Stock Market Sensitivities to European Monetary Policy

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Abstract:

In this paper we estimate the transmission of common euro area monetary policy shocks across the euro area main stock markets. To do so, we develop global SVAR models in which the ECB monetary policy is modeled as a function of euro area aggregate variables and the US variables that define the FED monetary policy shocks. Our results suggest, in line with economic theory, that the transmission of monetary policy across Eurozone stocks markets displays heterogeneity driven by differences in the listed firms' characteristics. In our study, we seek to explain this heterogeneity by focusing on the sectoral composition of financial markets. Our findings indicate that the differences between responses to monetary policy shocks cannot be explained by the sectoral mix of these financial markets.

1. Introduction

The European Monetary Union has faced numerous economic and political challenges. Among them, like in US states and economic regions, is the different respond of the economies of member countries to the (common) actions of the European Central Bank (ECB). Before euro and BCE common monetary policy adoption in January 1999, authors as Bayoumi and Eichengreen (1993) and Carlino and DeFina (1998 and 2000) point out that in presence of heterogeneous sovereign nations, likely differences in monetary policy responses will arise. Moreover, Mihov (2001) notes that a common monetary policy may fail in stabilizing macroeconomic fluctuations in country members when its effects exhibit heterogeneity across countries, even in the presence of a high degree of integration of the national business cycles in the common one. However, those differences did not make it difficult to form the European Monetary Union, contrary to what Carlino and DeFina (1998) foretold, or its management until today.

Nevertheless, it has not been until more recently that empirical analyses of these differences, as in Ciccarelli *et al*. (2013), Barigozzi *et al*. (2014), Georgiadis (2015), Cavallo and Ribba (2015) and Mandler *et al.* (2016), have been done. In this sense, Cavallo and Ribba (2015) argue that previously not enough data to study the influence of ECB's monetary policy stance on Eurozone countries were available. Note that all these analyses employ monthly or quarterly data, focusing exclusively on data after the introduction of the euro, i.e., from 1999 onward. As Mandler *et al*. (2016) note, we find in the literature other works based on data from the pre-euro period.[1] This fact requires carefully modeling the monetary policy country reaction functions and the monetary policy shock, as in Mojon and Peersman (2001) and Ciccarelli and Rebucci (2006), to

[1] Examples of these works that use country-level data are Ehrmann (2000), Mihov and Scott (2001), Rafiq and Mallick (2008) and Boivin et al. (2009).

control for the differences in the country's monetary policy reaction function, which describes how the national monetary policy endogenously reacts to shock-induced movements in variables.

Ciccarelli et al. (2013) use a restricted panel VAR model for two groups of euro area countries: countries that came under stress in the financial and sovereign debt crises and those that did not; and find significant differences in the output and inflation responses to ECB monetary policy shocks between 2003 and 2007. Barigozzi et al. (2014) use a structural dynamic factor model and show that there are significant differences between North and South Europe in the response of prices and unemployment to ECB monetary policy. Georgiadis (2015) develops a global VAR model and shows that euro area economies in which a higher share of aggregate output is accounted for by sectors servicing interest rate sensitive demand exhibit a stronger transmission of monetary policy to real activity. Cavallo and Ribba (2015), using a near-SVAR approach, investigate in eight Eurozone countries if the dominant source of macroeconomic fluctuations at the national level is represented by exogenous Eurozone shocks or, alternatively, by local shocks. They report evidence against asymmetric effects of monetary shocks but only attribute the Eurozone shocks as the dominant source of the business cycle to the four biggest economies. Mandler et al. (2016) using a Bayesian VAR analyze whether the ECB monetary policy has heterogeneous effects on these four countries and find output to respond less negatively in Spain than in the other three countries, the drop in the price level is less pronounced in Germany relative to France, Italy and Spain, and bond yields rise more strongly and persistently in France and Germany than in Italy and Spain.

When we focus on the effect of ECB monetary policy on the stock market returns, we find in the literature earlier works as those of Angeloni and Ehrmann (2003), Bredin et al. (2007), Bohl et al. (2008), Kholodilin (2009), and Hussain (2011). In this context, high frequency data permit to apply specific methodologies, as the seemingly unrelated regression model of Pearce and Roley (1983), the heteroscedasticity-based approach of Rigobon and Sack (2004) and the event study approach of Bernanke and Kuttner (2005), where samples of long time periods are not required. More recent papers, as those of Wang and Mayes (2012), Fiordelisi et al. (2014), Ricci (2014), Roger et al. (2014), Haitsma et al. (2016), and Paccico et al (2019) also use these specific financial market methodologies. However, all these approaches are focus on the simultaneous response of the stock market to monetary policy shocks. When, in the spirit of Patelis (1997), the aim is not only to analyze the simultaneous response but also the long-run dynamic of the response and/or the cumulative response of the stock market to monetary policy shocks, as Chatziantoniou et al. (2013) and Ruiz (2015) do for the German and the Spanish stock markets respectively, VAR methodologies, that require long enough data time series, become optimal again.

In this context, this paper centers its attention on the varied transmission of common monetary policy shocks within the principal regional stock markets of the euro area, aiming to elucidate the underlying heterogeneity. It is noteworthy that, as highlighted by Rodriguez-Fuentes and Dow (2003), this paper is specifically "focused on the repercussions of a unified European monetary policy across the countries comprising the Euro-zone, which have been conceptualized as ‘regions’ within this Euro-zone" in line with prevailing research trends. Additionally, the findings of Pacicco et al. (2019) affirm that the European Central Bank's conventional monetary policy exhibits both temporal and cross-country diversity in a stock market context. More recently, Hauptmeier and Holm-Hadulla (2023) try to identify any heterogeneity in these response patterns across different types of economic activities aiming to understand how this observed heterogeneity plays a role in influencing the actual effects of monetary policy.

In line with the seminal paper of Carlino and DeFina (1998), we are interested in measure the whole effect of monetary policy shocks in each regional stock market and therefore we use VAR models to do it. Following these authors, we introduce the hypothesis of the differences in the industry composition of the stock markets to explain the heterogeneity of these effects. To achieve this, we construct global Structural Vector Autoregressive (SVAR) models wherein the common monetary policy, encompassing both conventional and unconventional measures, is determined by euro area aggregate variables and the macroeconomic variables of the United States that characterize the shocks to the Federal Reserve's monetary policy. In these models the euro area country members are considered small open economies, and we only add the returns of their stock markets. Previous evidence in Cavallo and Ribba (2015) support that alternative VAR models in which a full interaction between the Eurozone and local variables is allowed report similar results. We also use this global SVAR model to analyze the effect of monetary policy shock on the whole euro stock market and on its industries.

Our results suggest, in line with economic theory, that the transmission of monetary policy across Eurozone stock markets displays heterogeneities driven by differences in the listed firms' characteristics. Contrary to previous understanding, we have found that these variations cannot be accounted for by the sectoral composition of the markets.

This paper is structured as follows. After this introduction, Section 2 presents the factors involved in the models and data used in the estimations. Section 3 describes the models, the SVAR methodology on which they build, and the alternative schemes used for their identification. In Section 4, we report and comment on the results. Finally, Section 5 summarizes the main results and concludes.

2. Factors, variables, sample and data

The analysis we are undertaking spans from September 2004 to December 2019. The choice of this specific timeframe is twofold. Firstly, it is influenced by a data limitation tied to the variable used for gauging monetary policy—the shadow rate devised by Wu and Xia (2016, 2017, 2020)[2]. Secondly, we have identified a structural disruption[3] caused by the COVID-19 pandemic, prompting us to conclude our sample at the close of 2019 as Hohberger et al. (2023) do.

The adoption of the shadow rate as a measure of monetary policy allows us to analyze both conventional and unconventional periods of monetary policy simultaneously. As suggested by Rossi (2021), the shadow rate, by construction, mirrors the short-term interest rate when outside the Zero Lower Bound (ZLB), serving as an intuitive and convenient indicator of the monetary policy stance in both conventional and unconventional periods. To illustrate these trends, Figure 2[4] showcases the evolution of

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2 Wu and Xia (2017) and Wu and Xia (2020) for EA and Wu and Xia (2016) for US

3 Figure 1 displays the CUSUM of squares and CUSUM test at the 1% significance level, highlighting the discernible impact of COVID-19 starting from 2020.

4 In Figure 2, we illustrate unconventional monetary policy as the variance between the shadow rate and conventional monetary policy.

both the nominal target interest rate set by the ECB[5] on the last day of each month and the shadow rate for the Economic Area (EA).

We categorized the nine factors utilized in subsequent SVAR analyses into three groups: (i) comprising factors defining global monetary policy shocks, (ii) encompassing factors delineating Eurozone monetary policy shocks and its industrial structure, and (iii) collecting country-specific factors, which naturally include country-specific stock market behaviors.

Table 1 summarizes these factors alongside the fundamental variables serving as their proxies for further empirical analyses. Additionally, Table 1 Panels A-D provides information on the data sources for these variables. Table 2, Panel A, presents the primary statistics depicting the variables utilized in our initial SVAR analysis for the Euro area jointly considered, while Panel B displays the covariance matrix for these specific variables.

2.1 Global monetary policy shocks

The Wu and Xia shadow rate, widely adopted after the federal funds rate hit zero, serves as a global monetary policy factor. Claus et al. (2014) show how the shadow rate mirrors US policy during ELB, while Bernanke et al. (2019) prove its efficacy and benefits over Taylor rule implied rates in ZLB. We can find other works, Eksi and Tas (2017) and Trifonova and Kolev (2021), that analyzed the impact of the Fed's unconventional monetary policies on stock markets, both utilizing Wu and Xia's database (2016a, 2016b).

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5 The Governing Council of the ECB sets the key interest rates for the Eurozone. The Governing Council meets twice a month. At its first meeting of the month, as a rule, the Governing Council assesses the economic situation and the stance of the monetary policy. Decisions on the key interest rates are normally taken during that meeting. The target interest rate is the rate of the "main refinancing operations" (MRO), which provide the bulk of liquidity to the banking system.

We have broadened the framework of our global monetary policy shock analysis by introducing additional parameters related to inflationary pressures and production dynamics. To proxy inflation, we employed the US Consumer Price Index, measuring the percentage change from the previous year and incorporating seasonal adjustments. Concurrently, we quantified production levels using the Industrial Production, assessing the percentage change from the prior year while employing seasonal adjustments.

Finally, as an essential component of our comprehensive global factor analysis, we incorporate stock market returns derived from the S&P 500 benchmark stock market index. We utilize month-end data to calculate monthly continuous compounding returns, thereby integrating this crucial metric into our broader assessment of the global financial landscape.

2.2 Eurozone monetary policy shocks

We also utilize the Wu and Xia (2020) shadow rate, aligning with the methodology employed by Hohberger et al. (2023), Anderl and Caporale (2023), Colabella (2021), Tillmann (2020) and Mouabbi and Sahuc (2019), to effectively gauge the monetary policy within the Euro area.

We include the following control variables to accurately delineate the ECB monetary policy shock: the year-to-year percentage-change in the Industrial Production Index for the Euro area, and the year-to-year percenchage-change in the Euro area Harmonized Consumer Price Index (working day and seasonally adjusted) to measure inflation.

The Eurozone stock market performance is represented using the benchmark index curated by Eurofidai, encompassing a substantial pool over 2,800 companies within its sample. This benchmark contains value-weighted companies for the 11 countries analyzed. We assess stock market returns through month-end values annualized and the benchmark contains companies for the 11 countries.

2.3 Country-specific variables

To account for country-specific contexts, we adopt a distinct country business cycle measure—the industrial production index—pertaining to the original eleven nations that constituted the European Monetary Union: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. We have computed the inter-annual growth rate by determining differences relative to the Industrial Production Index for the Euro area.

The benchmark indices capturing stock market returns for individual countries are derived from the Eurofidai database[6]. These indices report monthly returns adjusted with dividend weighted by value as a measure of performance. The respective codes for these indices are compiled and detailed in Table 1. Panel C.

Table 3, Panel A provides key statistics regarding the Euro area benchmark index and the additional country-specific indexes included in the analysis, detailing the respective number of companies within each index. Panel B exhibits the correlation matrix, encompassing relationships among the 12 benchmark indexes.

2.4 Industrial analysis

[6] We conducted a robustness test with the selective index for each country (ATX, BEL20, OMXH25, CAC40, DAX30, ISEQ20, FTSE MIB, FTSE LUX, AEX, PSI20 and IBEX35), and no discernible differences were observed in the results.

To account for variations in the industrial structure across diverse markets, we incorporate sectorial stock market returns derived from Eurofidai's sectorial benchmark indices. They also report monthly returns adjusted with dividend weighted by value. Table 1 Panel D outlines the distinct variables utilized in the analysis, detailing their sources, codes, and transformations. The database contains 10 sectors: Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Telecommunication Services and Utilities[7]. Table 4 Panel A presents the primary statistics concerning these indices, while Panel B displays the correlation matrix specifically focusing on the 10 sectors involved.

3. Structural global monetary VAR.

In our analysis, we employ Structural Vector Autoregressive (SVAR) models to explore the relationships among the listed factors. SVAR models represent a system of simultaneous equations enabling comprehensive analysis of interactions among the proxies associated with these factors. The utilization of SVAR models to investigate the interplay between monetary policy and stock markets has a robust history, originating from Sims' foundational work (1980).

Noteworthy examples of SVAR model applications include studies by D'Amico and Farka (2011), Bekaert et al. (2013), Galí and Gambetti (2015), and Miranda Agripino and Ricco (2021), focusing on the reaction of stock markets to Federal Reserve policies. Similarly, research by Fernández-Amador et al. (2013), Nave and Ruiz (2015), and Fausch and Sigonious (2018) delves into the European context, employing VAR models to examine similar dynamics within the European environment.

[7] In our robustness test involving the selective index, we employed the Euro Stoxx Industry indices, which adhere to the Industry Classification Benchmark. Notably, no discernible differences surfaced in the results obtained through this comparative analysis.

3.1. Identification scheme

To establish the SVAR models, a frequently used alternative is to draw on the Cholesky decomposition of the estimated covariance matrix. According to Colabella (2021), this identification approach aims to achieve a compromise between the necessity for precise identification of the shock and the preference for maintaining simplicity in the model. We adopt this recursive identification scheme as our initial framework. Consequently, the variable order becomes crucial. Our intentional arrangement enables Eurozone monetary policy to contemporaneously respond to global monetary policy shocks, while specific-country factors react instantaneously to Eurozone and global monetary factor shocks. Notably, throughout all conducted analyses, financial variables are consistently positioned in the final place.

In all conducted SVAR analyses, the empirical findings are depicted through (cumulative) impulse-response functions (IRF). All the IRF include confidence intervals up to 68% (from the 16th to the 84th percentile) as suggested by Sims and Zha (1999),[8] using parametric bootstrap calculations with 500 replications without resampling residuals. As usual in the literature, shocks have been normalized to a standard deviation of the variable that provides the leverage.

Selecting the appropriate lag is a crucial consideration in SVAR analysis. While the lag suggested by the Schwarz-Bayesian Information Criteria is often more precise for smaller samples (Ivanov and Kilian, 2005), and we have obtained 1 lag in all our conducted SVAR analyses, nevertheless, to minimize any potential for autocorrelation, we opted for

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[8] According to Sims and Zha (1999) it is a good idea to make one-standard-error intervals the norm, as they are likely to be closer to relevant range of uncertainty because the use of high-probability intervals camouflages the occurrence of large errors of over-overage. Moreover, sample characteristics described above in section 2 give us a firm foundation for using a “less certain” confidence level.

3 lags, as recommended by the Final Prediction Error (FPE) and Akaike Information Criteria, which have been widely favored across most of our SVAR models.

3.2 The Nine-factor country-specific Structural VAR models

In our initial analysis phase, we established a structural VAR utilizing eight variables, focusing on the Euro Area benchmark index. This initial model comprised four variables associated with global indicators defining the global monetary policy shock and an additional set of four variables representing the eurozone monetary policy shock. Expanding upon this groundwork, we augmented the SVAR model to encompass nine variables. This expanded model preserved the initial seven variables and substituted the eighth variable, the eurozone benchmark index, with country-specific indicators—specifically, the industrial production index and the country benchmark index. Consequently, we conducted a total of 12 analyses: one for the entire area and one for each of the individual countries.

3.3 The eight-factor industry-specific analysis.

In the subsequent phase of the analysis, we integrate the market's sectorial structure to investigate whether it elucidates differences between countries. To achieve this, we execute a structural VAR analysis encompassing eight variables, incorporating both global and eurozone indicators. Each of the previously mentioned sectorial benchmark indices is placed in the final position within the model, facilitating their contemporaneous response to the monetary policy shock. This approach entails conducting 10 SVAR analyses to explore how the sectorial indices respond to the monetary policy shock.

Finally, we merged the responses obtained for each sectorial index with the respective sectorial composition of each country[9]. Through this process, we delineated the portion

[9] The sectorial composition is collected in Table 5.

of the response attributed to the sectorial composition and identified the remaining segment representing unexplained differences across sectors.

4. Results

In the initial analysis, Figure 3 showcases the cumulative response of the eurozone benchmark index to a pre-defined monetary policy shock. As anticipated, the Eurozone stock market exhibits a negative response to a contractionary monetary policy shock. Like the approach in Carlino and DeFina (1999), we selected the cumulative response after 24 months, as the maximum response typically occurred within this timeframe across most conducted analyses.

The observed significant response contrasts with the findings of Tillmann (2020), who reported a non-significant response in their baseline VAR model. This lack of significance in their study could be attributed to potential model misspecification. Interestingly, they found significance when incorporating an external instrument into their analysis, suggesting that this adjustment resolved the issue of non-significance.

When analyzing the 11 country-specific benchmark indices (Figure 4, Panel A), it's evident that four countries (Austria, Germany, Luxembourg, and Spain) exhibit a response lower than the mean established by the euro area. In contrast, the remaining seven countries (Figure 4, Panel B) display a higher response, with France and Finland showing an accumulated response like that of the euro area mean (Figure 4. Panel C)

The highest impact resulting from a one standard deviation of the monetary policy shock corresponds to Ireland, at 0.3569, while the lowest impact is observed in Luxembourg, registering 0.1229, which is nearly three times smaller than the impact observed in Ireland. This discrepancy in response among different countries highlights the heterogeneity of reactions across the Eurozone. Hence, we conducted the second part of the study to investigate, similar to Carlino and DeFina (1999), whether this heterogeneity arises due to varying sector compositions in each country.

The next step in our analysis involves observing the impulse-response functions to a negative monetary policy shock across the previously described sectors. The 8-variable SVAR model developed replaces the eurozone index with the respective indices of each sector. The various sectoral IRF to the monetary policy shock are depicted in Figure 5.

As observed, all sectors respond as anticipated to an unexpected contractionary variation in the monetary policy measure, demonstrating a cumulative negative response. However, these responses vary among sectors, with Information Technology, Utilities, Financial, and Materials sectors showing higher sensitivity to the shock. Conversely, Telecommunications, Consumer Staples, Consumer Discretionary, and Energy sectors exhibit lower sensitivity. Industrials and Health Care sectors position themselves in an intermediate position in terms of their response to the shock.

We proceed to analyze the cumulative response to a monetary policy shock, considering the sectoral mix of each country. Table 5 displays the sectoral composition of each of the analyzed indexes. By combining this composition with the response obtained in the previous step, we calculate the cumulative response to a monetary policy shock explained by the sectoral distribution.

Table 6 presents a comparison of the cumulative response to this shock. Column 1 displays the response directly calculated based on the country's index, while column 2 demonstrates the response obtained by considering the sectoral composition of each index. The third column illustrates the differences between these outcomes.

When we observe the second column, we can see that the response to a monetary policy shock, considering the sectoral composition, is practically identical in all the studied stock markets. This implies that the sectoral mix is not explaining the differences in the effects of monetary policy on these markets' responses.

In the following step, we ascertain whether these differences are statistically significant or not. If found to be insignificant, it would imply that the sectoral mix accounts for such responses. Alternatively, if they are significant, we would need to seek explanations in other causes.

In our analysis, after obtaining variances from the confidence intervals of the outcomes, we proceed with the utilization of the probability density function derived from these results. By utilizing these density functions and considering a significance level of 10%, we estimate the probability that the complete response of each index is accounted for by its sectoral composition. This assessment is depicted in the last column of Table 6.

Upon referencing the entire Eurozone as a benchmark, it becomes evident that five countries—Germany, Ireland, Luxembourg the Netherlands, and Portugal—exhibit a lower probability, at a 10% significance level of having their cumulative response to a monetary policy shock explained by their sectoral mix. These countries were the same with the most extreme heterogeneity.

The remaining six analyzed countries exhibit a higher probability of being explained by their sectoral composition, corroborating the noteworthy results of 83% achieved by Belgium and Finland. In contrast, Ireland demonstrates a marginal 57% likelihood that its response could be explained by its industry mix. Furthermore, as previously highlighted, we observe a similar pattern in the French stock market (77% explained by sectoral composition) compared to the Euro Area average (74%).

We can observe the same result from a graphical standpoint. Thus, Figure 6 illustrates, on one hand, the cumulative response in the returns of each country's selective indices to a monetary policy shock after 24 months (blue square) along with their corresponding confidence intervals (broad shaded blue area). Additionally, it displays the cumulative response to the same shock considering the industrial composition of each index (green triangle) with their respective confidence intervals (narrow shaded green area).

Visual inspection clearly shows that the confidence intervals of countries with a lower probability of explaining the response to the monetary policy shock—such as Germany, Ireland, Luxembourg, the Netherlands, and Portugal—based on their sectoral mix, lie outside the established confidence margins for the respective country index response, which confirm the higher heterogeneity of the response when we do not have into account the sectorial mix of these countries.

5. Conclusions

The different response of the economies of member countries to the (common) actions of the European Central Bank (ECB) is one of the economic and political challenges that the European Monetary Union has faced. In this paper we estimate the transmission of common Eurozone monetary policy shocks across the Eurozone main regional stock markets. To do so, we develop nine-factor global SVAR models in which the common monetary policy is modeled as a function of Eurozone aggregate variables and the US variables that define the FED monetary policy shocks.

The results suggest, in line with economic theory, that the transmission of monetary policy across Eurozone stocks markets displays heterogeneities driven by differences in the listed firms' characteristics. However, heterogeneous differences arise between country-specific responses directly estimated by the nine-factor global SVAR models and responses computed indirectly from the Eurozone industry-specific portfolio responses to ECB monetary policy using the country-specific industry mix.

When we examine the results obtained by applying the sectoral mix, we observe that all responses are similar. This suggests that the sectoral mix does not account for the differences in the heterogeneity of responses to the monetary policy shock in the various observed markets. Therefore, the explanation for this difference must be sought in other factors, leaving the possibility open for further studies.

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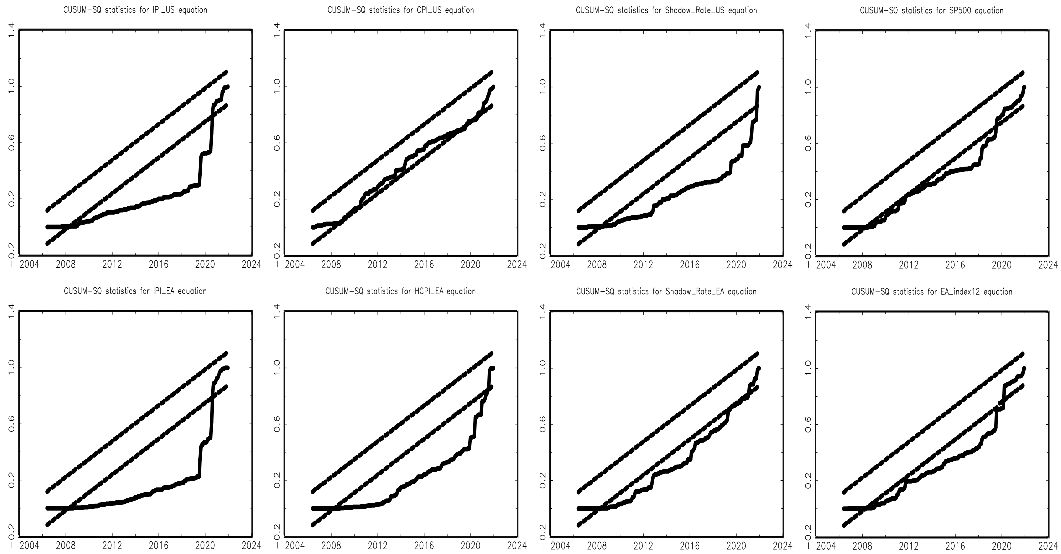
Figure 1.

CUSUM of squares



CUSUM test 1%

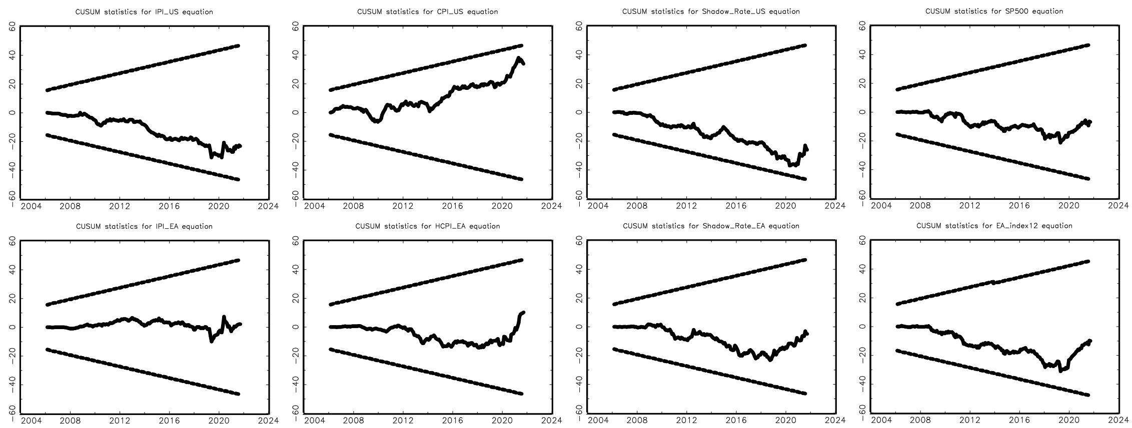


Figure 2.

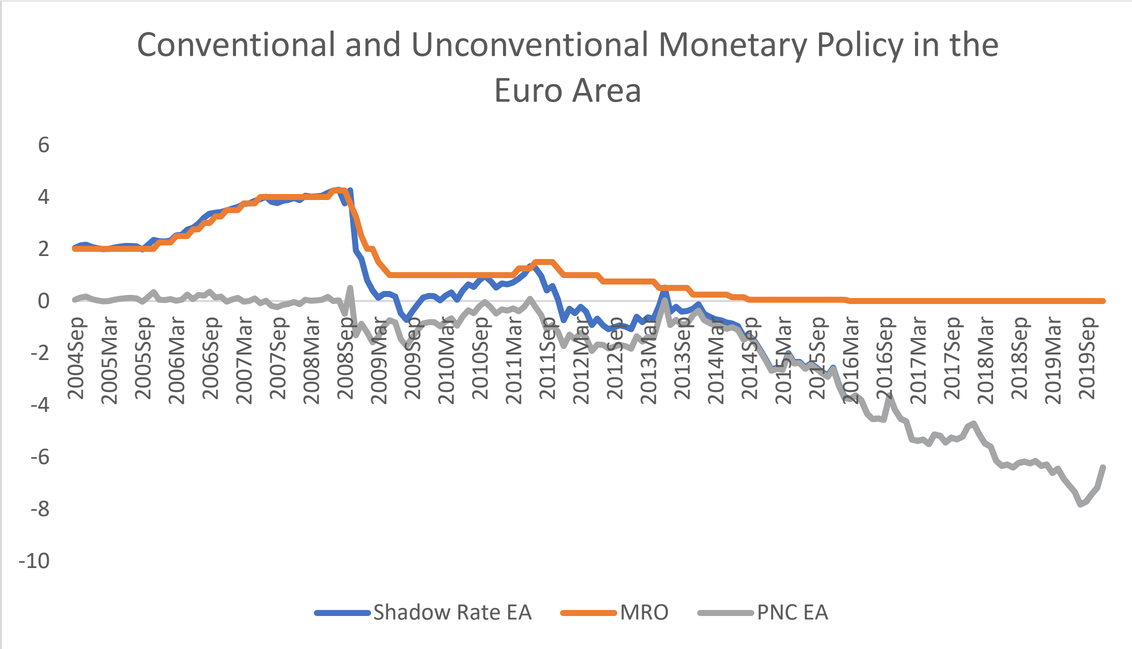
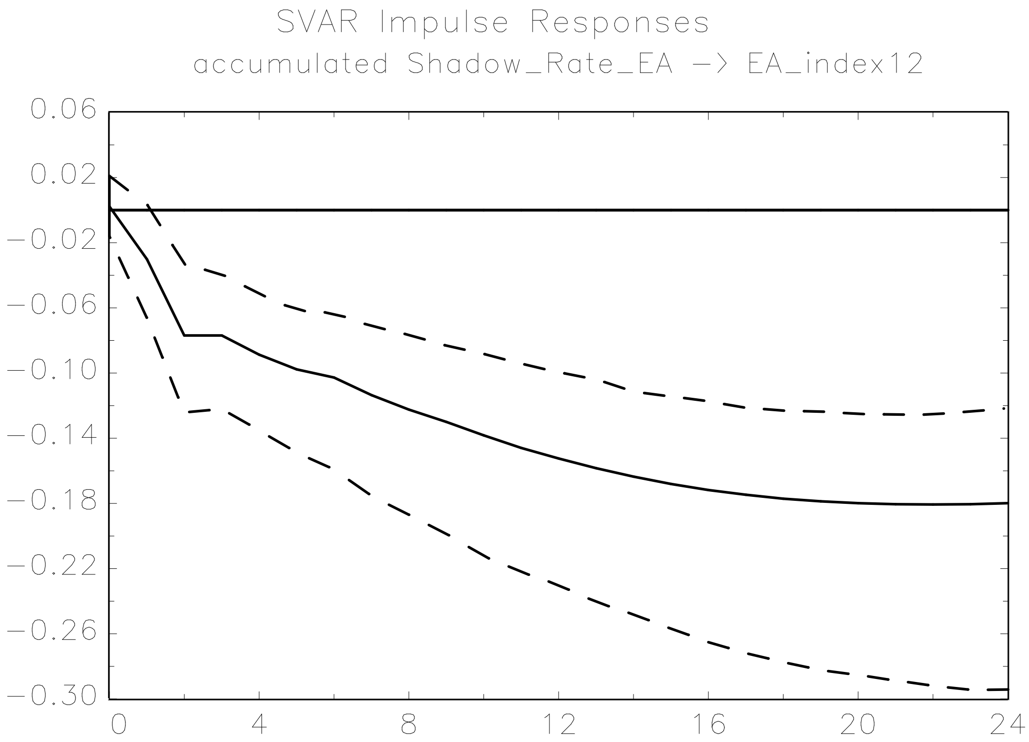

Conventional and Unconventional Monetary Policy in the Euro Area
6
4
2
0
-2
-4
-6
-8
-10
2004Sep
2005Mar
2005Sep
2006Mar
2006Sep
2007Mar
2007Sep
2008Mar
2008Sep
2009Mar
2009Sep
2010Mar
2010Sep
2011Mar
2011Sep
2012Mar
2012Sep
2013Mar
2013Sep
2014Mar
2014Sep
2016Mar
2016Sep
2017Mar
2017Sep
2018Mar
2018Sep
2019Mar
2019Sep
Shadow Rate EA
MRO
PNC EA

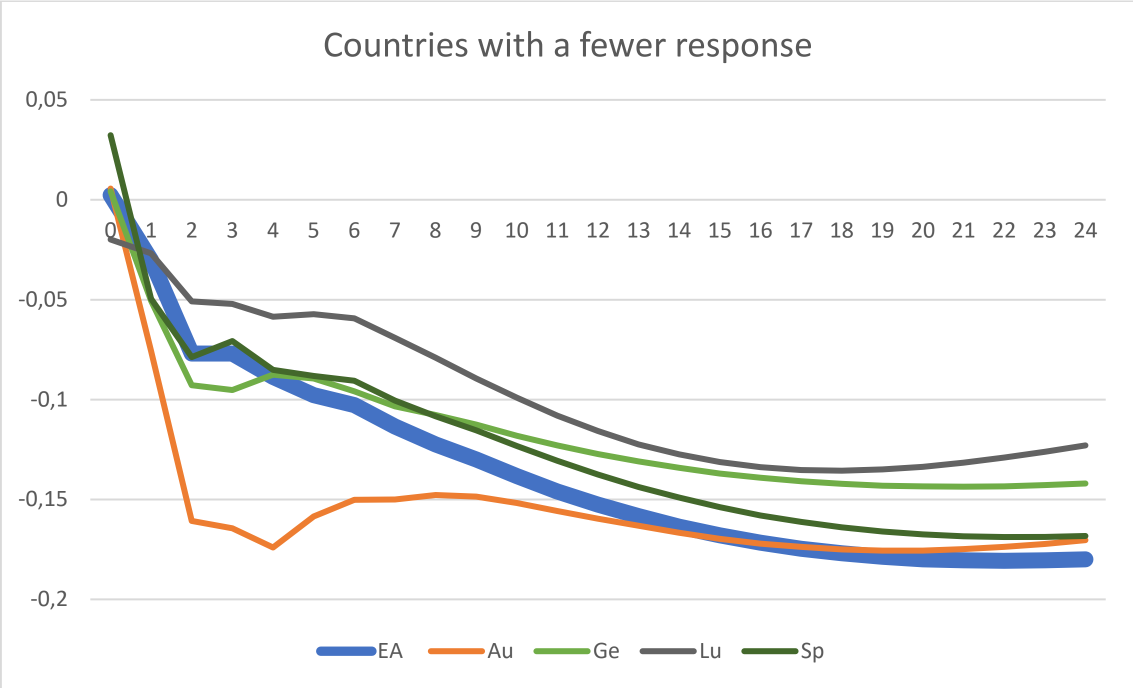
Figure 3.



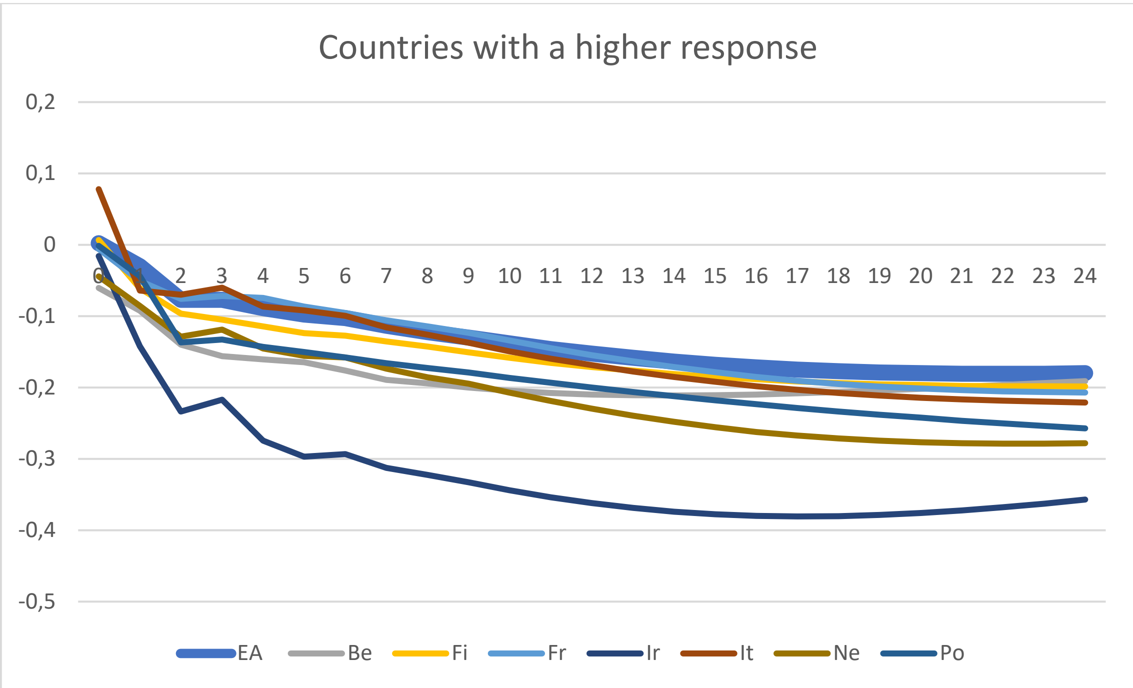
SVAR Impulse Responses
accumulated Shadow_Rate_EA -> EA_index12
0.06
0.02
−0.02
−0.06
−0.10
−0.14
−0.18
−0.22
−0.26
−0.30
0
4
8
12
16
20
24

Figure 4.

Panel A.



Panel B.



Panel C.

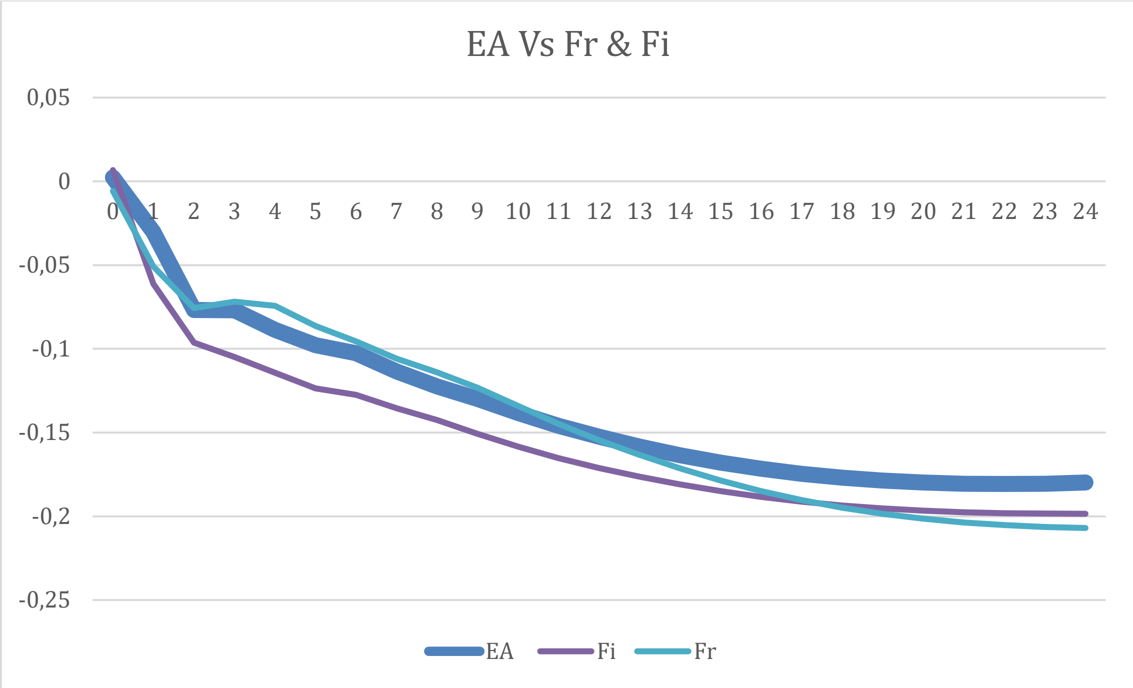
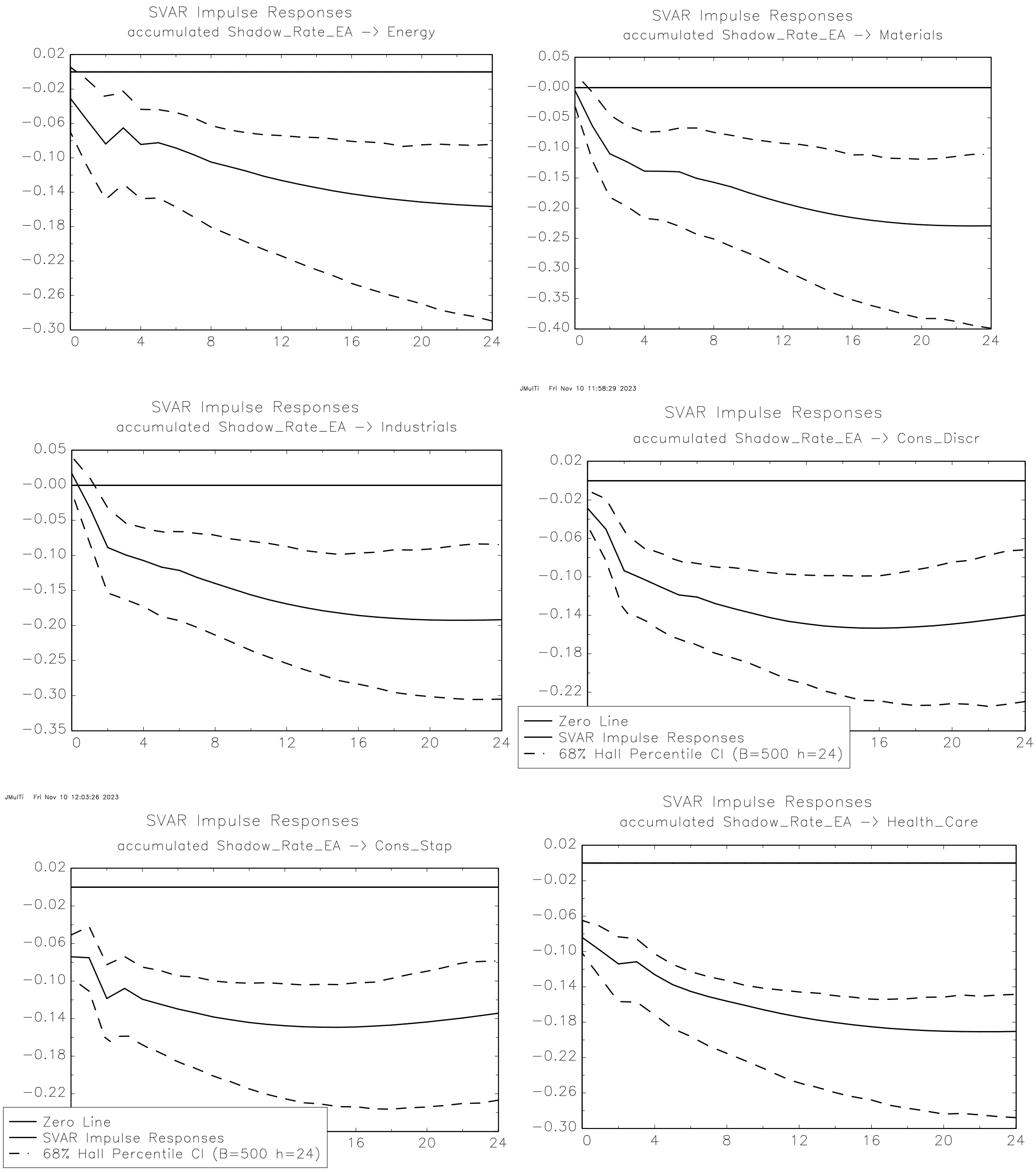
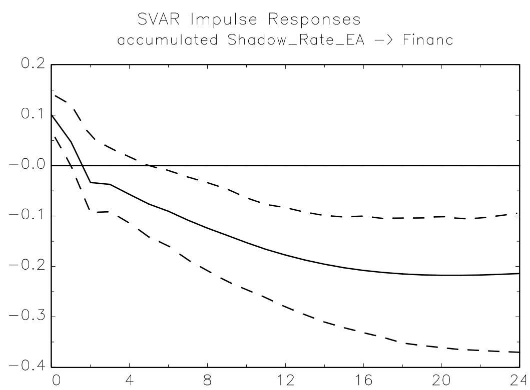
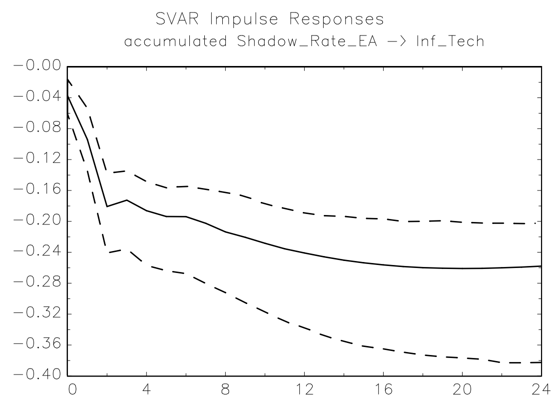
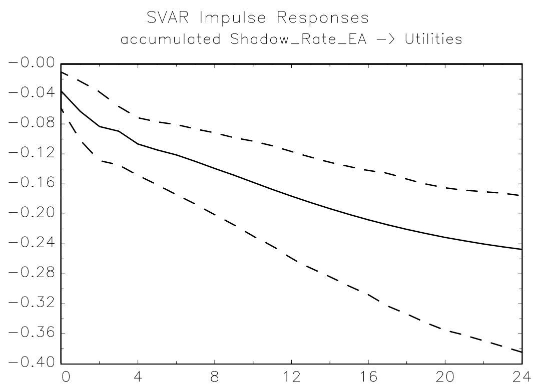

EA Vs Fr & Fi
0,05
0
-0,05
-0,1
-0,15
-0,2
-0,25
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
EA
Fi
Fr

Figure 5. Sectorial IRF to a mp shock.




SVAR Impulse Responses
accumulated Shadow_Rate_EA -> Financ
0.2
0.1
-0.0
-0.1
-0.2
-0.3
-0.4
0 4 8 12 16 20 24


SVAR Impulse Responses
accumulated Shadow_Rate_EA -> Inf_Tech
-0.00
-0.04
-0.08
-0.12
-0.16
-0.20
-0.24
-0.28
-0.32
-0.36
-0.40
0 4 8 12 16 20 24


SVAR Impulse Responses
accumulated Shadow_Rate_EA -> Utilities
-0.00
-0.04
-0.08
-0.12
-0.16
-0.20
-0.24
-0.28
-0.32
-0.36
-0.40
0 4 8 12 16 20 24

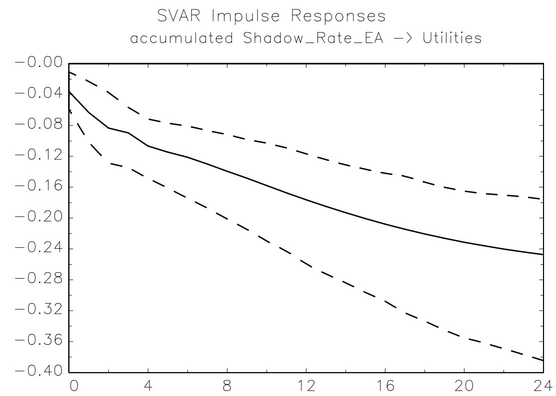

SVAR Impulse Responses
accumulated Shadow_Rate_EA -> Utilities
-0.00
-0.04
-0.08
-0.12
-0.16
-0.20
-0.24
-0.28
-0.32
-0.36
-0.40
0 4 8 12 16 20 24

Figure 6.

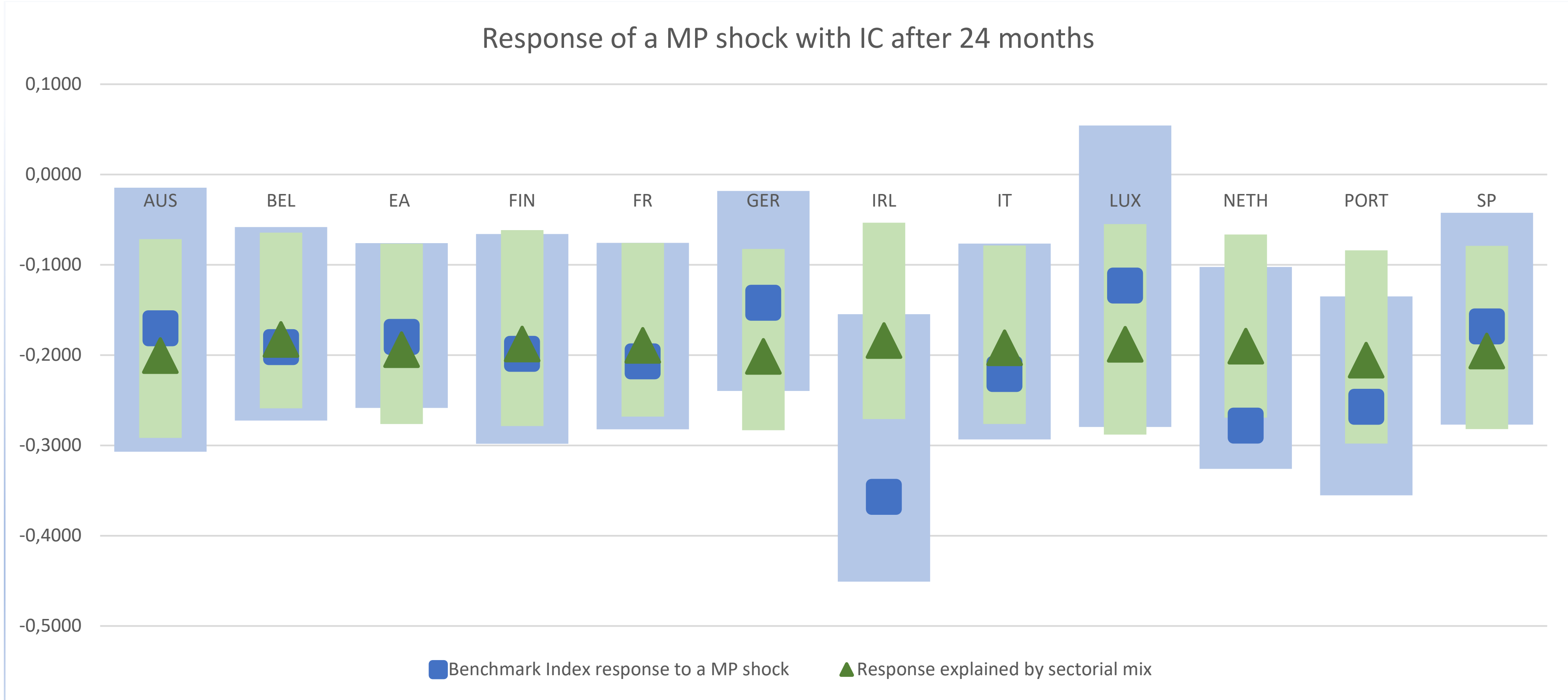

Response of a MP shock with IC after 24 months
0,1000
0,0000
-0,1000
-0,2000
-0,3000
-0,4000
-0,5000
AUS
BEL
EA
FIN
FR
GER
IRL
IT
LUX
NETH
PORT
SP
Benchmark Index response to a MP shock
Response explained by sectorial mix

Table 1. Factor, variables and sources.

Panel A. Factors defining global monetary policy shocks.

Variable	Source	Code / Link
US shadow rate	Jing Cynthia Wu official web page	https://sites.google.com/view/jingcynthiawu/shadow-rates
US Consumer Price Index	Federal Reserve Bank of St. Louis	CPIAUCSL_PC1
US Industrial Production	Federal Reserve Bank of St. Louis	INDPRO_PC1
S&P 500	Federal Reserve Bank of St. Louis	SP500

Panel B. Factors for the Eurozone monetary policy shocks.

Variables	Source	Code / Link
EA shadow rate	Jing Cynthia Wu official web page	https://sites.google.com/view/jingcynthiawu/shadow-rates
Eurozone Industrial Production Index	European Central Bank	STS.M.I8.Y.PROD.NS0010.4.000
Eurozone harmonized cons. price index	European Central Bank	ICP.M.U2.Y.XE0000.3.INX
Euro Area benchmark Index	Eurofidai	302000000250008

Panel C. Country-specific factors.

Variables	Source	Code / Link	Transformation
Austria benchmark Index	Eurofidai	302000000340092	Annualized
Belgium benchmark Index	Eurofidai	302000000340120	Annualized
Finland benchmark Index	Eurofidai	302000000340354	Annualized
France benchmark Index	Eurofidai	302000000340369	Annualized
Germany benchmark Index	Eurofidai	302000000340044	Annualized
Ireland benchmark Index	Eurofidai	302000000340510	Annualized
Italy benchmark Index	Eurofidai	302000000340525	Annualized
Luxembourg benchmark Index	Eurofidai	302000000340576	Annualized
Netherlands benchmark Index	Eurofidai	302000000340730	Annualized
Portugal benchmark Index	Eurofidai	302000000340760	Annualized
Spain benchmark Index	Eurofidai	302000000340310	Annualized
Austria IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Belgium IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Finland IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
France IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Germany IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Ireland IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Italy IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Luxembourg IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Netherlands IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Portugal IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI
Spain IPI	Eurostat	sts_inpr_m__8096346	Difference from EA IPI

Panel D. Sectorial Analysis.

Variables	Source	Code / Link	Transformation
Energy benchmark Index	Eurofidai	302000000150008	Annualized
Materials benchmark Index	Eurofidai	302000000340120	Annualized
Industrials benchmark Index	Eurofidai	302000000350008	Annualized
Consumer Discretionary benchmark Index	Eurofidai	302000000450008	Annualized
Consumer Staples benchmark Index	Eurofidai	302000000550008	Annualized
Health Care benchmark Index	Eurofidai	301000000650008	Annualized
Financials benchmark Index	Eurofidai	302000000750008	Annualized
Information Technology benchmark Index	Eurofidai	302000000850008	Annualized
Telecommunication Services benchmark Index	Eurofidai	302000000950008	Annualized
Utilities benchmark Index	Eurofidai	302000001050008	Annualized

Table 2. Descriptive statistics

Panel A.

	Mean	Median	St. Dev.	Kurt.	Asim. Coef.	Min.	Max.
IPI US	0,0076	0,0224	0,0435	4,3053	-1,9497	-0,1519	0,0851
CPI US	0,0207	0,0202	0,0133	0,3990	-0,1984	-0,0196	0,0550
Sh. Rate US	0,0083	0,0051	0,0230	-0,8417	0,3793	-0,0299	0,0526
S&P 500	0,0700	0,1417	0,4808	2,9301	-1,0590	-2,2276	1,2277
IPI EA	0,0064	0,0166	0,0521	5,2565	-2,0067	-0,2134	0,0935
HCPI EA	0,0142	0,0135	0,0050	-0,1653	0,5306	0,0047	0,0268
Sh. Rate EA	-0,0081	-0,0039	0,0335	-0,9055	-0,3626	-0,0782	0,0428

Panel B. Correlation Coefficient

	IPI US	*CPI US*	*SR US*	*SP500*	*IPI EA*	*HCPI EA*	*SR EA*
IPI US	1						
CPI US	0,4612	1					
SR US	0,0205	0,4625	1				
SP500	0,0614	-0,1943	-0,0731	1			
IPI EA	0,8095	0,4288	0,1511	0,0010	1		
HCPI EA	-0,0446	0,5319	0,4106	-0,1955	-0,0945	1	
SR EA	0,0631	0,3862	0,2774	-0,1292	0,0587	0,5905	1

Table 3.
Panel A. Main statistics for Euro Area Countries Indexes

	Mean	Median	St. Dev.	Kurt	Asim. Coef	Min.	Max.	Comp.
EA	0,0858	0,1669	0,5055	2,1597	-0,5909	-1,9267	1,9574	2858
Au	0,0911	0,1508	0,7427	3,7198	-0,8245	-3,3510	2,3721	81
Be	0,1152	0,2086	0,5607	4,9385	-1,2063	-2,8039	1,7544	151
Fi	0,1009	0,1533	0,7102	3,0984	0,1113	-2,3137	3,4441	205
Fr	0,1005	0,1563	0,5273	1,0899	-0,5579	-1,7234	1,7789	775
Ge	0,0997	0,1324	0,5750	3,9071	-0,9528	-2,7172	1,9229	819
Ir	0,0272	0,0597	0,7739	1,4197	-0,5328	-2,8629	2,0609	49
It	0,0391	0,1298	0,6699	0,9235	-0,4781	-2,2940	2,2428	403
Lu	0,0603	0,1219	0,9388	4,0391	-0,7952	-4,4782	2,6131	20
Ne	0,0908	0,1718	0,5756	2,7727	-0,9378	-2,3476	1,5089	121
Po	0,0633	0,0831	0,6010	1,8776	-0,6965	-2,5065	1,5683	56
Sp	0,0718	0,1342	0,6405	0,8804	-0,1578	-1,8753	2,1048	178

Comp. Indicate the total number of companies used along the sample.

Panel B. Correlation Coefficient for the EA Index

	EA	*Au*	*Be*	*Fi*	*Fr*	*Ge*	*Ir*	*It*	*Lu*	*Ne*	*Po*	*Sp*
EA	1											
Au	0,8638	1										
Be	0,8063	0,7548	1									
Fi	0,8054	0,7081	0,6645	1								
Fr	0,9574	0,8148	0,7627	0,7804	1							
Ge	0,9223	0,8026	0,7271	0,7610	0,8945	1						
Ir	0,7240	0,6652	0,5966	0,6028	0,6747	0,6384	1					
It	0,8423	0,7075	0,6338	0,6464	0,8216	0,7437	0,5909	1				
Lu	0,7341	0,7315	0,5754	0,6283	0,6866	0,7286	0,5330	0,5932	1			
Ne	0,9241	0,8351	0,7901	0,7260	0,8892	0,8442	0,6580	0,7409	0,7910	1		
Po	0,7693	0,7043	0,6329	0,6113	0,7514	0,6979	0,5562	0,7195	0,5311	0,6945	1	
Sp	0,8403	0,7124	0,6379	0,6498	0,8102	0,7415	0,5376	0,8363	0,5621	0,7337	0,7017	1

Table 4.

Panel A. Main statistics for the sectorial benchmark indices.

	Mean	Median	St. Dev.	Kurt	Asim. Coef	Min.	Max.	Comp.
Energy	0,0694	0,0949	0,6140	0,5854	-0,0006	-1,7730	1,9975	81
Materials	0,1178	0,1477	0,7047	2,4782	-0,5447	-2,7001	2,6395	282
Industrials.	0,0965	0,1548	0,6167	3,5026	-0,8366	-2,9267	2,2886	567
Cons Discr	0,1219	0,1733	0,4894	2,0461	-0,4885	-1,6697	1,8444	309
Cons Stap	0,1156	0,1447	0,4330	1,0918	-0,3855	-1,4181	1,3514	218
Health Care	0,1144	0,1385	0,4047	0,2694	-0,2149	-1,1884	1,2204	273
Health Care	0,0595	0,1404	0,7273	4,1071	-0,0562	-2,8644	3,6946	637
Financials	0,1312	0,1909	0,5842	2,5792	-0,6879	-2,6151	1,8156	337
Inf Tech	0,0451	0,0257	0,5238	0,1365	-0,0134	-1,2388	1,6140	73
Telecom	0,0839	0,1099	0,5133	0,5119	-0,2570	-1,5131	1,6219	81
Utilities	0,0694	0,0949	0,6140	0,5854	-0,0006	-1,7730	1,9975	81

Panel B. Correlation Coefficient for the Sectorial Indices.

	Energy	*Materials*	*Industrials*	*Cons Discr*	*Cons Stap*	*Health Care*	*Health Care*	*Financials*	*Inf Tech*	*Telecom*	*Utilities*
Energy	1										
Materials	0,6954	1									
Industrials	0,5372	0,8755	1								
Cons Discr	0,5698	0,8248	0,8723	1							
Cons Stap	0,5328	0,6545	0,7101	0,8107	1						
Health Care	0,4838	0,5574	0,5853	0,6944	0,7642	1					
Health Care	0,4838	0,5574	0,5853	0,6944	0,7642	1,0000	1				
Financials	0,5141	0,8030	0,8336	0,7909	0,6114	0,5224	0,5224	1			
Inf Tech	0,5532	0,7941	0,8527	0,8643	0,7258	0,6108	0,6108	0,7627	1		
Telecom	0,4201	0,5393	0,5819	0,6079	0,5749	0,5104	0,5104	0,6470	0,5309	1	
Utilities	0,5851	0,6532	0,6306	0,6432	0,6241	0,5623	0,5623	0,7101	0,5949	0,6709	1

Table 5. Sectorial composition of the eurozone countries.

	Energy	Materials	Industrial	Consumer Discretionary	Consumer Staples	Health Care	Financials	Information Technology	Telecomun Services	Utilities
EA	5,50%	10,90%	15,00%	10,34%	6,62%	7,42%	21,49%	9,57%	6,77%	6,38%
Au	11,34%	14,38%	10,90%	4,42%	1,27%	2,32%	41,65%	0,69%	4,83%	8,20%
Be	0,00%	10,97%	5,53%	2,43%	30,74%	6,29%	29,13%	2,37%	6,93%	5,60%
Fi	8,80%	19,82%	22,64%	4,75%	2,96%	2,88%	9,74%	11,12%	17,28%	0,00%
Fr	7,97%	8,21%	13,69%	13,66%	8,11%	12,50%	20,94%	4,40%	3,27%	7,23%
Ge	0,15%	9,55%	24,05%	8,77%	2,64%	10,26%	18,09%	15,97%	6,04%	4,49%
Ir	19,57%	27,89%	7,78%	8,94%	18,48%	1,16%	15,53%	0,42%	0,12%	0,11%
It	6,02%	8,58%	10,15%	16,71%	1,65%	3,83%	25,95%	8,35%	9,56%	9,20%
Lu	0,00%	50,21%	0,00%	23,55%	0,59%	0,00%	10,29%	0,00%	15,36%	0,00%
Ne	18,06%	11,45%	10,63%	11,05%	10,66%	4,32%	14,97%	16,37%	2,51%	0,00%
Po	7,99%	37,15%	9,73%	2,78%	8,07%	0,04%	6,42%	10,40%	6,79%	10,62%
Sp	3,50%	13,63%	8,37%	1,02%	11,85%	1,77%	31,12%	4,15%	11,94%	12,64%

Table 6.

	Acummulated response	Acummulated response explained by sectors	Difference	Probability of explained by sectors 10%
EA	-0,1799	-0,1939	0,0140	78%
Au	-0,1703	-0,2006	0,0303	86%
Be	-0,1912	-0,1825	-0,0087	87%
Fi	-0,1985	-0,1875	-0,0110	88%
Fr	-0,2070	-0,1891	-0,0179	81%
Ge	-0,1420	-0,2014	0,0594	77%
Ir	-0,3569	-0,1838	-0,1731	65%
It	-0,2210	-0,1919	-0,0291	79%
Lu	-0,1229	-0,1879	0,0650	85%
Ne	-0,2779	-0,1899	-0,0880	70%
Po	-0,2572	-0,2055	-0,0517	74%
Sp	-0,1683	-0,1954	0,0271	81%