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# Effects of Unconventional Monetary Policy on Income and Wealth Distribution: Evidence from United States and Eurozone

**Summary:** As an answer to the “Great Recession” and Zero Lower Bound problem, main central banks had to use unconventional monetary policy (UMP). This research focuses on the distributive effects of these measures on household income and household wealth in the United States of America (USA) and the Eurozone. For this purpose, this paper presents four models that were constructed using the Structural Vector Autoregressive methodology (SVAR). The results suggest that the UMPs applied by the Federal Reserve (FED) in the USA could increase wealth and income inequality through the portfolio channel. However, the same results were not observed in the Eurozone.

**Key words:** United States of America, Eurozone, Income inequality, Wealth inequality, Unconventional monetary policy.

JEL: D63, E52, E58.

Income and wealth inequality has increased in developed countries since the 1980s as measured by the income and wealth share of the top decile and the Gini coefficient (Thomas Piketty 2014; Hedva Sarfati 2015). It is a trend that has been accentuated by the “Great Recession”.

The distributional effects of monetary policy have been largely ignored in academic literature and in the daily life of the central banks. However, the recent escalation of inequality highlighted the importance of this issue, and recent studies have examined the channels through which monetary policy can have distributional effects (Olivier Coibion et al. 2012). Some of these studies conclude that aggressive monetary policies, which were implemented to fight against the “Great Recession”, have increased income and wealth inequality, especially with the implementation of the unconventional monetary policy (UMP) (James B. Bullard 2014; Ayako Saiki and Jon Frost 2014).

During the “Great Recession”, the conventional monetary policy, which signaled the desired level of the interest rate and usual balance sheet operations such as those carried out in the foreign exchange market, did not achieve the intended objectives; and different central banks made use of unconventional balance sheet policies,

which are so called because of their infrequent or unprecedented use (Claudio Borio and Piti Disyatat 2009).

Our research provides new empirical evidence by conducting a SVAR through Cholesky decomposition following the methodology of Saiki and Frost (2014). The portfolio channel, which is identified as the most important channel when an expansionary monetary policy entails undesired redistributive effects, has been evaluated to address the challenge proposed by Saiki and Frost (2014). This study was conducted from December 2008 to December 2013 in the USA and from July 2009 to September 2016 in the Eurozone. The results suggested that in the USA, UMP measures could have increased wealth inequality through the portfolio channel and income inequality due to the “snowball effect” (Emmanuel Saez and Gabriel Zucman 2014). However, such evidence was not demonstrated in the Eurozone.

This paper is structured as follows: the relationship between monetary policy, income, and wealth distribution is detailed in Section 1; the SVAR models and results are analyzed together with robustness tests in the methodology in Section 2; and the conclusions are presented in Section 3.

## 1. Relationship between Unconventional Monetary Policy and Inequality

Ben S. Bernanke (2015), former chairman of the FED, stated that the long-term character of inequality, seen both within and outside of the countries, is well-accepted in academia. It can be attributed to demographic, technological, and institutional changes or globalization itself (Daron Acemoglu 2002; Robert C. Feenstra and Gordon H. Hanson 2004; Jonathan Heathcote, Fabrizio Perri, and Giovanni L. Violante 2010).

Moreover, Rory O’Farrell, Lukasz Rawdanowicz, and Kei-Ichiro Inaba (2016) pointed out that monetary policy is neutral in the long-term, and thus its effects on inequality are modest. They also stated that the main objective of monetary policy is to achieve economic stability and other tools, such as fiscal policy or labor market policy, already exist to fight against inequality. However, these rationales do not mean that monetary policy does not have distributional effects nor they have to be studied. In this regard, it is noteworthy that wealth inequality is increasing at the same pace as income inequality, in which the “snowball effect” is the plausible explanation (Saez and Zucman 2014). Following the Household Finance and Consumption Survey (HFCS) published by the European Central Bank (ECB 2016a), we define wealth as net worth or the value of a household’s assets minus its liabilities, not including the current value of public and occupational pension plans.

The distributional effects of monetary policy are not novel. Richard Cantillon, who is considered by many as the father of political economics, was the first to break away from the idea of the neutrality of money. Richard Cantillon (1755) detailed how the change in the money supply leads to changes in relative prices and in the real economy, which in turn produce evident redistributive effects. Representative agent models that assume the neutrality of money dilute and simplify reality. Evidence shows that in studying the proper functioning of monetary policy, both in its objectives and other unintended consequences, we must take into account the heterogeneity of households.

In this regard, recent literature shows different channels through which monetary policy has effects on the distribution of income and wealth. However, the net direction of such effects is ambiguous. On one hand, there are several ways by which an accommodative monetary policy would help to achieve a more equitable income distribution. First is the (I) savings redistribution channel. Supposing that lenders are richer than borrowers, an expansionary monetary policy that reduces the interest rate or has the effect of increasing inflation will benefit the real value of borrowers against the real value of savers (Matthias Doepke and Martin Schneider 2006; Makoto Nakajima 2015). However, Christina D. Romer and David H. Romer (1998) showed that in the long-run, low inflation and stable aggregate demand is beneficial to the low-income group.

Another example is the (II) earnings heterogeneity channel. As unemployment rates are considerably higher in lower-income families, an expansionary monetary policy appears to primarily benefit them by decreasing their difficulty in obtaining employment, which tends to reduce income and wealth inequality (Seth B. Carpenter and William M. Rodgers 2004). Similarly, Heathcote, Perri, and Violante (2010) showed that the labor earnings at the bottom of the distribution are most affected by business cycle fluctuations and that an expansionary monetary policy could potentially reduce income inequality. In addition, Evelyne Huber and John D. Stephens (2014) demonstrated that a monetary policy-induced lowering of the unemployment rate by one percent could reduce the Gini coefficient for market income by approximately 0.4 points.

In contrast, there are other channels through which an accommodative monetary policy would imply an increase in inequality of wealth and income. Assuming heterogeneous households with different sources of income, (III) the income composition channel shows that the households with a higher proportion of interest income, which are normally the richest households, would benefit if an expansionary monetary policy shock increases assets and financial income more than wages (James K. Galbraith 1998; Coibion et al. 2012). Moreover, the benefit received by high-income households from increases in assets prices could also occur through the (IV) financial segmentation channel. Under the assumption that richer households tend to be more connected to financial markets, monetary policy-induced changes may benefit these more connected households better (Stephen D. Williamson 2009). Another case is the (V) portfolio channel. If higher-income households maintain a greater proportion of their wealth in assets, they would benefit more on an expansive monetary policy that increases the price of assets (Markus K. Brunnermeier and Yuliy Sannikov 2012). Furthermore, if monetary policy causes inflation, it would adversely affect households that need more cash for their transactions. On the other hand, Andrés Erosa and Gustavo Ventura (2002) noted that low-income households are more affected when they regularly keep their wealth. Furthermore, Joydeep Bhattacharya, Joseph H. Haslag, and Antoine Martin (2005) pointed out that the older generations own more cash and are greater consumers compared to younger generation, thus producing a transfer of income between generations.

Coibion et al. (2012) empirically showed that the savings redistribution (I) and earnings heterogeneity channels (II) were the most important channels before the crisis in the USA through the analysis of the five channels, and they concluded that

contractionary monetary policy shocks involved an increase in inequality during the crisis. However, Saiki and Frost (2014) pointed out several shortcomings in the study by Coibion et al. (2012) which include not taking into account the measures of wealth and the UMP that became more significant in 2008. They analyzed the impact of the UMP on the income distribution of Japan, a country with a long history of unconventional measures, and they claimed that the portfolio channel had a large impact on Japan, whereas the rest of compensatory channels did not cause broad effects as long as the UMP does not get the desired effects in the economy. Therefore, wealth inequality has been rising since the beginning of such policies, and it demonstrates the same risks for other economies wherein central banks have carried out similar policies.

Likewise, Richard Dobbs et al. (2013) stated that since the period of low-interest rates, households in the USA, United Kingdom, and Eurozone have seen sharp falls in their incomes based on interests earned on deposits and other fixed income investments. In addition, Bullard (2014) noted that the quantitative easing (QE) in the USA has depressed the performance of the safest assets, thus displacing investors to assets with higher risk such as stocks – logically resulting in rising prices and therefore, to an increase in inequality. Alternatively, Borio and Philip Lowe (2002) showed that in periods of low inflation, easy monetary policies stimulated demand for financial assets and not for real goods and services, which may result in monetary and financial instability. Dietrich Domanski, Michela Scatigna, and Anna Zabai (2016) showed that wealth inequality has been rising in the advanced economy since the financial crisis and suggested that monetary policy might have added to inequality through inflated equity prices. Karen Davtyan (2016) found that contractionary conventional monetary policy reduced income inequality in the USA.

On the other hand, Biagio Bossone (2013) emphasized that although the QE is the key to avoid financial collapse, increasing the monetary base is unable to stimulate aggregate demand. This may be due to the fact that QE increases the price of assets of individuals with greater wealth who, in turn, have a low propensity to consume, whereas the effect on the rest of individuals with a greater propensity to consume is modest. In this regard, the evidence shows that: (i) as a consequence of an unexpected reduction in interest rates, households with high mortgages and typically lower incomes had a greater than two-fold increase in their consumption compared to households with low mortgages (Marco Di Maggio, Amir Kermani, and Rodney Ramcharan 2014); moreover, (ii) a recent study by Sumit Agarwal et al. (2015) examined the ability of policymakers to stimulate household spending during the “Great Recession” by reducing banks’ cost of funds. The results show that an increase in credit limits raises total unsecured borrowing from consumers with the lowest FICO scores; however, it has no effect on consumers with the highest FICO scores. FICO score is a measure of creditworthiness and usually ranges between 300 and 900, and a higher score indicates a lower credit risk. Therefore, as banks’ marginal propensity to lend is lowest for consumers with the highest marginal propensity to borrow, the impact of credit expansions in stimulating economic activity will be limited; (iii) an unexpected reduction in interest rates after the expansionary monetary policy has a positive redistributive effect. The most indebted households, which are normally the low-income group, can re-finance their loans at a lower interest rate and benefit from such policy as long as they

have not signed a credit contract with fixed interest rates or a ground clause. However, a recent study in the USA shows that the most indebted households and those with a potentially higher marginal propensity to consume had more trouble refinancing their mortgages (Martin Beraja et al. 2015).

These studies highlight the value of two important lessons. First, monetary policy is not neutral, and there are important redistributive effects that should be analyzed. Second, the ineffectiveness of monetary policy in recent times could be due to its poor design as it does not consider the redistributive effects such as heterogeneity of households and marginal propensity to consume. Hence, the design of monetary policy may be relevant to its efficacy to avoid unwanted redistributive effects.

It is also important to add that the classic approach of neutrality of money has been discussed over the last decades (Bernanke and Alan S. Blinder 1992). It is already evident that monetary policy can alter financial markets. The portfolio channel is considered as one of the channels of transmission of monetary policy, especially when other channels, such as the mechanism of interest rate, have stopped working. The life cycle theory by Albert Ando and Franco Modigliani (1963) and the Q theory by James Tobin (1969) are proofs of how monetary policy through financial wealth can influence the real economy.

Multiple studies have emphasized the need to observe the relationship between monetary policy and stock market. In this regard, the structural VAR methodology is the most common and has been widely studied. Among these studies, we can highlight the work of William J. Crowder (2006). As noted in the introduction, the portfolio channel is currently identified as the main channel in which monetary policy affects inequality, and consequently, it will be the main focus of this study. However, it is important to remember that there are other compensatory channels that could dispel this effect if it occurs.

## 2. Empirical Analysis

### 2.1 Methodology

The VAR methodology, introduced by Christopher A. Sims (1980), is frequently used in literature for its ability to analyze stylized facts concerning the behavior followed by a set of variables as a consequence of orthogonal innovations to the model. Therefore, it is functional in analyzing the reaction of certain variables to shocks of any kind. The structural form of the VAR model can be expressed as:

$$A_0 y_t = (B_0 x_t + A_i y_{t-i} + u_t), \quad (1)$$

where  $y_t$  is vector of endogenous variables,  $x_t$  is vector of exogenous variables,  $A_0$  describes the contemporaneous relation among the variables collected in the vector  $y_t$ ,  $A_i$  is a matrix finite-order lag polynomial containing the coefficients on the  $i$  lag of  $y$ , and  $u_t$  is a vector of structural disturbances with zero mean ( $E[ut] = 0$ ) and a diagonal variance-covariance matrix ( $E[utut'] = I$ ). To derive the reduced form representation, we multiply both sides of the structural VAR representation (1) by  $A_0^{-1}$ :

$$y_t = A_0^{-1}B_0x_t + A_0^{-1}A_iy_{t-i} + e_t, \quad (2)$$

being  $e_t = A_0^{-1}u_t$ .

Throughout this investigation, the Cholesky decomposition method was used to identify the structural shocks, which impose a recursive structure that makes it possible to obtain the missing restrictions (Marco Del Negro and Giorgio E. Primiceri 1994). In using this method, errors were orthogonalized, and a lower triangular covariance matrix that imposes a causality order was obtained. The variables above the triangle contemporaneously affect other variables, and variables on the bottom of the triangle do not affect any other variables. This implies that the value of any variable in the system was not affected by the value of the variables in a higher order.

The Cholesky order was imposed assuming that monetary policy, as approximated by the monetary base (*mb*), reacts to the inflation rate ( $\pi$ ). This argument is logical, considering that the main objective of central banks analyzed, especially the ECB, is the inflation rate. Moreover, it was assumed that the corresponding stock market index (*smi*) reacts positively to an expansionary monetary policy. This implies that the relation between the reduced-form disturbances,  $e_t$ , and the structural disturbances,  $u_t$ , takes the following form:

$$\begin{bmatrix} 1 & 0 & 0 \\ -\alpha_{mb\pi} & 1 & 0 \\ -\alpha_{smi\pi} & -\alpha_{mb} & 1 \end{bmatrix} \begin{bmatrix} e_t^\pi \\ e_t^{mb} \\ e_t^{smi} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^\pi \\ u_t^{mb} \\ u_t^{smi} \end{bmatrix}. \quad (3)$$

It is important to make some considerations before presenting the various models and discussing the results. The objective of the methodology is to check if the stock market reacts to a monetary policy shock, and if it does, we could speculate that the expansive measures being undertaken by the world's main central banks are increasing inequality through the portfolio channel, which is identified by Saiki and Frost (2014) as the most important link between monetary policy and inequality. This hypothesis is plausible as supported by the study of Domanski, Scatigna, and Zabai (2016), wherein they applied simulation techniques in a large number of European countries using data from the HFCS published by the ECB; and they found that low interest rates and rising bond prices have minimal effects on wealth inequality, whereas rising equity prices might have added to wealth inequality and largely benefit the top end of the net wealth distribution. They also showed that the recovery of house prices only seems to have partly offset this impact. These results coincide with the study conducted by Adam Kershen and Panagiota Tzamourani (2016) for the Eurozone as well and with the one published by the Bank of England (2012). Furthermore, Bing Chen and Frank P. Stafford (forthcoming) conducted a similar research in the USA in which they found that less than 20 percent of households, mainly the wealthy, directly own stocks. Thus, they concluded that the wealthy may benefit more as stock prices and capital returns increase.

Nevertheless, this presents some problems. (1) The monetary base is a good proxy for measuring unconventional monetary policies. However, it is not perfect although it is able to capture, with sufficient precision, the policies of balance sheet expansion, such as QE or long-term refinancing operation (LTRO), and other types of unconventional measures, such as negative interest rates, or the forward guidance

concept, which do not logically have a clear representation in the balance of the central bank. (2) As the programs of unconventional monetary policy are currently taking place, there are no updated monthly frequency data of inequality such as Gini coefficient or any approximation. Thus we will not use them in the estimation as Saiki and Frost (2014) did in the Japanese case. However, looking at the household wealth composition surveys by the Federal Reserve (FED 2016)<sup>1</sup> and the European Central Bank (ECB 2016a)<sup>2</sup>, it can be concluded that a positive shock in the stock market favors those with highest incomes – thus increasing inequality. (3) The objective of this analysis is to see the effect of monetary policy on the distribution of income and wealth solely through the portfolio channel, and although previous works identify it as the most important channel, conclusions should not be made without analyzing the compensatory channels.

## 2.2 The United States of America Case

We present two VARs identified through the Cholesky decomposition method to analyze the effects of unconventional monetary policies carried out by the FED on major stock indices in the USA economy. We used three variables on a monthly basis, from December 2008 to December 2013, the years between the QE1 and QE3, namely: (1) money base (*base\_money*) obtained from the Federal Reserve Bank of St. Louis (2016a)<sup>3</sup>; (2) harmonized consumer prices percentage change on the same period of the previous year (*inflation\_rate*) obtained from the Organization for Economic Co-operation and Development (OECD 2016)<sup>4</sup>; and (3) stock market index SP500 (*SP\_500*) and Dow Jones 30 (*Dow\_Jones*) obtained from the ECB (2016b)<sup>5</sup> and Federal Reserve Bank of St. Louis (2016b)<sup>6</sup>, respectively. Money base and the stock market index were transformed into logarithms to facilitate interpretation.

The existence of unit roots were tested with the Augmented Dickey-Fuller (ADF) test, which tests the null hypothesis of a unit root present in time series and the alternative hypothesis stationarity. The ADF statistic is greater than the critical value for all the variables (see Table 1). Therefore, we cannot reject the presence of unit root. Given the results, all the variables have been transformed into first differences with an ADF statistic lower than the critical value – thus rejecting the null hypothesis. The

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<sup>1</sup> **Federal Reserve (FED)**. 2016. Survey of Consumer Finances. <http://www.federalreserve.gov/econresdata/scf/scfindex.htm> (accessed March 03, 2016).

<sup>2</sup> **European Central Bank (ECB)**. 2016a. Household, Finance and Consumption Network. [https://www.ecb.europa.eu/pub/economicresearch/research-networks/html/researcher\\_hfcn.en.html](https://www.ecb.europa.eu/pub/economicresearch/research-networks/html/researcher_hfcn.en.html) (accessed March 03, 2016).

<sup>3</sup> **Federal Reserve Bank of St. Louis**. 2016a. St. Louis Adjusted Monetary Base. <https://fred.stlouisfed.org/series/BASE> (accessed March 03, 2016).

<sup>4</sup> **Organization for Economic Co-operation and Development (OECD)**. 2016. Harmonized Indices of Consumer Prices by COICOP Divisions. [https://stats.oecd.org/Index.aspx?DataSetCode=HICP\\_COICOP](https://stats.oecd.org/Index.aspx?DataSetCode=HICP_COICOP) (accessed March 03, 2016).

<sup>5</sup> **European Central Bank (ECB)**. 2016b. Standard and Poor's 500 Composite Index. [http://sdw.ecb.europa.eu/quickview.do?SERIES\\_KEY=143.FM.M.US.USD.DS.EI.S\\_PCOMP.HSTA](http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=143.FM.M.US.USD.DS.EI.S_PCOMP.HSTA) (accessed March 03, 2016).

<sup>6</sup> **Federal Reserve Bank of St. Louis**. 2016b. Dow Jones Industrial Average. <https://fred.stlouisfed.org/series/DJIA> (accessed March 03, 2016).

Akaike information criterion (AIC) determined the use of one lag as optimum in both models (see Table A.1 and A.2 in the Appendix). The Cholesky order imposed is:

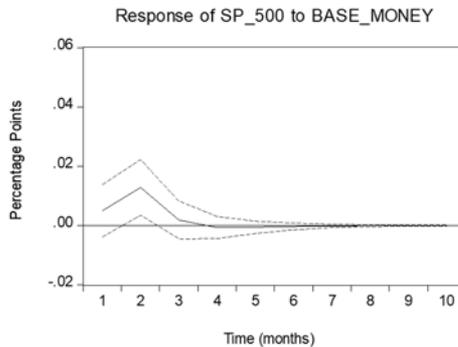
- (i) Inflation\_rate - Base\_money - SP\_500;
- (ii) Inflation\_rate - Base\_money - Dow\_Jones.

**Table 1** Augmented Dickey-Fuller (ADF) Unit Root Tests (USA)

	Levels		First differences	
	<i>t</i> -statistics	<i>p</i> -value	<i>t</i> -statistics	<i>p</i> -value
Inflation_rate	-2.387704	0.1495	-4.56093	0.0005
Base_money	-0.004559	0.9541	-5.592976	0.0000
SP_500	-0.537036	0.8760	-6.372624	0.0000
Dow_Jones	-0.545297	0.8742	-6.306562	0.0000

Source: Authors' estimations.

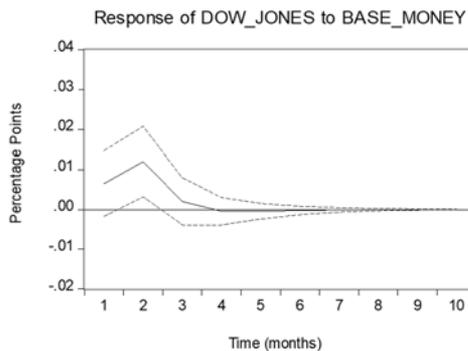
Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 1** Response of S&P 500 to the Money Base Shock

Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 2** Response of Dow Jones 30 to the Money Base Shock

Impulse responses of these two models are presented in the Appendix (see Figures A.1 and A.2). We are interested in how the stock market index, S&P 500 and Dow Jones 30, responded to the increase in monetary base. Figures 1 and 2 show the dynamic impact of monetary base one-standard-deviation shocks on the S&P 500 and the Dow Jones 30 in a span of 10 months and a confidence interval of 90%. In both cases, the increase in monetary base appeared to positively affect the stock market index. The impact became statistically significant after two months when the maximum increase of 0.01 points occurred, thereafter the effect dissipated quickly. Based on these results, an increase in the monetary base caused by unconventional measures in the USA economy has, indeed, a positive effect on the stock market, and therefore, it could lead to an increase in inequality through the portfolio channel.

### 2.3 Eurozone Case

In the Eurozone, it is more difficult to determine the period of study as QE does not start at the same time as in the USA. However, we have decided the study period to be from July 2009 to September 2016 or from the month when the enhanced credit support program, which is the first program of unconventional measures, is activated. The whole Eurozone were explored using Dow Jones EURO STOXX 50 stock market index. Due to the heterogeneity of countries in the Eurozone, an individual analysis has been conducted for the four largest economies in the Eurozone using the following stock market indices: IBEX 35 (Spain), DAX 30 (Germany), CAC 40 (France), and FTSE MIB (Italy). Variables used for the Eurozone are money base (base\_money) from the ECB (2016c)<sup>7</sup>, harmonized consumer prices percentage change on the same period of the previous year (inflation\_rate) from Eurostat (2016)<sup>8</sup>, and the stock market indexes retrieved from Investing.com (2016)<sup>9</sup>.

The model for the Eurozone was carried out similarly as the one for the USA economy. Money base and stock market indices were transformed into logarithms, and all variables were in first differences based on Augmented Dickey-Fuller test results (see Table 2). The AIC criterion determined the optimal use of one lag (see Table A.2 in the Appendix). Finally, applying the Cholesky decomposition method, the following orders were imposed for the models:

- (i) Inflation\_rate - Base\_money - Eurostoxx50;
- (ii) Inflation\_rate - Base\_money - Ibex35;
- (iii) Inflation\_rate - Base\_money - Dax30;
- (iv) Inflation\_rate - Base\_money - Cac40;
- (v) Inflation\_rate - Base\_money - FTSE\_MIB.

<sup>7</sup> **European Central Bank (ECB)**. 2016c. Base Money. [https://sdw.ecb.europa.eu/quickview.do?jsessionid=F17273070163835687F8D92B007FDB86?SERIES\\_KEY=123.ILM.M.U2.C.LT00001.Z5.EUR](https://sdw.ecb.europa.eu/quickview.do?jsessionid=F17273070163835687F8D92B007FDB86?SERIES_KEY=123.ILM.M.U2.C.LT00001.Z5.EUR) (accessed March 03, 2016).

<sup>8</sup> **Eurostat**. 2016. Harmonized Indices of Consumer Prices (HICP). [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc\\_hicp\\_manr&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_hicp_manr&lang=en) (accessed March 03, 2016).

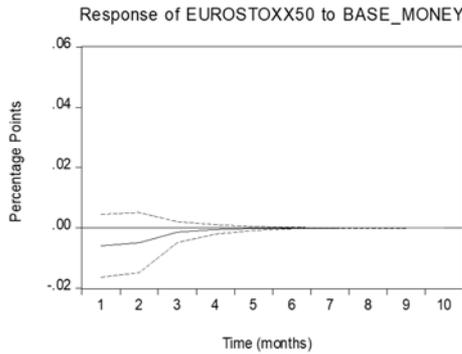
<sup>9</sup> **Investing.com**. 2016. Indexes. <https://es.investing.com/indices> (accessed March 03, 2016).

**Table 2** Augmented Dickey-Fuller Unit Root Test (Eurozone)

	Levels		First differences	
	<i>t</i> -statistics	<i>p</i> -value	<i>t</i> -statistics	<i>p</i> -value
Inflation_rate	-1.631779	0.4621	-8.578195	0.0000
Base_money	-1.262673	0.6435	-2.926237	0.0466
Eurostoxx 50	-1.838593	0.3597	-9.254531	0.0000
Ibex 35 (Spain)	-1.964662	0.3018	-9.458091	0.0000
Dax 30 (Germany)	-1.184692	0.6780	-8.723621	0.0000
Cac 40 (France)	-1.686338	0.4345	-9.512274	0.0000
FTSE_MIB (Italy)	-1.802346	0.3771	-8.905313	0.0000

Source: Authors' estimations.

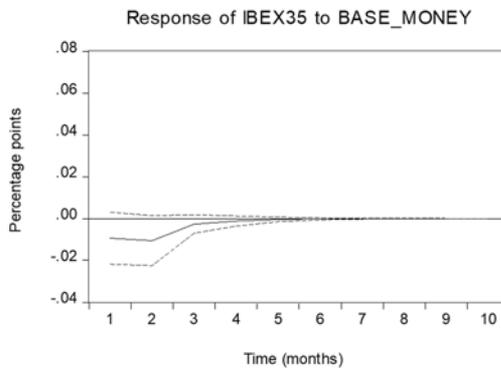
Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 3** Response of Dow Jones Euro Stoxx 50 to the Money Base Shock

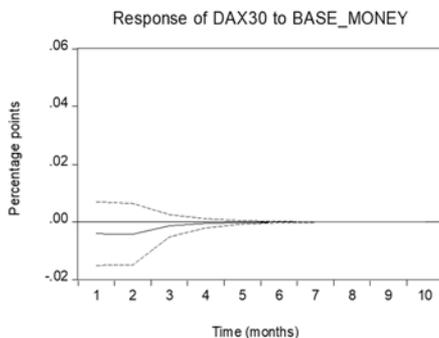
Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 4** Response of IBEX 35 to the Money Base Shock

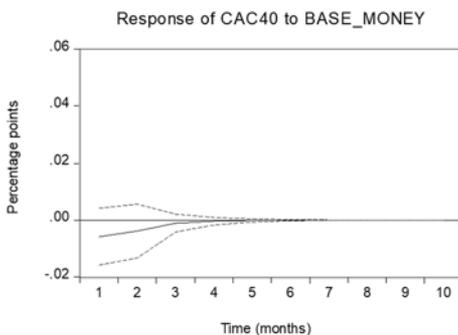
Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 5** Response of DAX 30 to the Money Base Shock

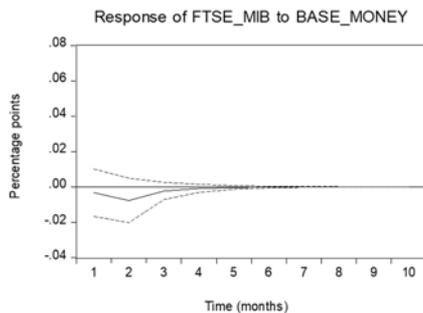
Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 6** Response of CAC 40 to the Money Base Shock

Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.



Source: Authors' estimations.

**Figure 7** Response of FTSE MIB to the Money Base Shock

Impulse responses of these five models are presented in the Appendix (see Figures A.3 to A.7). The results observed in the response of the stock market index to the increase in monetary base (Figures 3 to 7) are contrary to what economic logic would suggest. In all cases, it is found that a positive shock of UMP for the period does not have the expected effect in the European stock markets. The results show that one-standard-deviation shock in the monetary base reduced the corresponding stock market index by approximately 0.01 points, reaching the maximum effect in the second month and rapidly returning to the trend from the third month. However, these results are not statistically significant in any of the cases – thus showing the null effect of UMP shock on the stock market prices, both in the Eurozone and in other countries analyzed. These results contradict those obtained for the USA and those determined by Saiki and Frost (2014) for Japan. Therefore, in the Eurozone, expansionary monetary policies have not increased inequality through the portfolio channel. It is important to add that the Eurozone, as a whole, was treated using the Euro Stoxx 50 index, and subsequently, the respective indices of the four largest economies in the Eurozone were analyzed – obtaining in all cases a zero effect of the UMP on the stock market.

This phenomenon in the European area can be explained by several hypotheses, such as the relationship between the stock market and monetary policy breaks due to low expectations for future profits for the agents or the so-called liquidity trap by Keynes (Gauti Eggertsson and Paul Krugman 2012; Gianluca Benigno and Luca Fornaro 2015). Alternatively, Richard Koo (2012) claims that UMP have little effect on aggregate demand due to the “balance sheet recession”. He added that the process of massive private sector deleveraging after the financial collapse in 2008 caused monetary policy and others, such as fiscal policy, to not to be a determinant and necessary in stimulating the aggregate demand and in achieving the objectives of inflation and employment. In this sense, Carolina Tuckwell and Antonio Mendonça (2016) point out that the evolution of unemployment, inflation and GDP growth point to a weaker effectiveness of monetary policy in the Eurozone. Nonetheless, they state that this lower effectiveness may be due to fiscal consolidation policies applied after the sovereign debt crisis of 2010.

However, a more plausible explanation seems to be the less importance of the portfolio channel in the Eurozone due to excessive banking in the European economy. José M. González-Páramo (2012) shows that almost 80% of the financing needs of nonfinancial corporations in the Eurozone area are met by bank loans, whereas in the United States, the financing needs settled through bank loans are below 40%. The greater importance of the secondary debt market to the real economy’s financing conditions in the United States, as compared to the Eurozone, helps to explain further why measures supporting debt markets played a predominant role among the unconventional measures adopted by the FED in dealing with crisis. Therefore, it had a direct effect in the stock market. John Muellbauer (2016), states that as capital markets in the Eurozone are less important in financing companies, programs like LTRO could be more effective in reactivating the real economy. Thus, in the Eurozone, the portfolio channel is less important in transmitting monetary policy to the real economy. On the other hand, Jef Boeckx, Maarten Dossche, and Gert Peersman (2014) show that the ECB’s balance sheet expansion between 2008 and 2013 had a significant effect on

output and price level, with an effect that is very similar to those produced by changes in conventional monetary policy. However, this effect turns out to be heterogeneous between countries. Countries with a better degree of capitalization in their banking sector have been more lax in the granting of credits, and therefore, the effects of these unconventional measures have been greater. This reiterates the importance of banking and excessive banking in the Eurozone and the lesser significance of the portfolio channel as compared with other channels of monetary policy transmission such as the credit channel (González-Páramo 2012).

The inability of the ECB to influence financial private debt markets presents two opposing interpretations. On one hand, there is no evidence that the unconventional measures in the European area are increasing inequality. However, it is shown that the transmission mechanism based on the price of the assets that aims to stimulate the wealth effect does not work in the stock market.

### 3. Conclusions

This study shows the redistributive effects of the UMP, as represented by the monetary base, on the USA and the Eurozone. The results suggest that in the USA, the measures implemented by the FED had undesired effects on income and wealth distribution through the portfolio channel, but the same result cannot be affirmed for the Eurozone. Therefore, it can be suggested that measures of UMP implemented by the FED in response to the “Great Recession” had greater distributional effects than those applied by the ECB.

However, we should be cautious with this conclusion, as a plausible explanation for this phenomenon might be the excessive banking and the lesser role of the portfolio channel in the Eurozone. Through the portfolio channel, it could be implied that there is a lower effectivity in transmission of monetary policy to the real economy – consequently impeding the rest of compensatory channels mentioned in Section 1 and making the total result ambiguous. Moreover, there are alternative channels this study has not explored extensively and should be adopted for future research: (i) low interest rates allow refinancing the debt of households and businesses in better conditions, and this usually favors low-income group that proportionately accumulate more debt; moreover, (ii) aggressive monetary policies not only increase the stock market price but also the price of housing. As long as low-income households maintain a higher proportion of their wealth in housing, accommodative monetary policy could increase house prices and therefore reduce wealth inequality.

As discussed throughout the paper, much remains to be studied. However, it is clear that the neutrality of money could only be the result of chance, and policymakers should take into account all the consequences and adverse effects of such policies. It is naive to think that the expansionary monetary policy carried out by major central banks around the world should not have been made if it was shown to have negative total effect on equity. We should take into consideration the alternative scenario: what would the rate of inflation or growth rates have been without an accommodative monetary policy? However, we could take monetary policy design or the application of compensatory policies into account to eliminate these adverse distributional effects from any theory of social justice we can consider.

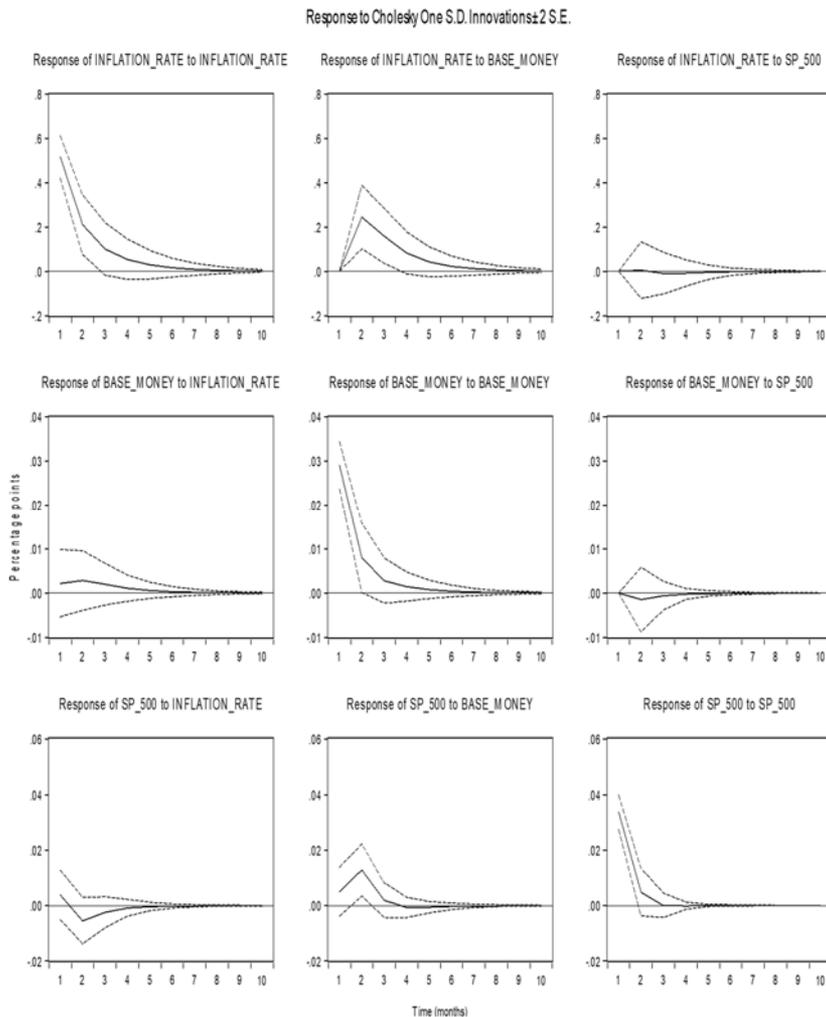
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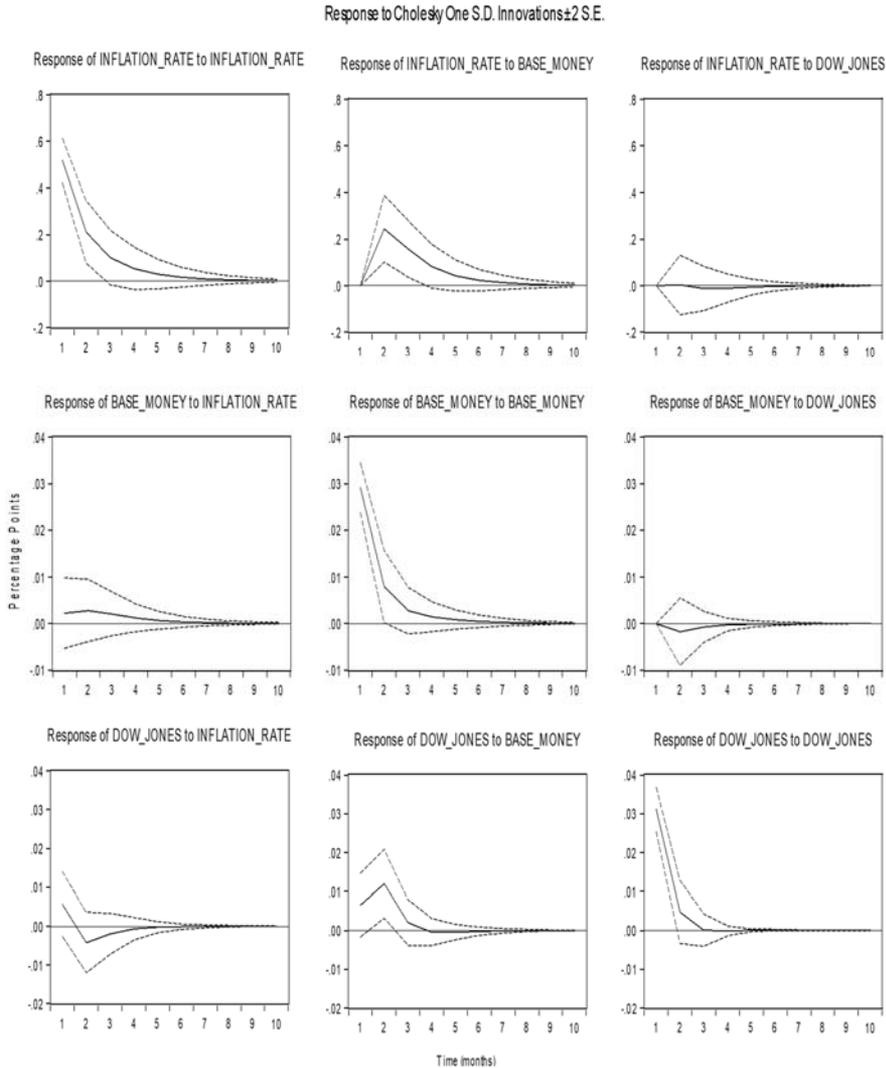
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# Appendix



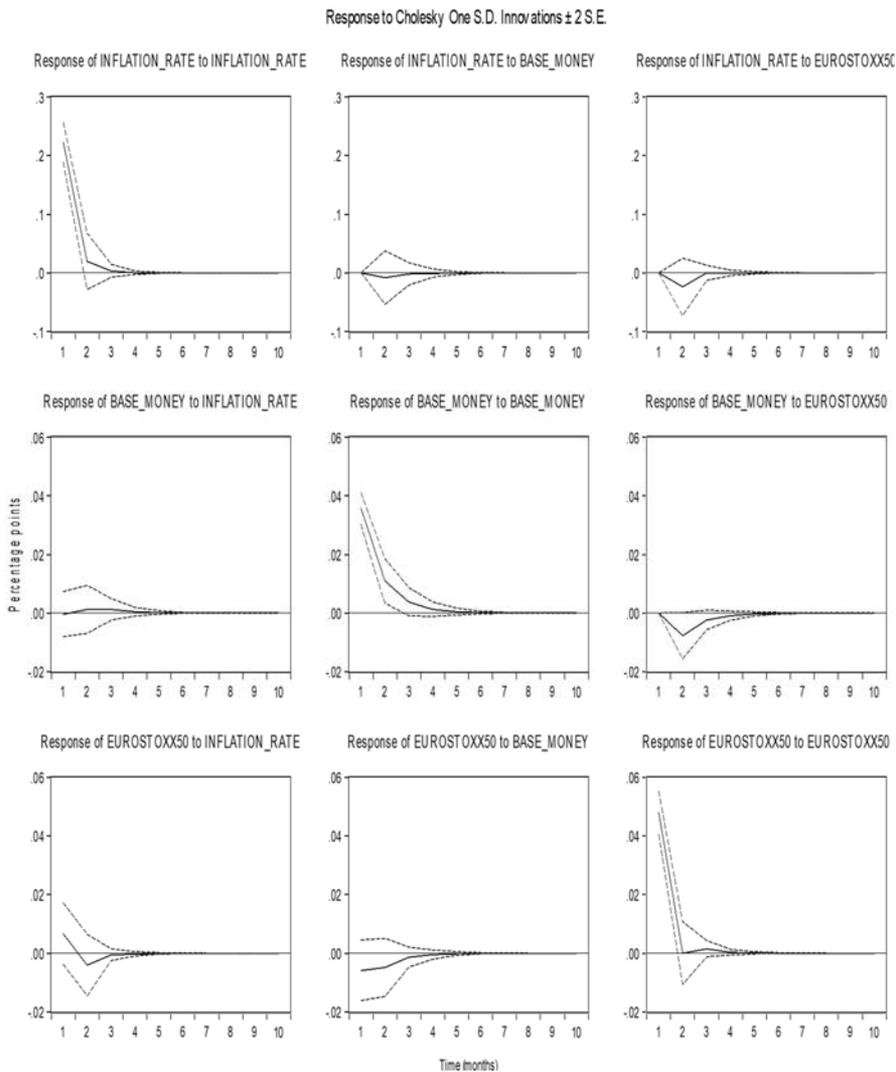
Source: Authors' estimations.

**Figure A.1** Impulse Response Function of VAR Analysis: Model I for the USA



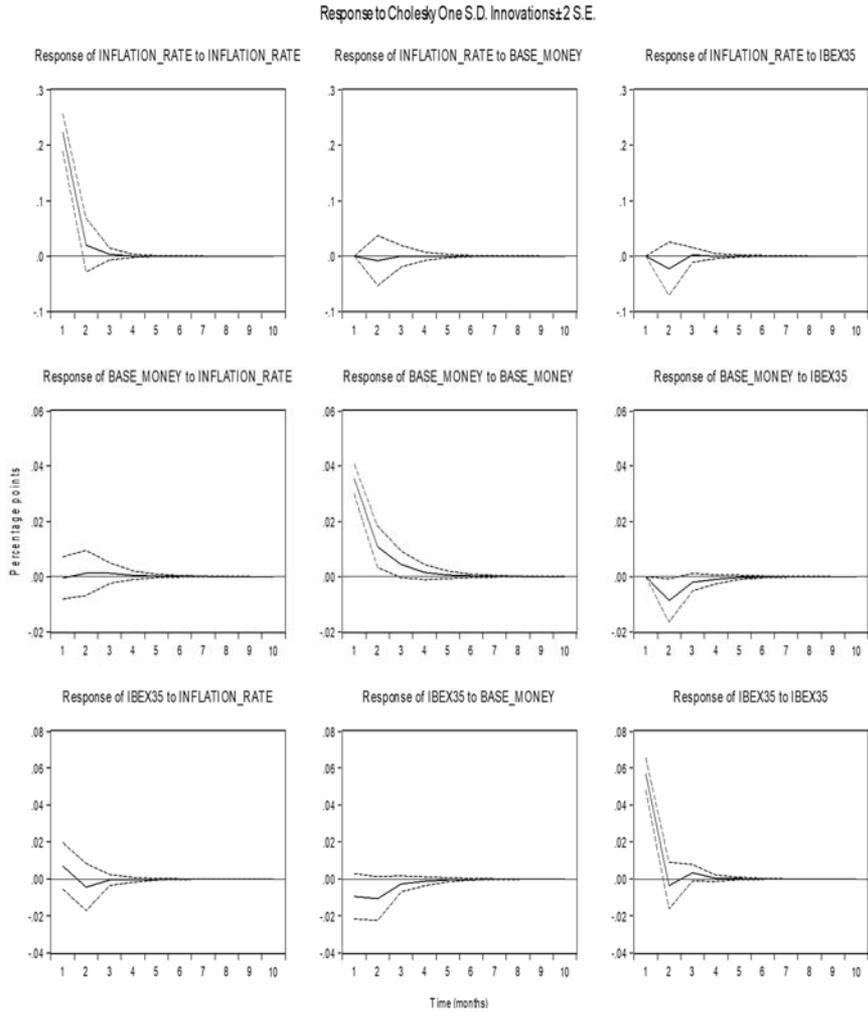
Source: Authors' estimations.

**Figure A.2** Impulse Response Function of VAR Analysis: Model II for the USA



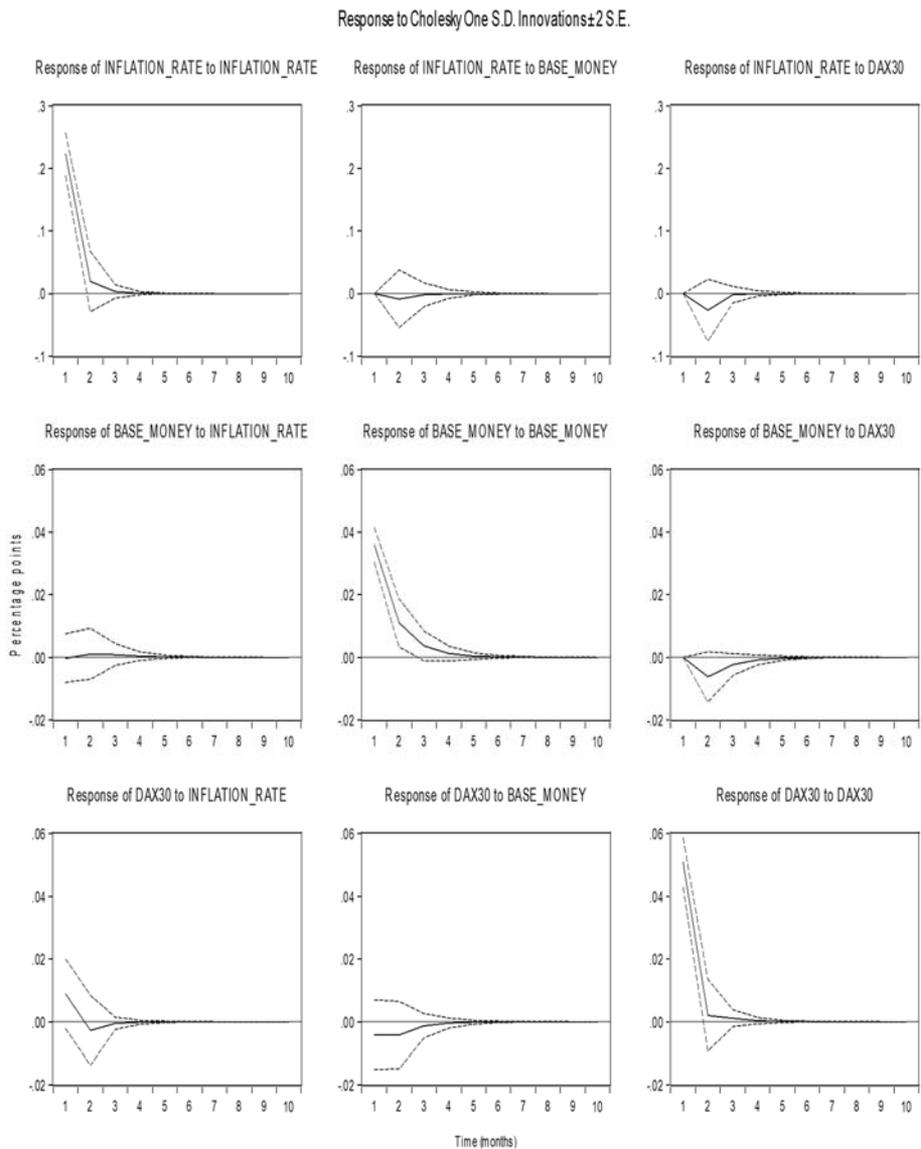
Source: Authors' estimations.

**Figure A.3** Impulse Response Function of VAR Analysis: Model I for the Eurozone



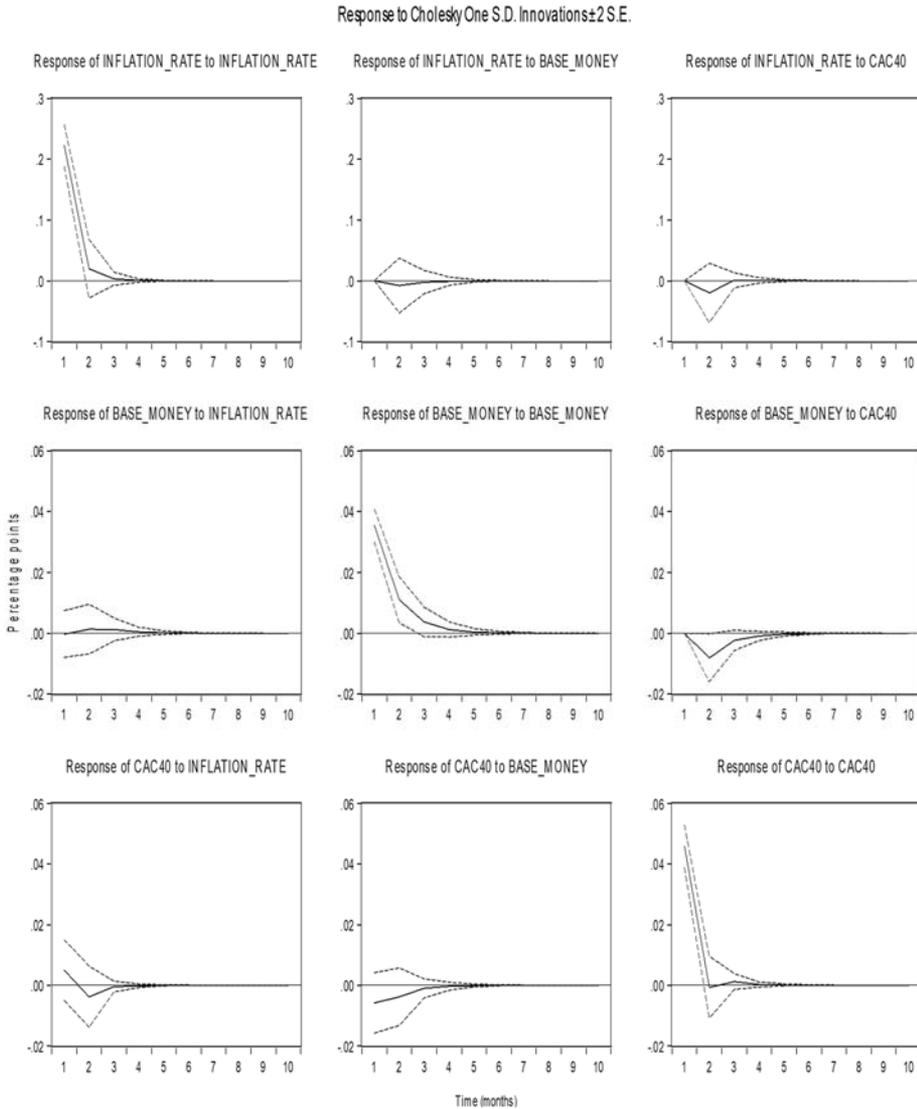
Source: Authors' estimations

**Figure A.4** Impulse Response Function of VAR Analysis: Model II for the Eurozone



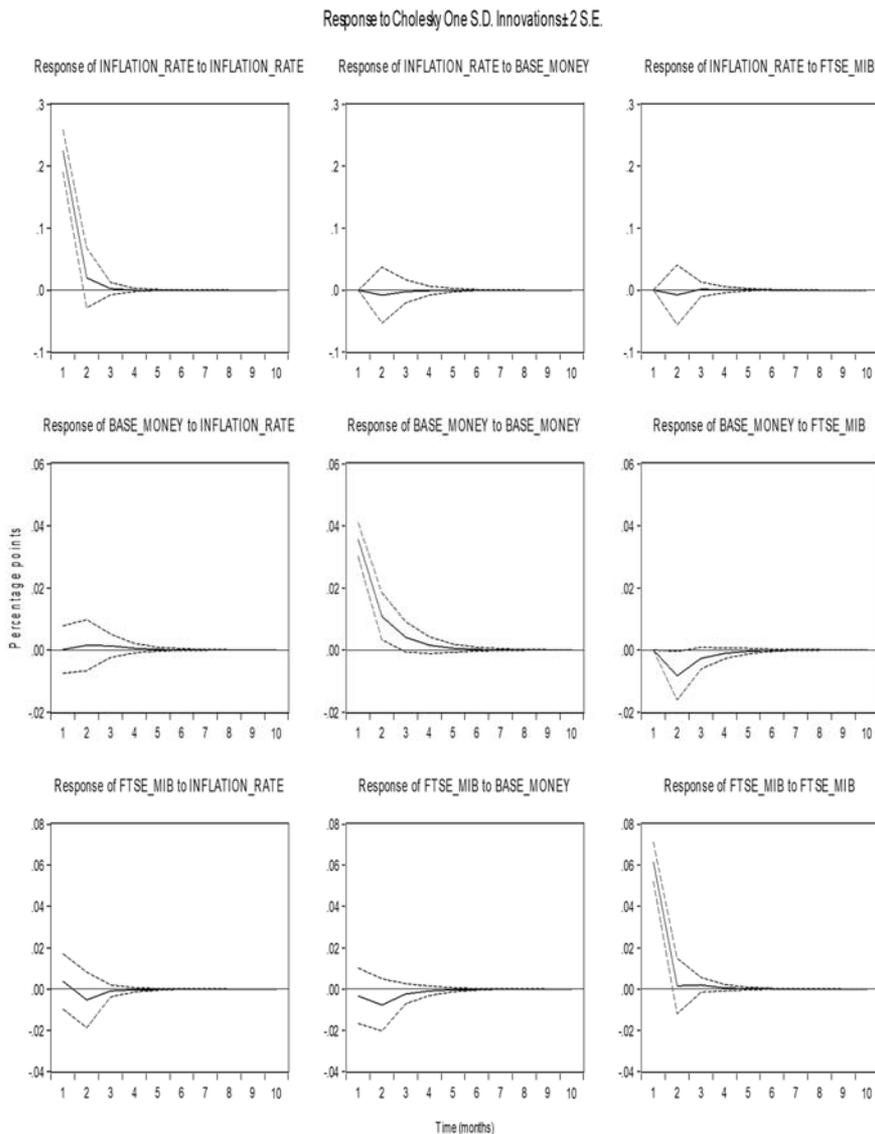
Source: Authors' estimations.

**Figure A.5** Impulse Response Function of VAR Analysis: Model III for the Eurozone



Source: Authors' estimations.

**Figure A.6** Impulse Response Function of VAR Analysis: Model IV for the Eurozone



Source: Authors' estimations.

**Figure A.7** Impulse Response Function of VAR Analysis: Model V for the Eurozone

**Table A.1** VAR Lag Order Selection Criteria (USA)

Lag	Model I	Model II
	AIC	AIC
0	-6.922746	-7.162345
1	-7.482892*	-7.691969*
2	-7.232049	-7.450407
3	-7.173285	-7.402301
4	-7.118847	-7.383482
5	-6.899595	-7.158577
6	-6.936032	-7.131231
7	-6.849650	-7.033821
8	-6.758859	-6.926066

Notes: \* indicates lag order selected by the criterion; AIC: Akaike information criterion.

Source: Authors' estimations.

**Table A.2** VAR Lag Order Selection Criteria (Eurozone)

Lag	Model I	Model II	Model III	Model IV	Model V
	AIC	AIC	AIC	AIC	AIC
0	-7.354178	-6.952826	-7.238868	-7.447438	-6.836245
1	-7.378308*	-6.992455*	-7.244916*	-7.477844*	-6.873514*
2	-7.331148	-6.950786	-7.220887	-7.389302	-6.792915
3	-7.332311	-6.942362	-7.176032	-7.404372	-6.775331
4	-7.231835	-6.854371	-7.075057	-7.296077	-6.663249
5	-7.140477	-6.762982	-6.998160	-7.204804	-6.571772
6	-7.112324	-6.730098	-6.953961	-7.180427	-6.568091
7	-7.066504	-6.648097	-6.976817	-7.083728	-6.479702
8	-7.120904	-6.632391	-6.954536	-7.107693	-6.491253

Notes: \* indicates lag order selected by the criterion; AIC: Akaike information criterion.

Source: Authors' estimations.