter in fact usually increases after a big bond's purchase made by the FED. The NB in many cases follows the trend of the price.

As happened for the first graphical analysis for the single futures, for this second part a final analysis has been made too, trying to sum up the results of the single bonds that have been studied. For this final analysis, the purchase amounts of any single bonds have been summed up and the medium net basis of any single bond has been computed too. As it will be explained later, the result of this final analysis is very interesting and and it brings to a very straightforward concept.

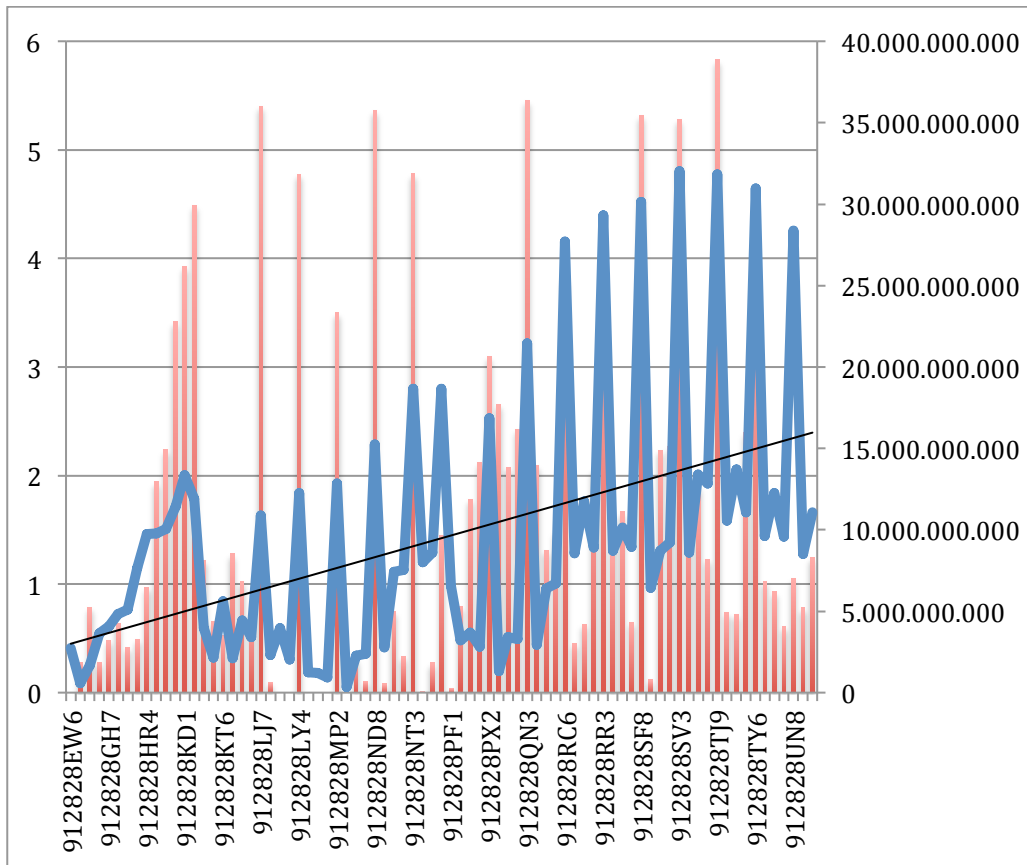


Figure 28: final relationship between net basis and total purchase amount (bond analysis)

Figure 28 illustrates how the NB of a bond moves as time goes by and how it moves related to the total amount of purchase of the bond. On the horizontal axis stand the "Cusips" of the Bond that represent the bond and the time (from the less recent to the more recent bond). The two vertical axis, as always, represent the NB (blue line; values on the axis on the left) and the total purchase amount (red lines; values on the axis on the right). Looking at the graph we can see that the NB generally increases as time passes and it is also positively correlated with the purchase amount of a bond; the black line is the trend line of the NB and we can see that it has a positive trend meaning that as time passes, the net basis of the bonds generally increases, probably because positively affected by the monetary policy of the Federal Reserve.

Most of the high peaks of the NB, are correlated with a very high value of the total purchase amount, and vice versa, many low values of the NB are related to a low value of the red line. This second concept is confirmed by the correlation between the total purchase amount of a bond and its NB that is 0,609, meaning that as the total amount of a bond increases , in most cases, it brings to an increase of the NB too.

Figure 29 explicitly describes and illustrates the correlation:

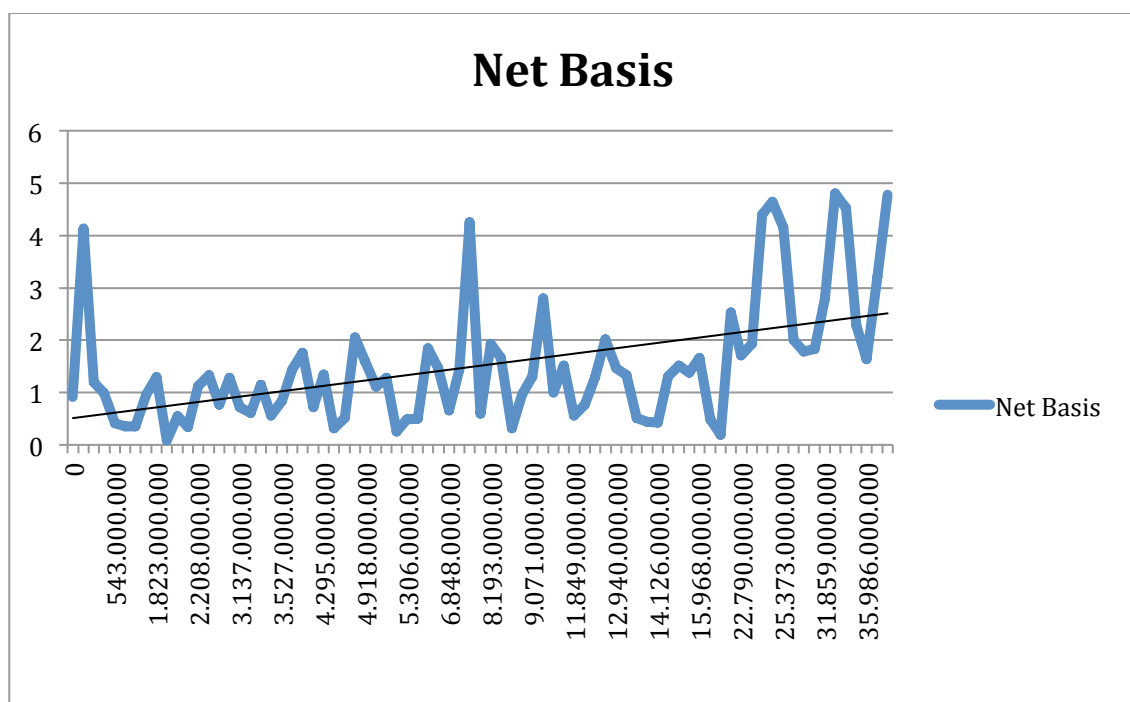


Figure 29

On the horizontal axis stand the values of the purchase amounts (from the lowest to the biggest), while the vertical one represents the value of the net basis.

There are just a few exceptions to the correlation effect between NB and purchase amount described above: they mostly owned to bonds with a very recent date, indicating that they already have a very high NB, probably due to the QE program effects, and they don't need to be purchased by the FED anymore.

Figure 30 shows another important and interest effect of the QE program implemented by the FED. The graph tries to explain the effects of the assets purchases on the yield, showing how it has a completely different behaviour from the net basis:

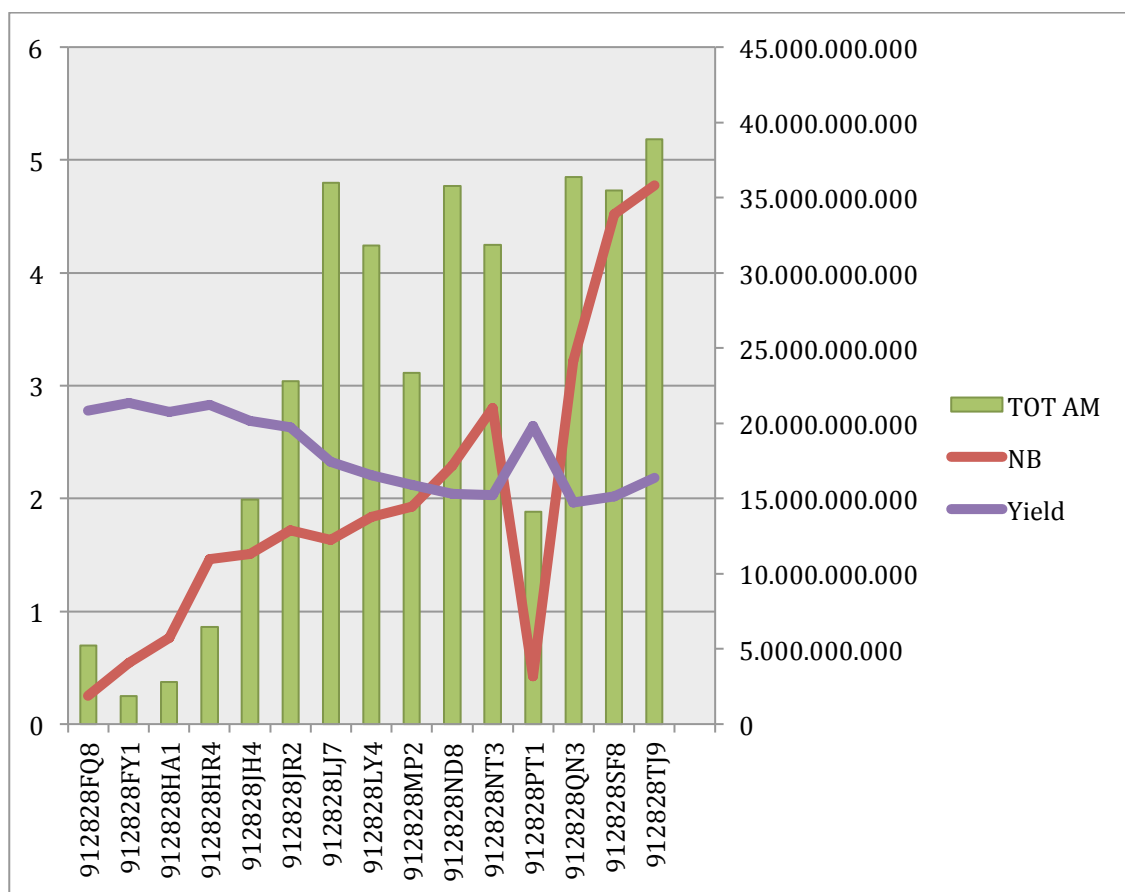


Figure 30: final relationship between net basis, yield to maturity and total purchase amount

This graph is very clear and it describes very explicit trends.

First of all, as time goes by (horizontal axis), on average, the yield decreases while the NB increases, showing that the monetary policy has worked.

Secondly, we know that when we purchase an asset, its price should go up, while its

yield should decrease; and this is what is possible to understand looking at the graph.

The yield in fact generally decreases as the total amount of purchase of the bond increases; the correlation between the yield and the total purchase amount is $-0,91$ confirming what the graph is showing

Third, the NB follows the trend of the amount of purchase: the NB increases as the total purchase amount of the asset becomes bigger. The NB then, oppositely to the yield, increases as time passes.

This is what really happens in the market: the NB and the yield of a single bond should have different behaviours correlated to the time and the purchase amount of the asset itself. This is the reason why the NB and the yield of the bonds are negatively correlated (-0.766).

5.2: THE NUMERICAL ANALYSIS: LINEAR REGRESSIONS

The last analysis of this work aim at describing from a numerical point of view what has been studied looking at the graphical analysis. During the first part of the paper in fact we discovered, from a graphical point of view, very important trends and relationships with other factors, of the net basis; now, the goal is to go even deeper into the analysis and see if the numbers confirm what has been shown by the graphs.

The analytical tool used for the analysis is the linear regression while the program used is Eviews for econometrics. We will focus on two different kind of linear regression: cross section and time series and the aim is always the same: try to understand the movements of the Net Basis of a bond.

The data for the first linear regression are sorted as a cross section in excel. With this regression we want to focus on the result shown by graph number 1 where for an entire bond, the higher the total purchase amount of that bond, the higher the value of its medium net basis as we can see looking below:

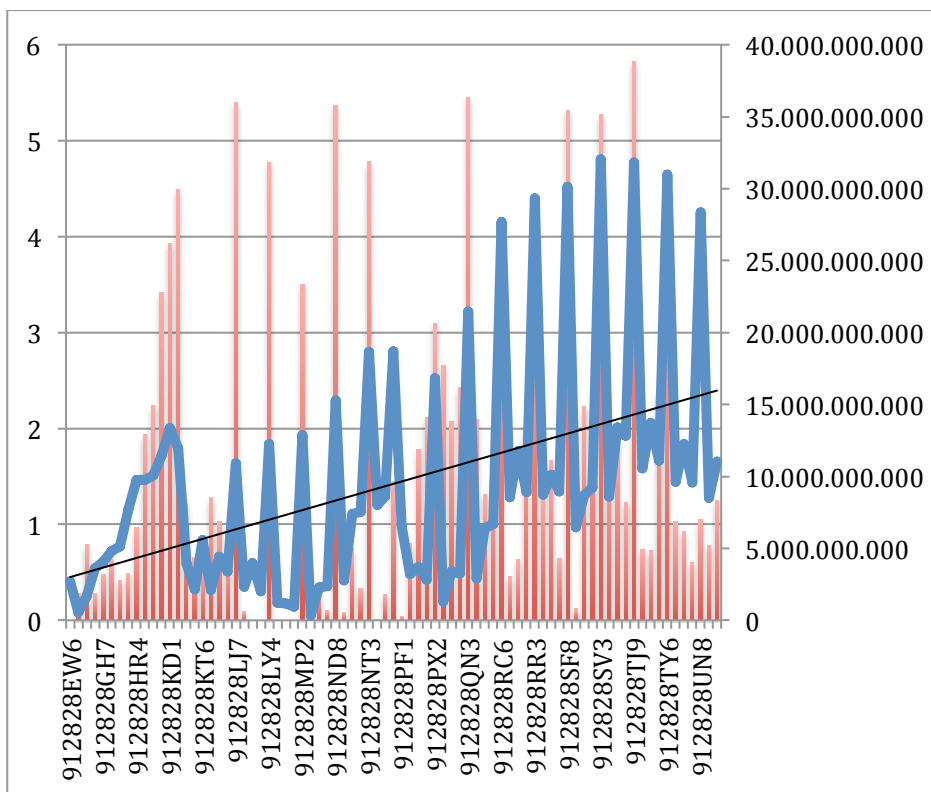


Figure 28: final relationship net basis and total purchase amount (bond analysis)

We see in fact, as already explained in the previous chapter, that generally for high peaks of the purchase amount of a particular bond, there is a very high peak of the net basis of that particular bond too.

The data used for computing the first regression that we are going to see now, are the same data of those used for creating graph number 1: so with this first regression we just want to confirm from a numerical point of view what is shown by the graph above. The dependent variable is obviously the net basis while, the explanatory variables we decided to put in are: “total purchase amount”, “coupon”, “number days ctd”, and “maturity” of the asset. The variable “number days ctd” stands for the number of days that a bond has been the ctd for all the futures while the variable “maturity” explains the years of maturity from the purchase of the asset.

As already explained above, the data are sorted as a cross section where in the rows there are the bonds and in the columns the respective variables as shown by screenshot 1 took from the excel input file; the total number of observations are 83 meaning that 83 is the number of bonds we are analyzing.

Cusip	Medium NB	Tot purchase amount	Years to Maturity	Number days CTD	Coupon
912828FF2	0,08565963	1.865.000.000	6,328125	129	5,125
912828FQ8	0,25101816	5.244.000.000	6,498054475	65	4,875
912828FY1	0,54585393	1.875.000.000	6,666666667	0	4,625
912828GH7	0,61045846	3.191.000.000	6,728045326	65	4,625
912828GS3	0,7219821	4.246.000.000	6,839712919	65	4,5
912828HA1	0,76740517	2.800.000.000	6,993801653	66	4,75
912828HH6	1,14678405	3.275.000.000	7,113138686	64	4,25
912828HR4	1,46294139	6.461.000.000	7,208809135	65	3,5
912828HZ6	1,46441193	12.940.000.000	7,325958702	65	3,875
912828JH4	1,50968992	14.930.000.000	7,470430108	66	4
912828JR2	1,71656415	22.790.000.000	7,596034696	63	3,75
912828KD1	2,00357131	26.180.000.000	7,64516129	66	2,75
912828KQ2	1,78774823	29.944.000.000	7,609263658	65	3,125
912828KR0	0,59148318	8.110.000.000	6	0	2,625
912828KS8	0,32105532	4.369.000.000	6	0	2,625
912828LD0	0,51129698	4.753.000.000	6	0	3,25
912828LJ7	1,63463443	35.986.000.000	7,605482718	65	3,625
912828LL2	0,34691776	645.000.000	6	0	3
912828LY4	1,8376337	31.822.000.000	7,61097852	63	3,375
912828MP2	1,9274474	23.339.000.000	7,658198614	65	3,625
912828MV9	0,34076797	2.105.000.000	6	0	3,25
912828NA4	0,35578246	714.000.000	6	0	3,125
912828ND8	2,28914353	35.770.000.000	7,660160735	65	3,5
912828NG1	0,41892197	543.000.000	6	0	2,75
912828NK2	1,11097167	5.013.000.000	6	0	2,5

Screenshot 1 from excel

The correlation between the variables has been computed and table 4 shows the results:

	Medium nb	Purchase amount	Maturity	Days ctd	Coupon
Medium nb	1	0,708159401	0,8000412	-0,0296611	-0,2723383
Purchase amount	0,708159401	1	0,74134335	0,18083073	0,01224103
Maturity	0,8000412	0,74134335	1	0,41938851	0,2801384
Days ctd	-0,029661082	0,180830726	0,41938851	1	0,66988296
Coupon	-0,272338264	0,01224103	0,2801384	0,66988296	1

Table 4: Correlation between the variables: from excel

As shown by the table above, the correlation between the maturity and the purchase amount is pretty high: in fact the most purchased treasuries by FED are the ones with a longer maturity. For this reason it has been decided to remove the variable “maturity” for estimating the equation for the regression since the most important explanatory variable for the analysis is the purchase amount.

Finally, after deciding the variables usefull for the regression, the equation has been estimated and the initial result is shown by table 5:

Dependent Variable: NB

Method: Least Squares

Date: 02/04/15 Time: 12:19

Sample: 1 83

Included observations: 83

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.380165	0.195851	7.047033	0.0000
COUPON	-0.349685	0.079340	-4.407417	0.0000
PURCHASE	0.000768	9.80E-05	7.837172	0.0000
CTD	0.002301	0.003720	0.618450	0.5381
R-squared	0.582184	Mean dependent var	1.370637	
Adjusted R-squared	0.566318	S.D. dependent var	1.188242	
S.E. of regression	0.782511	Akaike info criterion	2.394376	
Sum squared resid	48.37357	Schwarz criterion	2.510946	
Log likelihood	-95.36658	F-statistic	36.69286	
Durbin-Watson stat	1.782892	Prob(F-statistic)	0.000000	

Table 5: Regression 1, Eviews

As we can see looking above (“Regression 1”), the variables “coupon” and “purchase amount” are significative while “ctd” is not and it has to be removed for estimating the equation.

After removing the variable “ctd”, the result for the final regression is provided by table 6:

Dependent Variable: NB
 Method: Least Squares
 Date: 02/04/15 Time: 12:22
 Sample: 1 83
 Included observations: 83
 White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.301260	0.170201	7.645426	0.0000
COUPON	-0.307720	0.057437	-5.357547	0.0000
PURCHASE	0.000779	9.06E-05	8.599813	0.0000
R-squared	0.580466	Mean dependent var		1.370637
Adjusted R-squared	0.569978	S.D. dependent var		1.188242
S.E. of regression	0.779202	Akaike info criterion		2.374382
Sum squared resid	48.57246	Schwarz criterion		2.461810
Log likelihood	-95.53686	F-statistic		55.34398
Durbin-Watson stat	1.732796	Prob(F-statistic)		0.000000

Table 6: Final regression 1, Eviews

The results for the final regression are what we were expecting and perfectly confirm what has been shown by graph number 1: the variable “purchase amount” is in fact both significant and positive. This means that the net basis of a bond is very influenced by the purchase amount of the single bond and it moves as the purchase amount changes: being more precise, since the variable “purchase amount” has a positive coefficient, it means that the net basis of a bond increases when the purchase amount of that particular bond increases. This result, again, is the same result found in the graphical analysis and confirms the theory: higher purchase amount → higher net basis.

In order to conclude with the numerical analysis, in the following pages we provide the results of three linear regression which data are daily and sorted as time series.

The data used for the regressions refer to the entire bond. It has been decided to refer to the entire bond instead that to the single future because the sample and so, the number of observations, for the entire bond is much bigger than the number of observations provided by the single future.

Three regressions on the most purchased bonds from march 2009 to october 2014 have been made. The dependent variable of the three regressions is for instance the net basis of the entire bond, while the explanatory variables are: “purchase amount”, “five, ten and twenty years yield” indexes in the US bond market and the “total purchase amount of all the other bonds” on the proper date. Doing so, we want to understand the effect of the explanatory variables on the net basis and see if the dependent variable is influenced by the single explanatory variables and how.

The first bond analyzed (cusip 912828LJ7) has been issued on August 17, 2009 and it expires in 10 years. With a total purchase amount of 35,986 trillion dollars it has been purchased 57 times by the FED between August 12, 2009 and August 29, 2012 and its medium net basis is 1,635.

After having imported in Eviews all the vectors (explanatory variables) listed above, the first step is to see if the variables are stationary/trend stationary (I_0) or stationary in first difference (I_1), in order to create the right input for the final regression. If our dependent variable is an I_0 , the input for the explanatory variables that are I_1 would be $d(\text{“name of the variable”})$ in order to put on the same level all the variables (dependent and explanatory): without this passage in fact, the linear regression would not be correct and we would focus on bad results.

The Unit Root test for this bond brings to a particular result. The three yield indexes and the net basis in fact are I_1 , while the “purchase amount” and the “bonds’ total purchase amount” are I_0 . Now, since the dependent is an I_1 , the two explicative variables I_0 should not be included in the equation input for the final linear regression. But the purchase amount and the total bonds amount are the factors on which we are mostly interested in, so they have to be included in the equation input for the regression. It is possible to include them bringing all the variables that are I_1 to I_0 , simply writing them in the equation input, as explained before, $d(\text{“name of the variable”})$: doing so, the purchase amount can be included for computing the final regression.

Table 7 is the final result of the linear regression:

Dependent Variable: D(NB)
Method: Least Squares
Date: 02/06/15 Time: 16:51
Sample(adjusted): 2 811
Included observations: 810 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.008795	0.006416	-1.370778	0.1708
AMOUNT	6.01E-11	2.93E-11	2.052170	0.0405
D(FIVEYY)	0.155943	0.314670	0.495575	0.6203
D(TENYY)	-0.358361	0.567928	-0.630997	0.5282
BONDS_AMOUNT	-5.97E-14	3.67E-12	-0.016274	0.9870
D(TWENTYYY)	-1.018228	0.388767	-2.619123	0.0090
R-squared	0.183603	Mean dependent var	-0.003491	
Adjusted R-squared	0.178526	S.D. dependent var	0.184858	
S.E. of regression	0.167547	Akaike info criterion	-0.727728	
Sum squared resid	22.56985	Schwarz criterion	-0.692935	
Log likelihood	300.7297	F-statistic	36.16296	
Durbin-Watson stat	2.594999	Prob(F-statistic)	0.000000	

Table 7, Regression 2, Eviews

With a confidence level of 5%, we see that the explanatory variables “bonds_amount”, “five, ten years yield) are not significant and removing step by step all of them, the final regression is provided by table 8:

Dependent Variable: D(NB)
Method: Least Squares
Date: 02/06/15 Time: 17:56
Sample(adjusted): 2 811
Included observations: 810 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.008842	0.005971	-1.480806	0.1390
AMOUNT	5.90E-11	2.50E-11	2.364486	0.0183
D(TWENTYYY)	-1.235742	0.093450	-13.22361	0.0000
R-squared	0.183198	Mean dependent var	-0.003491	
Adjusted R-squared	0.181174	S.D. dependent var	0.184858	
S.E. of regression	0.167277	Akaike info criterion	-0.734640	
Sum squared resid	22.58103	Schwarz criterion	-0.717243	
Log likelihood	300.5290	F-statistic	90.49990	
Durbin-Watson stat	2.590510	Prob(F-statistic)	0.000000	

Table 8, Final regression 2, Eviews

The final regression for bond (cusip 912828LJ7) tells us that, like in the cross section regr and in the graphical analysis, the purchase amount is a positive and significant variable; also the twenty years yield index is a significant variable, but its coefficient is negative, meaning that it has a negative effect on the net basis.

The test on the residuals is positive, meaning that the residuals are I_0 .

The final result of the regressions for the other two bonds is pretty different. Bond (cusip) 912828ND8 is a ten years maturity asset and it has been issued on May 17, 2010; it a total purchase amount realized by the FED of 35,770 trillion dollars and its medium net basis is 2,29. The last bond analyzed (cusip 912828TJ9) has been issued on August 8, 2012 and it expires in ten years. The FED purchased it for a total amount of 38,871 trillion dollars and its medium net basis is 4,775.

The test for the stationarity of the variables brings to the same result of the bond analyzed above, but after having estimated the equation for the regression the results are different, as table 9 and table 10 show:

Bond912828ND8:

Dependent Variable: D(NB)
 Method: Least Squares
 Date: 02/05/15 Time: 11:55
 Sample(adjusted): 2 842
 Included observations: 840
 Excluded observations: 1 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.007249	0.006940	-1.044483	0.2966
BONDS_AMOUNT	4.08E-12	3.34E-12	1.223802	0.2214
AMOUNT	-1.11E-11	2.70E-11	-0.411216	0.6810
D(FIVEYY)	0.108096	0.355913	0.303716	0.7614
D(TENYY)	-0.253489	0.637344	-0.397727	0.6909
D(TWENTYYY)	-1.385015	0.434042	-3.190972	0.0015
R-squared	0.216276	Mean dependent var	-0.002293	
Adjusted R-squared	0.211577	S.D. dependent var	0.201809	
S.E. of regression	0.179193	Akaike info criterion	-0.593590	
Sum squared resid	26.77983	Schwarz criterion	-0.559780	
Log likelihood	255.3079	F-statistic	46.03004	
Durbin-Watson stat	2.562633	Prob(F-statistic)	0.000000	

Table 9, regression 3, evIEWS

Bond 912828TJ9:

Dependent Variable: D(NB)
 Method: Least Squares
 Date: 02/05/15 Time: 12:49
 Sample(adjusted): 2 466
 Included observations: 463
 Excluded observations: 2 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.007661	0.006502	-1.178198	0.2393
AMOUNT	1.79E-11	1.89E-11	0.946164	0.3446
BONDS_AMOUNT	-5.91E-13	4.63E-12	-0.127567	0.8985
D(TENYYY)	-0.701661	0.789532	-0.888705	0.3746
D(FIVEYY)	0.386888	0.409124	0.945649	0.3448
D(TWENTYYY)	-2.152893	0.570045	-3.776708	0.0002
R-squared	0.441020	Mean dependent var	-0.010704	
Adjusted R-squared	0.434904	S.D. dependent var	0.168986	
S.E. of regression	0.127031	Akaike info criterion	-1.275891	
Sum squared resid	7.374599	Schwarz criterion	-1.222270	
Log likelihood	301.3687	F-statistic	72.11198	
Durbin-Watson stat	2.512690	Prob(F-statistic)	0.000000	

Table 10, Regression 4, Eviews

As we can understand, for both bonds all the explanatory variables, a part from the twenty years yield, are not significative and removing them one after the other, the only significative variable remains “twenty years yield” with a negative coefficient.

There could be an explanation for this pretty unsuccessfull result regarding the relationship between the net basis and the purchase amount of those two bonds.

Looking at the single bond graphical analysis, we saw that, usually, the purchase of a bond happens when its net basis is pretty low after a visible decrease. The effects of the purchases then, are not perceived immediately, but after a little period of time. The thing is that, with the regressions analysis it is not possible to perceive this phenomenon: the linear regression in fact studies the relationship between the dependent and the explanatory variables day by day, without considering that the positive effect of the monetary policy is perceived a little bit later the intervention on the market.

CHAPTER 6: CONCLUSIONS

The attention of this thesis is focused on the behaviour of the net basis of a bond, trying to understand, at the same time, the trends of prices and yields; the data belong to the U.S. market.

The Fed, buying Treasuries in the market for implementing its monetary policy, is a strong protagonist of the Government Bond Market. However, the Fed can only operate in the spot market, never operating in the future one. This is the reason why in this work we particularly aim at studying the movements and the different values of the Net Basis when a Bond is purchased by the FED. The Net basis in fact, as already explained, is, in simple words, the difference between the cash and the future price of a Treasury asset; it is from this concept that our goal is to understand how the FED can affect the value of the Net basis operating only in the spot market and not in the future one.

In the graphical analysis we saw, as the literature teaches, that the price of an asset increases after the purchase and at the same time its yield decreases. This is because the risk of the asset diminishes after the purchase (yield drops) and the asset can be sold more easily in the market (it becomes more liquid): this is, in a few and very simple words, one of the main effects of the monetary policy “Quantitative Easing” implemented by Central Banks.

We then focused on the net basis of a bond which has been defined and explained during the first part of the thesis. The principal aim is to understand how the purchases of a Treasury influence the value of its net basis, trying to understand if it decreases or increases and if the effects are perceived immediately or after a little period of time.

The overall final analysis of both single futures and single entire bonds showed that there is a positive and pretty high correlation between the total purchase amount of a bond and its net basis. The higher the purchase of a Treasury, the higher its net basis: this result is valid both for a single Treasury and for the single futures.

The results have been provided by the final graphic analysis studied above: the most explicit figures are on page 46 (figure 21), on page 51 (figure 28) and on page 52

(figure 30). The latter even shows that the behaviors of the net basis and the yield to maturity of a particular bond are almost the opposite: in fact, as we can see looking at figure 30, the higher the purchase amount of a Treasury, the higher its net basis and the lower its YTM.

We then moved to the empirical analysis which is provided in the last chapter.

The aim of the empirical analysis (regressions) was to confirm the results gave by the graphical analysis described above.

We made three times series regressions which results, always looking at the variable “purchase amount” were in part positive and in parte negative, revealing in just one case the purchases by the FED significative and positive; an explanation of this result has also been provided.

The cross section regression instead, estimated with the same data used for creating figure 28 on page 51, perfectly confirmed the relationship between purchase amount and net basis shown by the graphs. With other explanatory variables, the “purchase amount” variable was positive and significative in the final regression as shown by table 6 on page 58, meaning that the net basis of a bond is positively influenced by the total purchase amount of the bond itself.

Concluding, we would like to point up again, and for the last time, the straightforward concept and relationship found out in this work. The purchase amount of a Treasury positively influences the net basis of the asset itself:

HIGHER PURCHASE AMOUNT → HIGHER NET BASIS.

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