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Spillovers of Monetary and Fiscal Policy on Financial Markets in EMU Countries

Rute Daniela Pires Pereira

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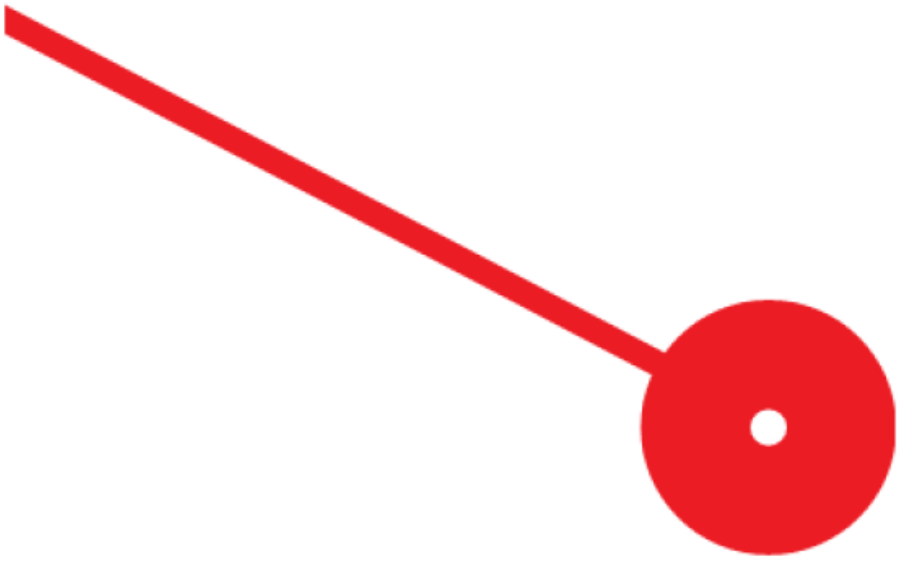

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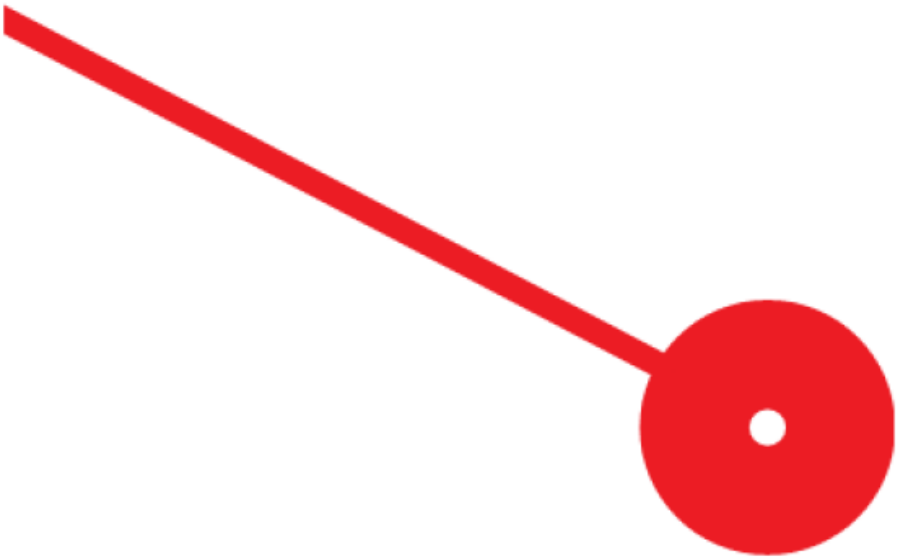
Dissertação de Mestrado
Apresentado ao Instituto Superior de Contabilidade e Administração do Porto para obtenção do grau de Mestre em Contabilidade e Finanças
sob orientação de Professora Doutora Celsa Maria de Carvalho Machado e Professora Doutora Ana Paula Ribeiro



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RESUMO

Além de alternativa de financiamento das empresas, as bolsas de valores, através do preço das ações, registam o valor de mercado das empresas, refletem expectativas económicas e o património líquido e, afetam o bem-estar das famílias. Assim, a dinâmica destes preços é fundamental para decisões de consumo/investimento. Adicionalmente, esses mercados estão profundamente integrados internacionalmente, reagindo a determinantes externos.

Enquanto a maioria dos estudos concentra-se nos determinantes ao nível micro/empresa dos preços das ações, poucos analisam o papel dos determinantes macro e ainda menos, o papel das políticas macroeconómicas. Considerando o impacto das políticas monetária e orçamental na economia, é importante compreender o seu efeito no valor das empresas e, consequentemente, nas decisões de investimento. Além disso, a crescente globalização torna não-negligenciável a importância das repercussões internacionais nos preços das ações domésticas.

Neste contexto, propomos analisar/avaliar o impacto destas políticas nos preços das ações num grupo de países da Área Euro. Além da escassa literatura relevante focada nestes países como um todo, oferecem um estudo de caso particular: possui uma política monetária comum, contando com políticas orçamentais individuais para cada país e apresenta uma forte integração económica, tornando não-negligenciáveis, repercussões internacionais das políticas orçamentais. Para isso, estimamos um modelo PVAR com metodologias alternativas para correção da endogeneidade, dependência transversal e heterogeneidade dinâmica, usando dados trimestrais para 12 países da Área Euro de 1999-2021.

Os resultados sugerem um impacto significativo negativo nos preços das ações domésticas com um aumento da taxa de juro do BCE. Nas políticas orçamentais não são tão robustos, diferindo entre os métodos de estimação. Um choque nos gastos domésticos governamentais é neutro/negativo nos preços das ações, enquanto os efeitos internacionais são neutros/positivos, operando através de taxas de juros e comércio. Adicionalmente, descobrimos que os preços das ações nos PIIGS reagem menos à política monetária e à política orçamental doméstica, enquanto as repercussões internacionais orçamentais apresentam-se maiores.

Palavras-chave: Política monetária, Política orçamental, *Spillovers* entre países, Preços das ações.

ABSTRACT

Besides being one of the alternatives for firm's financing, stock markets, through stock prices, record firms' market value, that reflects economic expectations and firms' net worth and affect households' welfare. Thus, the dynamics of stock prices is critical for both consumption and investment decisions. Moreover, these markets are deeply integrated internationally, also reacting to external determinants.

While most of the studies focus on the micro/firm level-determinants of stock prices, few analyze the role of macro-determinants and, even fewer focus on the role of macroeconomic policies. Considering the impact that monetary and fiscal policies have on the economy, it is important to understand their effect on firms' value and thus on their investment decision. Moreover, growing globalization makes non-negligible the importance of international spillovers on domestic stock market prices.

In this context, we propose to analyze and assess the impact of both policies on stock prices in a group of countries of the Euro Area. Besides the lack of relevant literature focusing on these countries as a whole, the Euro Area provides a very particular case study: it has a common monetary policy while relying on individual fiscal policies for each country, and exhibits strong economic integration that makes non-negligible international spillovers from fiscal policies. To that end, we estimate a PVAR model with alternative methodologies to correct endogeneity, cross-sectional dependency and dynamic heterogeneity, using quarterly data for 12 countries of the Euro Area from 1999 to 2021.

Our findings suggest that an increase in the ECB's interest rate has a significant negative impact on domestic stock prices. Results of the effects of fiscal policies are not so robust, differing across estimation methods. A shock in domestic government spending is neutral or negative for stock prices while expansionary fiscal policy international spillovers are neutral or positive, apparently operating through interest rate and trade channels. In addition, we find that stock prices in PIIGS react less to monetary policy and domestic government spending shocks, while international spillovers from fiscal policy are larger.

Keywords: Monetary policy, Fiscal policy, cross-country spillovers, Stock prices.

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Aos docentes, pela motivação e conhecimento, porque sem eles não seria possível ter a inspiração para o tema escolhido, nem a realização deste trabalho.

LIST OF ACRONYMS AND ABBREVIATIONS

ADF - Augmented Dickey-Fuller

AF - Active Fiscal

AIC - Akaike Information Criterion

AM - Active Monetary

AVG_G - Average of Government spending

CIPS - Cross-sectional Augmented Im-Pesaran-Shin

DOLS – Dynamic Ordinary Least Square

DSGE – Dynamic Stochastic General Equilibrium

EA - Euro Area

ECB - European Central Bank

ECM – Error Correction Model

ECT –Error-Correction Term

EME - Emerging Market Economies

EMU - Economic and Monetary Union

EU - European Union

Fed - Federal Reserve

FMOLS - Fully Modified Ordinary Least Square

FOD - forward orthogonal deviation

G - Government expenditure

G7 - Germany, Canada, United States, France, Italy, Japan e United Kingdom

GDP - Gross Domestic Product

GMM - Generalized Method of Moments

HIPC - Harmonized Index of Consumer Prices

HQ - Hannan-Quinn information criterion

IRF – Impulse Response Function

MMSC - Model and Moment Selection Criteria

MSCI - Morgan Stanley MSCI share price index

MSCIGR - MSCI Share Price Index Growth Rate

OECD - Organisation for Economic Co-operation and Development

OLS - Ordinary Least Squares

PF - Passive Fiscal

PI - Price Index

PIIGS – Portugal, Italy, Ireland, Greece and Spain

PM - Passive Monetary

PP - Phillips-Perron

PSVAR – Panel Structural Vector Autoregressive Model

PVAR – Panel Vector Autoregressive Model

Q - Quarter

QE - Quantitative Easing

RI - Returns Index

S&P500 - Standard & Poor's 500 Index

SC - Schwartz information Criterion

SSR - Shadow Short Rate

SVAR – Structural Vector Autoregressive Model

SVECM – Structural Vector Error Correction Model

UK - United Kingdom

UMP - unconventional monetary policy

US - United States

VDC – Variance Decomposition

VECM – Vector Error Correction Model

ZLB - Zero Lower Bound

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1. INTRODUCTION

For companies, the method of financing can be through debt or through equity, namely by issuing shares in the capital markets.

The stock market is a market for trading company shares and their derivatives at an agreed price (Jonathan & Oghenebrume, 2017), and the indicators used to measure its performance are market indices. Market indices represent portfolios of shares in a market segment and are calculated through the daily average of shares from the more important companies, representing the global state of the market (Henriques, 2016).

Thus, in addition to providing information about their financial condition, share prices also reflect their expected value - relationship between economic expectations and company's net worth. Financial asset prices are an indicator of investment profitability and, on the other hand, an important vehicle for wealth effects on economies, affecting directly and/or indirectly companies' investment decisions. Moreover, financial markets are global and they have a high degree of transmission between countries that became more evident with the great recession of 2007-08. A greater integration of these markets can bring benefits, but also creates more vulnerability in countries to global shocks (Lehkonen, 2015).

Since stock prices are determinant for investment decisions it is important to assess the impacts on asset prices of firm-level determinants, such as profitability, but also of macro-level determinants, such as monetary and fiscal policies. The literature usually focuses on firm-level and micro determinants of stock prices dynamics (*e.g.*, Sukhija, 2014; Herawati & Putra, 2018; Ligocká & Stavárek, 2019; Bellocchi, Marin & Travaglini, 2021; Mittelbach-Hörmanseder, Hummel & Rammerstorfer, 2021), while a smaller fraction deals with macroeconomic determinants. Among the latter, only very few studies, analyze the spillovers on stock market prices of macroeconomic policies.

While there is some literature that focus on the impacts of domestic monetary and fiscal policies (*e.g.*, Caporale & Soliman, 2013; Jonathan & Oghenebrume, 2017; Ogbulu, Torbira & Umezinwa, 2015; Mbanga & Darrat, 2016), the effects of both domestic and external policies on stock market prices are barely studied.

Empirical literature on these issues mainly provides analyses at a country level (*e.g.*, Van Aarle, Garretsen & Gobbin, 2003; Handoyo, Jusoh & Zaidi, 2015; Thanh, Thuy, Anh, Thi

& Trurong, 2017). There are few empirical studies that analyze the impact of fiscal and monetary policies on stock market prices for European countries and none, to the best of our knowledge, covering international policy spillovers on the stock market. Although we find papers that investigate international spillovers of these policies, we did not find any that covers Economic and Monetary Union (EMU) countries that share the same monetary policy. In that sense, this study aims to fill this gap and contribute to the existing literature.

In this context, we propose to study how demand-side policies affect the stock market prices in the Euro Area. These countries have very particular characteristics: i) they share a common monetary policy implemented by the European Central Bank (ECB) (Semmler & Zhang, 2004), while ii) keeping decentralized fiscal policies and iii) are highly economically integrated, which makes them prone to international fiscal spillovers.

To achieve these goals, we first identify, through a literature review, the transmission mechanisms of domestic policies to the prices of financial assets, as well as the mechanisms of international policy spillovers. Besides assessing the effective impact of policies on stock market prices, the review of empirical literature also contributes to the selection of an adequate empirical methodology.

Then, we proceed with a quantitative methodology by estimating a panel Vector Autoregressive (PVAR) model for twelve selected EMU countries, using quarterly seasonally adjusted data from 1999Q1 to 2021Q4. We use government expenditure, as a proxy for the fiscal policy stance, the shadow short rate for the Euro Area, as a proxy for conventional and non-conventional ECB monetary policy, and two stock market indices - a price index and a returns index. Furthermore, we only consider international policy spillovers within EMU countries: from common monetary policy and from average fiscal policies taken in the remaining countries, by using bilateral trade as a measure of inter-country linkages.

We estimate the impulse responses of stock market prices to domestic and external macroeconomic policy shocks and check robustness of results to three alternative estimation methodologies. First, we apply the baseline PVAR, with the shocks identification scheme based on the Cholesky decomposition; second, we use the PVAR Generalized Method of Moments (GMM) estimator to correct for the bias arising from the correlation between the lagged endogenous variables and the unobserved time invariant components on each of these

variables; and third, we employ the panel structural VAR (PSVAR) method developed by Pedroni (2013), to account for potential problems arising from the presence of cross-sectional dependencies and dynamic heterogeneities.

After introduction, the remaining structure of this dissertation is organized as follows. Section 2 presents a literature review on the theoretical mechanisms of domestic and external macroeconomic policies to stock markets and on corresponding empirical overview of the main results. Section 3 describes data and methodology. Section 4 presents and discusses empirical results and section 5 concludes.

2. LITERATURE REVIEW

As fluctuations in the stock market have significant macroeconomic effects through investment and consumption decisions of the economic agents (Akinkuotu, 2021), it is important to assess the impact that policy decisions can have on this market. While monetary policy directly affects the price of financial assets (*e.g.*, Stoica & Diaconasu, 2012), the impacts of fiscal policy are more indirect and also less studied (*e.g.*, Afonso & Sousa, 2011). The same happens with international cross-countries spillovers on financial markets, resulting from the conduct of monetary and fiscal policies by large countries (*e.g.*, Bonatti, Fracasso & Tamborini, 2021).

2.1 Transmission mechanisms of monetary policy to the price of financial assets

Monetary policy aims to preserve price stability and to stimulate economic growth through the use of monetary instruments by central banks (Baykara, 2021), by controlling, directly or indirectly, money supply (Ghani & Chaudhary, 2016). Central banks have at their disposal conventional measures that allow them to manage the supply of liquidity through key interest rates (*e.g.*, Amoroso, 2018) and operate under mandates that also include additional objectives such as full employment, sustainable growth, interest rates or stable exchange rates. To meet these objectives, they operate in financial markets which, in turn, affect the real economy (Hildebrand, 2006).

2.1.1 Theoretical mechanisms

The transmission mechanism from conventional monetary policy to the stock market operate through different channels (Akinkuotu, 2021). According to Mishkin (1995), monetary policy influences the movements on stock market prices either through the interest rate channel, through other asset price channels - such as exchange rate, equity prices - and also through credit channels, bank lending and balance sheet. But is important to distinguish between the mechanism that affect directly the stock market prices and the indirect ones that affect inflation and the aggregate output, through other macroeconomic variables, that in turn, influence the stock market prices. The upstream effect, which traditionally link assets prices to demand, can be related to channels of interest rate, equity prices, balance sheet and household. On the downstream effects, which, by affecting demand, indirectly influence the assets price, like the exchange rate, expectations, future cash flows and changes in the output.

Through the interest rate channel, an expansionary monetary policy leads to a decrease in real interest rates, which reduces the user cost of capital and increases the profitability of projects, causing an increase in investment and raises the stock prices which, in turn, lead to an increase in aggregate demand and raises the output (Hu, Han & Zhang, 2018).

The equity price channel, resorting to Tobin's q-theory (Tobin, 1969), gives a mechanism on how the monetary policy, through its effects on the valuation of shares, can affect the economy (Mishkin, 1995). Tobin′s q, is given by the ratio between the market value of a firm and the replacement cost of capital (Dan, 2013) measuring the marginal cost of consumption of a unit of capital, with the investment/capital ratio (Benigno & Paciello, 2014). So, if the q is greater than 1, capital is more valuable on the firm and greater than its replacement cost of capital, allowing companies to issue shares and obtain a higher price in relation to the cost of purchasing facilities and equipment. In that way, an expansionary monetary policy which lowers interest rates, makes bonds less attractive relative to stocks, increasing their demand, driving up their prices, rising q or dropping cost of capital that leads to a higher investment spending and output (Mishkin, 2001). But, on equity prices channel we can also find an effect through wealth effect on consumption. With a decrease in interest rates, the value of financial wealth increases, rising the value of stock prices that has a positive effect on consumption and production (Santos, 2017). As Mishkin (1995) referred, both mechanisms described is link to a general definition of equity that allows to relate housing and land price to equity which can represents wealth. So, a monetary expansionary policy that increase house prices relative to the replacement cost, increase aggregate demand through a rise in Tobin's q and production and, simultaneous, through an increase in wealth and consumption.

As for the credit channels, the balance sheet channel focuses on the demand side (Aysun & Hepp, 2011), *i.e.*, on the ability of a firm to contract loans, given its net worth, presented as a collateral to reduce the moral hazard and adverse selection problems related to bank finance (Iturriaga, 2000). Thus, the net worth of a business firm determines changes the equity stake of owners along with their incentives to engage in risky investment projects, along with the probability that lenders get back funds and, therefore, influences the value of loans to finance investment expenditures (Mishkin, 2001). In that way, an expansionary monetary policy, which lower interest rates and raise stock prices, increases net worth and reduces the debt service, while increasing the present value of collateral and the demand for credit (Igan, Kabundi, Simone & Tamirisa, 2017). That leads to a higher investment spending and output because it decreases adverse selection and moral hazard problems. Another perspective, is

the household balance sheet effect that works through the liquidity of the assets that affects financial distress of consumers. When stock market prices increase, the value of financial assets rises relatively to their debts and, by lowering the probability of financial distress, stimulates the consume of durable expenditure (Mishkin, 1995), output and feeds back on firm's value again. In addition, an indirect effect arises, when a decrease in the nominal interest rate can also improve firms' balance sheets because it leads to high future cash flows and market value (Nwaogwugwu, 2018), or raises real net worth with the unanticipated of rise in price level (Mishkin, 1995).

Another indirect way, also in the credit channel, the bank lending channel, in turn, relates to the supply of loans (Igan *et al*., 2017). An expansionary monetary policy facilitates the availability of bank credit, with an increase in bank reserves and deposits, favoring financing via credit, which causes an aggregate reaction of the growing investment economy and, in turn, of production, allowing companies access to capital markets that were previously unattainable (Iturriaga, 2000) that could lead to stock prices to rise.

Through the exchange rate channel, an expansionary monetary policy, through lower interest rate, reduces the attractiveness of investments, namely deposits, denominated in domestic currency (Iturriaga, 2000), causing nominal and real depreciation in the short term; this changes the attractiveness of goods produced domestically relatively to the ones produced abroad, with effects on competitiveness; increasing external net demand (a rise in net exports) has a positive impact on the production of domestic goods and services, leading to an increase on asset prices (Chatziantoniou, Duffy & Filis, 2013).

Besides conventional monetary policy, based on interest rates, central banks have been adopting similar measures but based on the quantitative expansion of their balance sheets (Zabala & Prats, 2020). Resort to unconventional monetary policy (UMP) resulted from cutting interest rates aggressively, the policy rates reached the zero lower bound (ZLB) (Dell'Ariccia, Rabanal & Sandri, 2018) and is no longer possible to stimulate the economy by dropping the interest rates or encourage investment, consumption, aggregate demand and inflation, because economic agents prefer to withhold the money (Bruno, 2015).

According to Dell'Ariccia, *et al*. (2018) the methods of unconventional monetary policy are forward guidance, quantitative easing, and negative interest rate policies, that have the purpose to stimulate the aggregate demand, inflation and output, and in this way can affect stock prices. When inflation rises, increase the nominal interest rate, leading to an increase of the demand for bonds and a decreasing of the demand for stocks (Quayes & Jamal, 2008).

On the demand side, a higher nominal interest rate, decrease the incentive for a business firm to issue bonds for raising funds, preferring selling equity, raising stock supply and lowering the stocks prices (Quayes & Jamal, 2008).

Quantitative Easing (QE) aims to rise the monetary base through large-scale purchase of securities, involving buying long-term government bonds or assets financed with the addition on reserves accounts, that commercial banks hold at central bank (Dell'Ariccia, *et al*., 2018), to induce lower interest rates (Miyakoshi, Shimada & Li, 2017), improve credit market conditions (Neely, 2015) and provide liquidity to financial institutions, supporting the offer of credit (Alekseievska, Kyfak, Rodionova & Yakubovskiy, 2019). According to Driffill (2016), the portfolio balance and bank's lending are the most study channels through which QE might affect the economy, direct and indirectly respectively. The portfolio balance channel, works by replacing long-term government debt from the private sector with cash, increasing[1] the quantity of bank deposits and decreasing medium- and long-term government bonds, probably raising their prices, dropping returns, and encouraging investment spending on private sector debt and equity - substitution effect (Driffill, 2016), similar to the equity price channel above. At the same time, asset substitution will drop term premium and default premium of the long-term government debt, causing the fall on several interest rates and a greater availability of loans to economic agents, encouraging consumption and investment (Janus, 2016) and, thus, actively stimulate trading and increase stock prices, through lower premia for illiquidity (Joyce, Tong & Woods, 2011). On the bank lending, the commercial banks have more liquid assets in form of reserves held at the Central Bank, that will increase bank lending and money supply (Driffill, 2016). Similar, the credit easing, as unconventional monetary policy method (*e.g.* Coroiu & Mitu, 2016; Gupta & Jooste, 2017; Bats & Hudepohl, 2019), operates through a credit channel that tends to extend the terms for granting loans, expanding the composition of central banks acceptable loan collateral, providing loans on an unsecured basis, and lowering loans interest rates, liberalizing the refinancing conditions for commercial banks (Alekseievska *et al.,* 2019), that could boost the investment and consequently make the stock price to rise.

Forward guidance has the purpose of influencing, through announcements, medium to long-term interest rate expectations of key interest rates (Bruno, 2015). It can be made conditional on how economic activity or inflation evolves - Delphic type - or, regardless economic conditions, central bank will keep the interest rates low - Odyssean type (Campbell, Evans,

[1] assuming that financial markets are imperfect and agents are not risk-neutral

Fischer & Justiniano, 2012). In this line, the policy signaling, is about expectations of economic agents of changes in interest rate that can encourage inflation expectations (Bauer & Rudebusch, 2014). This may lower real interest rates and modify the term structure of market interest rates, particularly the fall of long-term interest rates, rising the consumption, investments and the overall demand (Janus, 2016) raising stock prices.
Negative interest rates policy is when central banks keep the nominal short-term interest rates below zero (Alekseievska *et al.*, 2019), charging, instead of paying, interest rates on the reserves that commercial banks hold at the central bank (Dell'Ariccia, *et al.*, 2018) to counter low inflation (Ouerk, Boucher & Lubochinsky, 2020).

But Joyce *et al.* (2011), identified other channel related to the confidence level that can boost private investors to consumption and investment (Hausken & Ncube, 2013), increasing stock prices.

2.1.2 Empirical literature

In empirical terms, there are a significant number of previous studies that pay attention to the relationship between monetary policy and stock market performance. Many studies find that there is a positive relation between monetary policy and stock prices, and thus, an expansionary (contractionary) monetary policy, that decreases (increases) the interest rate, will lead to a rise (fall) of the stock prices. Table 1A (in annexes) reports the main results for empirical effects of monetary policy, summary described below.

Thorbecke (1997) observes that there are positive impacts of the expansionary monetary policy, through the credit channels, from 1967 to 1990, on the returns of the US stock market. Ioannidis and Kontonikas (2008), using stock returns in 13 OECD countries, between 1972 and 2002, shows that a contractionary monetary policy, lowers nominal and inflation-adjusted stock returns, in seven sample countries via higher discount rates and lower future cash flows. Caporale and Soliman (2013), for Germany, the US and the UK, in the period 1992-2009, finds that an increase in the short-term interest rate (a monetary contraction) leads to a decline in stock prices for the last two countries. Lütkepohl and Netšunajev (2018), using data from 1999 to 2014, founds that the ECB's contractionary monetary policies, through the interest rate channel, caused real European stock prices to decline in the long-term. But they also discovered that higher stock prices lead to an increase in industrial production, inflation, commodity prices and interest rates. This happens because stimulates consumption, through a wealth effect, and investment, through a Tobin Q effect, leading to

a higher aggregate demand. Due to the nominal rigidity of prices, inflation and commodity prices increase in the intermediate run, encouraging central bank to raise interest rates to combat the inflationary pressure of high aggregate demand. Jonathan and Oghenebrume (2017) for the Nigerian stock market, in the period from 1985 to 2015, finds that a contractionary monetary policy, in the long run, leads to an increase in the rate at which the future cash flows of companies are capitalized, causing the stock prices to fall.

The literature also analyzes the impact of unconventional measures on stock prices. For instance, Hosono and Isobe (2014), analyzed reactions to policy announcements for two stock price indexes in the Eurozone, using data from 2007 to 2013. They showed that an expansionary monetary policy had a negative response – announcements were more expansionary than expected – possible explain by the signaling effect, where ECB projected worse economic condition than market participants. In turn, Haitsma, Unalmis and Haan (2016) examine how stock markets respond to the policies of the ECB, on 12 euro-area countries, in 1999–2015. They found that the credit channel is the most notable for unconventional monetary policy surprises because the impact differs on the basis of the financial structure of the firms and that loser stocks are more reactive. Also, an unexpected expansionary monetary policy, during the crisis, is related with higher stock prices although the coefficients are insignificant in most cases.

We still find studies, that besides the impact of the monetary policy on the stock markets, analyzes the impacts over time and the direction of causation. This is the case of Stoica and Diaconasu (2012) that, studying 27 EU members, from January of 2000 to February of 2012, with monthly data from the variables short-term interest rate and stock price, find a negative relation between them. They also discover in a short-run, a bi-directional causality effect for some countries; for others, unidirectional from the stock to the money market and, in a long-term, covering the crisis period, they found out that there's an interdependence among the two variables in twenty countries. Similarly, Bjørnland and Leitemo (2009) identify this interdependence for the US stock market, from 1983 to 2002, showing that in the short-run, contractionary monetary policy causes the real stock prices to fall via discount rate of dividends that temporarily reduce the output and increase the cost of borrowing. And, the increase of stock prices leads the interest rates to increase, via rise of consumption through a wealth effect and investment affecting aggregate demand and inflation.

2.2 Transmission mechanisms of fiscal policy to the price of financial assets

Fiscal policy is one of the tools used by the Government to influence macroeconomic variables, using government spending and revenues, through taxes (Omran, 2017).

2.2.1 Theoretical mechanisms

A fiscal policy can act through effects on aggregate demand or supply and is said to be expansionary when government spending (current and capital expenditure) increases and/or when revenue (taxes and others revenues) cuts are made to boost output (the reverse applies to contractionary policies). An increase in government spending can lead to an increase in the level of income, increasing the capacity of economic agents to buy financial assets in the capital market, increasing demand and, consequently, also the stock prices. Reducing the tax rate stimulates demand through the wealth effect for consumers (Chinyere, Chukwujekwu, Uchenna & Chinedu, 2019), which can drive up stock prices.

However, the literature refers that the economic effects of fiscal policy on the stock market through the aggregate demand mechanism can be either positive, in the Keynesian view; negative, according to Classical theory; or neutral, in the Ricardian perspective (Chatziantoniou, Duffy & Filis, 2013). According to Keynesian theory, an increase in budget deficits is expected to have a positive effect on stock markets, by stimulating aggregate demand; according to the Classical economic theory, fiscal policy leads to a crowding-out effect on private sector investment and consumption and therefore plays only a limited role in stimulating demand and; finally, the Ricardian theory recognizes that, under certain conditions, the anticipation of higher future taxes to finance current deficits, increases savings, with no effect of fiscal policy on aggregate demand and, therefore, will not affect stock markets (Hu *et al*., 2018).

But fiscal policy can also have direct effects on the prices of bonds because when taxes increase by more than government spending does, the supply of government debt reduces, rising its price and reducing expected returns (Tavares & Valkanov, 2001). This may have a substitution effect on the investors, stimulating demand on stock market and bringing spillovers on bonds prices.

On the impact of fiscal changes and its announcements, in times of "good" and "bad" news, on stock markets, Blanchard (1981) explained that an expansionary fiscal policy that conducts the output, profit and interest rates to increase can lead to an ambiguous outcome

on the stock market, with prices falling under of bad news and an increase in case good news. During the time brake between the announcement and the implementation of the policy, under a bad news scenario, an anticipated growth on short-term interest rate occurs, the stock prices fall, discouraging private spending and, because the government spending is still unchanged, output and short-term interest rate effectively fall, while long-term interest rate rises. At the time of the implementation, the government spending increase as well as output and the short-term interest rate, negatively affecting stock market prices. In the case of the good news, the anticipation of higher profits overlaps the growth of the interest rate, stimulating stock prices.

Considering excessively large fiscal deficits, Kumar and Baldacci (2010) explain that they are expected to decrease national savings and intensify aggregate demand, creating an excess supply of government debt, which leads to higher real interest rates and a decrease in stock prices is expected.

2.2.2 Empirical literature

Although the research focusing on the effects of fiscal policy in equity markets is scarce, the results of the studies are strongly mixed. On Table 2A (in annexes) there are the main results for empirical effects of fiscal policy, summary described below.

Ardagna (2009), with data from 1960 to 2002 from OECD countries, shows that in countries facing large government deficits for years, the implementation of government expenditure cuts, dropping government debt, are associated with greater reductions in interest rates and increases in stock market prices. Agnello and Sousa (2013), for a sample of ten industrialized countries, from 1955 to 2007, reveal a negative effect on stock markets to an increase in the budget deficit, although the reaction seems to be only temporary and; increases in budgetary revenue have positive impacts on stock prices. Foresti and Napolitano (2017), over the period 1999-2012, examined the fiscal policy effects on stock markets of 11 countries in the Eurozone and showed that increases (decreases) in public deficits cause decreases (increases) in stock markets. Ogbulu, Torbira and Umezinwa (2015), studying the period of 1985 to 2012 for stock prices in Nigeria, show that the relationship of government expenditure on stock prices, was negative, while government domestic debt outstanding was positive. Mbanga and Darrat (2016), when analyzing the S&P500 index from 1960 to 2010 and comparing it with changes in the US budget deficit, conclude that, in a long-run, fiscal policy and stock prices have a stable relation. In the other hand, in a short-term,

contractionary fiscal policies, that decrease budget deficits, may reduce stock prices showing that the market could be inefficient facing the available information on fiscal policy movements. Arin, Mamun and Purushothman (2009) investigated the response of stock returns of the US, Germany and Japan in excess of the risk-free rate to fiscal policy innovations on taxes, with data from 1967 to 2005. They discovered that, the impact of higher indirect taxes is larger than that of labor taxes but both decrease the excess market returns, while the effect of corporate taxes on stock returns, for United States and Japan, is not statistically significant because firms are able to switch its financing from equity to debt. Mumtaz and Theodoridis (2020), analyzed the response of US stock prices to an expansionary fiscal shock, from 1955 to 2015. They observed that was positive pre-1980, because real activity, total factor productivity and real wages rise while inflation drops, and negative post-1980 due to the fall of real wages and rising inflation.

2.3 Interaction between fiscal and monetary policies on the price of financial assets

Both the central bank and the fiscal authority supply assets through the issuance of currency, reserves and government bonds which, in turn, "provide liquidity services to firms and households" (ECB, 2021 p. 9). Differently of monetary policy, fiscal policy has an implementation lag longer, influencing economic conditions slower and less effectively; moreover, the accomplishment of monetary policy depends crucially on fiscal sustainability because price level can be a determinant of the value of government's liabilities (Afonso & Sousa, 2021). In this context, it is important to analyze separately, but also jointly, the effect of both policies on the stock markets.

2.3.1 Theoretical mechanisms

The interaction between both policies influences stock market, in a direct way, through the impact of government inter-temporal budget constraint on monetary policy and, through an indirect effect of fiscal policy on monetary variables (Chatziantoniou *et al*., 2013).

The inter-temporal budget constraint involves that government expenditure is financed through taxation, borrowing or seignorage (Chatziantoniou *et al*., 2013) and unsustainable fiscal policy decisions can bring difficulties to monetary policy (Sargent & Wallace, 1981). For fiscal sustainability of the inter-temporal budget constraint, "the market value of public debt must be equal to the present value of all discounted future budget surpluses" (Khadan

& Deonarine, 2019, p.1). If there's a contractionary monetary policy to reduce the inflation, when the interest rate is larger than the growth rate of the economy, the deficit financing will eventually require monetary growth leading to higher inflation (Chatziantoniou *et al*., 2013).

On the effect of this interaction on output, inflation, interest rate and, by extension, the stock market, is through the co-movement between the policies that can be complementary or substitute or, opposing movements of the two policies based on competing situation or game theory framework (Lawal, Somoye, Babajide & Nwanji, 2018). The substitutability effect arises when the incentive provided by one policy instrument reduces the need to use another policy instrument, compensating (at least in part) this greater use of one instrument at the expense of using the other instrument; complementarity occurs when both instruments pull together, i.e., more stimulus from one policy increases the space and effectiveness of the other policy (Bartsch, Bénassy-Quéré, Corsetti & Debrun, 2020). Monetary and fiscal policies affect output and inflation but, while the first one tries to achieve inflation usually below the fiscal authorities' ideal, the second one aims at achieving output beyond the central bank's ideal, resulting in inflation and output to more extreme values than the ideal points of each policy maker (Dixit & Lambertini, 2001). In New Keynesian DSGE models, with expected inflation above the target, central bank should raise the interest rate and reduce aggregate demand to achieve the inflation rate back to the target (Gaffard, Napoletano & Battiston, 2018). Regarding to inflation, when it rises, increase the nominal interest rate, decreasing stock prices.

If the fiscal authority aims for an excessive level of output, after an inflation shock there will be excessively tight monetary policy, excessive fiscal expansion, and a fast accumulation of public debt; a Nash equilibrium will result in large welfare losses (Kirsanova, Stehn & Vines, 2005). This restrictive monetary policy and expansionary fiscal policy leads to a government debt increase because there is a lack of monetary financing of the public deficit (Gaffard *et.al,* 2018). The increase of the government debt will reduce its price and may have a substitution effect on the investors, discouraging the demand on stock market.

Is also important to refer that the monetary-fiscal policy interactions can be also considered in models with regime-switching policies. These regimes can vary from active monetary/passive fiscal to passive monetary/active fiscal to both policies passive or active. Leeper and Davig (2011) explain that an active monetary (AM) means that policymakers, facing inflation, dramatically increase the nominal interest rate, which raises the real rate

and induces agents to postpone consumption; and a passive fiscal (PF) policy, with higher government spending, have an equivalent increase in lump-sum taxes to offset spending. A passive monetary (PM) policy does not increase nominal rates strongly with inflation, so the real rate declines; and an active fiscal (AF) policy means that higher taxes are not expected to fully finance the increase in government spending, and the usual negative wealth effect on labor supply and consumption is mitigated. Thus, with a monetary union, the central bank in order to achieve inflation-targeted stability, imposes budgetary requirements on fiscal policy to achieve a stable equilibrium to avoid the failure of a fiscal authorities that compromise this balance (Bonam & Hobjin, 2021). However, moving to more sustainable fiscal regimes in the future, with temporary leaving from requirements to absorb country-specific shocks (switching regimes), may be more feasible for more stability in monetary unions (Bonam & Hobjin, 2021).

2.3.2 Empirical literature

Considering the macroeconomic effects of the monetary and fiscal policies on the stock market, Van Aarle, Garretsen and Gobbin (2003), with data from 14 EMU countries on the period of 1980:1 to 2001:4, they found out that the monetary and fiscal policies seem to be complements for Austria, Belgium, Germany and the UK, and substitutes in Ireland, Portugal, and Sweden. Handoyo, Jusoh and Zaidi (2015), using monthly data from 2001 to 2011, provide evidence that the two policies are capable of influencing the Indonesian stock price individually, but also find that the inclusion of fiscal variables in the model, relative to monetary ones only, helps to explain the performance of the stock market. Lawal, *et al*., (2018) conclude that interactions between policies in the Nigerian stock market, from 1985 to 2015, influence stock market returns and stock market volatility hold, supporting the complementary hypothesis of this interaction. And, Thanh, Thuy, Anh, Thi and Trurong (2017) concluded that monetary and fiscal policy, from 2002 to 2015, do not only affect the Vietnam stock market individually, but also through its interaction on the Consumer Price Index (CPI) and the budget deficit, as a consequence of changes in inflation. So, if there is an expansionary monetary policy that causes inflation, it will rise the CPI and decrease de demand for stock market that, in turn, makes government's spending to exceed its revenues, encouraging the issuance of bonds to cover their spending with borrowing, further reducing the stock market prices.

2.4 International Spillovers

According to Guo, Li and Shao (2022), interconnected and interdependent between countries increased with the globalization. They said that, as a consequence, changes in economic policies affect operations in the domestic economy and implies a spillover effect on foreign countries. And also defended that, the economic policy uncertainty, with continuous development of financial markets and international trade, offers channels for the transmission of the spillover, due to the complex and volatile external economic environment and intensifying the negative impact, in general, of local imbalances.

2.4.1 Theoretical mechanisms

For instruments of monetary and fiscal policies, Bonatti *et al.*, (2021) identified two main channels of transmission for cross-country spillovers, by bilateral trade, the real one, where there are demand effects of domestic policy through exports; and by capital movements, financial one, where there is mediation of the impact of domestic policy on domestic interest rates vis-à-vis foreign ones.

On the monetary policy, when interest rates increase, has a contractionary effect on the domestic economy, through consumption and investment, lowering the demand for both domestic and foreign goods (decrease imports) - aggregate demand channel (Degasperi, Hong, & Ricco, 2020). This decrease of the imports and domestic wealth will also affect the exports, and thus, the international trade. In fiscal policy, the government purchases of domestic and foreign goods have a direct effect on the trade balance and an indirect effect because changes in government spending and taxes affect the private sector's consumption decisions (Nicar, 2015). But the increase of the interest rates will also have effects on the exchange rate. The current and expected (short-term) interest rate differentials, between two currencies, and the currency risk premia are reflected by the exchange rate - expenditure switching channel (Ca'Zorzi, Dedola, Georgiadis, Jarocinski, Stracca & Strasser, 2020). So, if there's a contractionary monetary policy that lift the domestic long-term yields and thereby reduces the price of other asset prices, will lead capital flows to internal economy, via portfolio balance effects and, will appreciate the exchange rate (Boye, 2020). Also, an expansionary fiscal policy, with the increase in government spending or a reduction of the net tax, will boost domestic economy that can raise the domestic real interest rate, leading to a real exchange rate appreciation (Nicar, 2015). The domestic currency appreciation,

switches the global demand towards foreign goods, decreasing the exports, because foreign goods become relatively cheaper (Degasperi, *et al*., 2020).

In financial markets, the change of the exchange rate will determine the relative valuation of financial assets denominated in different currencies (Ca'Zorzi, *et al*., 2020) that can affect the value of the stock prices through the performance of the firm or by the investor's portfolio rebalancing. Also, international capital mobility, saving and consumption decisions of domestic agents will reflect the returns on the domestic and foreign assets through trade with the rest of the world made by home firms, financial intermediaries and households (Ca'Zorzi, *et al*., 2020). On the balance sheet effects, with a higher interest rate that raises the funding cost of major global banks, can deteriorate borrowing conditions to domestic financial intermediaries (Degasperi, *et al*., 2020). This will affect firms with a higher discount factor and decline expected cash flows, lowering asset values and changing their balance sheet structure (Ca'Zorzi, *et al*., 2020).

On fiscal policy, the financial channel, is related to the impacts on sovereign debt that will trigger a reaction on the stock markets and the development of this markets have an impact on economic activity (Bonatti *et al*., 2021).

2.4.2 Empirical literature

In literature, we have works in monetary spillovers and other in fiscal spillovers. On the international monetary spillovers, Bhattarai, Chatterjee and Park (2017) analyzed the impact of US monetary policy shocks on fifteen major emerging market economies (EME), from 1984 to November 2015. They show that a contractionary US monetary policy shock leads to an increase in long-term country spread and short-term policy rate, and a depreciation of the exchange rate, of the EME, declining their domestic stock prices and capital inflows. Ono (2017), studied the effect of US conventional and unconventional monetary policies to Russian financial markets, from 2004 to 2016. He observed that a contractionary monetary policy shocks, with both conventional and unconventional measures, decrease stock prices whereas, expansionary monetary policy shocks does not increase stock prices. Miranda-Agrippino and Nenova (2022), from the period of 1999 to June 2019, focus their paper on the international spillovers of ECB and Fed unconventional monetary policies. They found out that, contractionary monetary policies, in both economies, contracts global activity and trade, restricting global capital flows, decreasing global stock markets, and a rising risk aversion. They also observed that the spillovers are bilateral and spread internationally

through the trade and risk-taking channels but, in the first one, the magnitude of ECB spillovers is smaller than Fed's and the second, they equally powerful.

Suurlaht (2021), studying the impact of unanticipated changes in domestic and foreign monetary policy on aggregate stock market performance and risk in France, Germany, Italy, Spain and the UK, from 1999 to 2018. She finds that, contractionary monetary policy surprises decrease stock market returns and increase financial market risk, during recessions and periods with low sentiment.

On international fiscal spillovers, Barrell, Holland Liadze and Pomerantz (2007), for 13 EU economies, from 1968 to 2004, and conclude that a fiscal expansion in one country affects export demand in its trading partners, affects interest rates and hence exchange rates if monetary authorities respond to the shock, and affects private sector wealth through its impact on debt and equity prices. Ilori, Paez-Farrell and Thoenissen (2022), using data from the late 1990s until 2019 for the United States and Germany, they find that an expansionary fiscal policy through the rise of government expenditures, increase the output, consumption and private investment. The effects of this policy go beyond internal movements and cross countries, like U.S. between the G7 countries and between Germany and other European countries, through international trade. Belke and Osowski (2016), from 1995 to 2015, using a Global VAR for 20 countries[2], they found that spillover effects of fiscal policy shocks originating in Germany or France are larger in Euro Area member countries than for non-member countries in Europe, measuring the impact of government expenditures, public revenues and government budget balance, on GDP. Gros and Hobza (2001), with data from 2001 to 2010, studying the impact of a fiscal expansion in Germany on the rest of the euro area, found that the transmission channels of the financial market of international, in most of the cases, it seems to override the impact the trade channel, measuring the impacts on macro variables, like consumption, investment, output, GDP, interest rate and exchange rate.

Studying, both policies, we find Santos (2017), that analyzed spillovers of fiscal and monetary policies of the US, UK, EA and Japan, with the variables government expenditure and M2 money aggregate, on Shanghai stock returns. In the period of 1996 to 2015, he finds out that, there are significant spillovers of the monetary policy of US has positive impact

[2] Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

and the fiscal has negative impact on Shanghai stock returns and the Japanese monetary policy also have a negative impact with China.

There are few empirical studies that analyze the impact of fiscal and monetary policies on stock market prices for European countries and none, to the best of our knowledge, covering international policy spillovers on the stock market.

In this context, we propose to study how demand-side policies affect the stock market prices in the Eurozone. These countries have very particular characteristics: i) they share a common monetary policy while ii) keeping decentralized fiscal policies and iii) are highly economically integrated, which makes them prone to international fiscal spillovers.

In the following sections we will present the data and the Vector Autoregressive method and apply to a panel of 12 EMU countries, a standard methodology used in the empirical literature, interpreting the results.

3. DATA AND METHODOLOGY

This paper is framed within the scope of Economics and Finance, aiming the impact of economic policies on the stock markets prices. Focusing on EMU countries, the literature review above was carried out at a conceptual and empirical level, to explain the mechanisms of policy propagation and to summarize the results that other authors obtained. In this section we will make a brief description of the selected data, the variables and the method that we will use to carry out the empirical tests.

3.1 Data and variables

On this dissertation it is used quarterly data from 1999Q1 to 2021Q4 of 12 European countries, Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. These countries were selected for the year they joined the European Union, but above all because they were the first countries in the EMU (the euro was born on 01/01/1999, although Greece joined later on 01/01/2001). This allows us to have a longer time frame and use as much data as possible.

Following the work of Chatziantoniou, *et al.* (2013) we include on the model, the Gross Domestic Product (GDP) and Harmonized Index of Consumer Prices (HICP), Government expenditure (G) as a proxy for the fiscal policy stance, and two stock market indices - a Price Index (PI) and a Returns Index (RI). In turn, as a proxy for conventional and non-conventional ECB monetary policy, we use the Shadow Short Rate (SSR) for the Euro Area of Krippner, data from 2021, while, the Average of Government spending (AVG_G), accounts for the government spending spillover emanating from other countries, a proxy for the fiscal policy international spillover.

There is no consensus on the literature on which is the better variable to represent the fiscal policy stance. Following among others Chatziantoniou, *et al.* (2013), we have chosen government spending instead of taxation or fiscal deficit. One of the advantages of using government spending over tax revenues is that the former is much less influenced by contemporaneous changes on economic activity than the latter.

The Shadow Short Rate (SSR) for the Euro Area was used for the monetary policy stance, because it helps to identify monetary policy shocks that better reflect the unconventional policy measures (Lombardi & Zhu, 2014) and ECB has been applying these non-standard

monetary measures since 2009. In this regard of using of the shadow interest rate we follow recent literature (*e.g.*, Creel & Herradi, 2020; Evgenidis & Papadamou, 2020).

We follow Auerbach and Gorodnichenko (2013) by using bilateral trade as a measure of inter-country linkages, to aggregate national fiscal policies and account for the international fiscal policy spillover. For each country *i*, the Average of Government expenditure (AVG_G_i) intends to capture the spillover on country *i* of the fiscal policies of the other countries.

Using these variables, to provide a clearer view of non-seasonal trends and cyclical data and to have more meaningful comparisons of economic conditions from period to period, all variables are seasonally adjusted. Table 1, describes the variables used on the models, as well as the source of the data.

Table 1 - Variables description

Variable	Definition	Source
GDP	Seasonally adjusted Gross Domestic Product measured by Chain linked volumes (2010), million euros	Eurostat
HICP	Harmonized Index of Consumer Prices (2015 = 100). The variable was seasonally adjusted using the Eviews' STL decomposition command	Eurostat
G	Seasonally adjusted Government expenditure measured by Chain linked volumes (2010), in million euros	Eurostat
PI and RI	Stock market Price Index, based on quotations and without dividends, and Returns Index, including dividends. Both variables were seasonally adjusted using the Eviews' STL decomposition command	DataStream
SSR	Shadow Short Rate for the Euro Area. The variable was seasonally adjusted using the Eviews' STL decomposition command	Krippner
AVG_G_i	$AVG\_G_i = \sum_{j \neq i} G_j \times {X_{i,j}}/{X_i}$, where ${X_{i,j}}/{X_i}$ represents the exports from country *i* to *j* in country *i*'s total exports	Eurostat for G and UNCTAD for X

Source: own elaboration.

The next step is to analyze the descriptive statistics of the data, where its shown, on Table 2, the mean, median, maximum, minimum, standard deviation and the number of observations.

Table 2 - Variables descriptive Statistics (Common Samples)

	AVG_G	***G***	***GDP***	***HICP***	***PI***	***RI***	***SSR***
Mean	76387.16	40975.27	195890.5	92.06912	1125.999	3883.356	0.550319
Median	75316.91	17899.45	81524.15	93.95504	857.0894	2070.628	0.582056
Maximum	121316.0	163684.2	750021.2	111.9305	4352.973	22911.27	4.876995
Minimum	47877.76	1150.500	7193.900	67.31609	111.2771	151.2275	-3.769178
Std. Dev.	13009.64	42763.41	205368.5	10.43598	869.5429	4222.899	2.445844
Observations	1084	1084	1084	1084	1084	1084	1084

Source: own elaboration; Notes: Observations is the number of observations[3], Mean is the average value, Std Dev is the standard deviation.

Analyzing Table 2, given the amplitude between values on the data, we will apply a natural logarithm to all variables, except for the SSR.

3.2 Methodology

This study attempts to explore how stock market prices responds to monetary and fiscal policies, both at country level or resulting from international spillovers effects.

To address this, we rely on impulse reaction functions of stock prices to three policy shocks faced by the Euro Area-12 (founding) countries: an interest rate of common monetary policy shock, a country specific shock in government spending and a shock in (average) government spending resulting from fiscal policies taken place in the remaining euro area partners. IRF are driven by a reduced-form of a Vector Autoregressive (VAR) model that capture the dynamic relationships between all variables as they are treated in the system as fully endogenous (*e.g.*, Hsing & Hsieh, 2004; Quresshi, Hussain, Khan, Rehman, Qureshi & Ghafoor, 2019).

Since our data covers for several countries with observations over a period of time, it allows the use of a most suitable model, a Panel Vector Autoregressive (PVAR), instead of a VAR applied to the Euro Area as a whole. A PVAR allows to explore the dynamic interactions of

[3] On the sample the period of 1999Q1 to 2000Q4 for Greece and 2021Q4 for all countries was not considered due to the lack of data.

several entities at the same time because they "are often deeper than standard VAR models since they not only examine the interaction between variables naively, as a conventional VAR model would, but they also add a cross-subsectional structure to the model" (Zungu & Greyling, 2022, p.3). These models are able to combine the characteristics of a VAR with techniques from a panel dataset, that allows to the panel setup to better control for unobserved heterogeneity and endogeneity in a setup where all variables are treated as endogenous (Love & Zicchino, 2006). Moreover, *e.g.*, Agnello and Sousa (2013) also mention the advantage that a PVAR increases the efficiency of the statistical inference, since a VAR estimation at a country/group of countries-level would suffer from a reduced number of degrees of freedom due to the shortage of available data. With a PVAR, the model gains degrees of freedom by examining a panel of countries and helps to improve the modeling of spillovers from one country to another, since it captures country-level heterogeneity (*e.g.*, Bouvet, Brady & King, 2013). Finally, PVAR models seem to be particularly suitable for the study of the policy impacts, as they are able to "(i) capture both static and dynamic interdependencies, (ii) treat the links across units in an unrestricted fashion, (iii) easily incorporate time variations in the coefficients and in the variance of the shocks, and (iv) account for cross sectional dynamic heterogeneities" (Canova & Ciccarelli, 2013, p. 2).

Indeed, our objective is to capture fiscal and monetary policies effects on stock market prices. Besides including in the PVAR policy and stock market prices variables, we also include other relevant variables that are direct determinants of stock prices, and are, simultaneously, affected by and targets to which policies react (namely, output and inflation). In particular, the general reduced-form of the PVAR is given by equation (1):

$$Y_{i,t} = \sum_{k=1}^{K} \sum_{p=1}^{P} Y_{k,i,t-p} + \alpha_i + dummy_{crisis} + \varepsilon_{i,t} \qquad (1)$$

Where *k* refers to first differences of log GDP, G, AVG G, HIPC, either PI or RI, and to changes (in percentage points) of SSR. $Dummy_{crisis}$ is included in some of the specifications and account for the pandemics period (2020-2021) and the 2008-2009 economic and financial crisis. Indexes *i* and *t* capture cross-section and time dimensions, respectively, and *p* represents the optimal number of lags for endogenous variables, variable across alternative estimation methodologies.

In the baseline specification, the Least Squares Dummy VAR estimator is employed, in which country time-invariant characteristics are accounted for by including country fixed

effects, α_i. However, OLS or fixed-effects estimations in the presence of lagged dependent variables in the right-hand side of the system of equations, will possibly render estimates biased even with a large number of cross-sectional units (Nickell 1981). For this estimation method, optimal lag choice will be detailed below with a lag selection test.

Thus, the bias arising from the correlation between the lagged endogenous variables and the unobserved time invariant components is tackled through the use of the Panel VAR GMM estimator proposed by, *e.g.*, Love and Zicchino (2006) and Abrigo and Love (2016), for robustness because, even if the sample size is small (i = 12), the length of the series (23 years, with quarterly frequency, t) makes the time dimension quite large to imply negligible Nickell bias. This estimator uses as instrument for the endogenous lagged terms, the past lags of the variables. In particular, we choose lags 2 to 8 as instruments and set p=1 as optimal lag for endogenous variables, for this estimation method, relying on Andrews and Lu's (2001) Model and Moment Selection Criteria (MMSC) tests adapted to the GMM estimator. Moreover, in this setup, we remove fixed effects, correlated with the lags of the dependent variables, by using the "Helmert procedure" (Arellano & Bover, 1995), through which the panel-specific fixed effects are removed using forward orthogonal deviation (FOD), i.e., it subtracts the average of all available future observations, thereby minimizing data loss. Because past realizations are not included in this transformation, this procedure still allows to use the lags of the regressors as instruments to estimate the coefficients by system GMM (Blundell & Bond, 1998), preserving the orthogonality between the transformed variables and the lagged regressors (Agnello & Sousa, 2013). Finally, our specification includes, dummy variables for the 2008-09 quarters and the pandemic crises, quarters 2020-21. Regarding software application, we use Abrigo and Love built-in tools in STATA 17.

A third alternative estimation procedure is also followed, for robustness purposes, to account for potential problems arising from the presence of cross-sectional dependencies and dynamic heterogeneities in multi-country panels, by using the panel structural VAR (PSVAR) method developed by (Pedroni, 2013). First, failing to control for dynamic heterogeneity, estimation of average dynamic responses to shocks among the countries in the panel becomes inconsistent; second, without controlling for cross-sectional dependence, inference about such responses becomes inconsistent as well (*e.g.*, Montiel & Pedroni, 2019). On this method, we choose the maximum of 8 lags as instruments and p is set as optimal lag for endogenous variables by the statistic program selected. This procedure relies

on “a structural decomposition of shocks into common type shocks versus idiosyncratic type shocks, as well as into the component shocks within each of these types” (Pedroni, 2013, p. 181). Regarding software application, we use built-in package available in E-VIEWS 12.

3.2.1 Identification Strategy

Cholesky

Either in OLS accounting for fixed effects estimations and the GMM PVAR, we rely on Cholesky decomposition to impose a recursive structure on the PVAR. We assume ordering AVG G ➡ GDP ➡ HIPC ➡ G ➡ PI(or RI) ➡ SSR, i.e., contemporaneously, external, overall, fiscal policy shocks are exogenous, while monetary policy fully reacts, contemporaneously, to all the remaining endogenous variables; this ordering assumes that country specific fiscal policy reacts to both external variables and internal macroeconomic conditions (output and inflation) while the common monetary policy reacts to both overall fiscal policies and macroeconomic conditions, an also to stock market prices capturing supervision of financial markets to ensure financial stability. Apparently, results are not sensible to alternative orderings.

Structural VAR

Since VAR approach relying on (alternative) Cholesky decompositions is too restricted in (triangular, recursive) identification of structural shocks (Qin, 2011), we also estimate a Structural Vector Autoregressive (SVAR) model that allows, through the inclusion of more general structural restrictions from theory, to analyze casual relations between the variables. Results are not, however, very distinct from the PVAR estimation following Cholesky decomposition.

Regarding the PSVAR of Pedroni (2013), the methodology differentiates common and idiosyncratic elements of a global shock (Garcia-Singh, Thomas & Persad, 2021). This method decomposes shocks into a common structural shock that causes them, as well as in specific idiosyncratic structural shocks of each country (Pedroni, 2013). Besides being better suited for a number of panel data types then the others SVAR models because the responses to common structural shocks have heterogeneous dynamics and cross-sectional dependencies, Pedroni’s approach enables to obtain consistent estimates of the quantiles of the heterogeneous country-specific impulse responses for both idiosyncratic and common

structural shocks and also for composite shocks (*e.g.*, Montiel & Pedroni, 2019) evidencing potential heterogeneity in stock market prices responses across countries to alternative policy shocks. This feature provides insights on potential different transmission mechanisms across countries, allowing to detect "which shocks will be consistent across countries while accommodating the observation of distinct outcomes as well" (Garcia-Singh, *et al.*, 2021, p. 5).

3.3 Preliminary tests

On this section we perform some preliminary tests on data to check the presence of cross-section dependence and the need of transforming variables to ensure their stationarity. We also apply tests to choose the optimal lag length for the PVAR estimation stage.

3.3.1 Cross-section dependence and unit root tests

Before checking stationarity, we test the existence of cross-section dependence in the panel through the Pesaran CD test.

Table 3 - Cross-section dependence

	AVG_G	***GDP***	***HIPC***	***G***	***PI***	***RI***	***SSR***
Variables in level (in logarithms)							
Pesaran CD.	60.66502	46.78522	75.71993	46.63801	30.37305	45.00287	76.91757
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: EVIEWS 12; Notes: All variables are in natural logarithms except SSR.

The Table 3 presents the cross-section dependence Pesaran CD test, for all variables. The null hypothesis is that there is no cross-sectional dependence, that is, there is no contemporaneous correlation in the residuals between the disturbances in different cross-section units. The results of the test for all variables are of zero probability. Therefore, the null hypothesis of cross-section independence is rejected and the alternative hypothesis of cross-section dependence is accepted.

First generation unit root tests are based on the assumption that there is no cross-sectional dependence. These tests may not be efficient, if that assumption is violated. Therefore, unit root tests second generation were developed in order to deal with the presence of the phenomenon of dependence sectional in the panels.

Table 4 reports the results for applying traditional, first generation, unit root tests of Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for all variables in levels and first difference. It also reports the results of applying the second order generation unit tests, the Cross-sectional Augmented Im-Pesaran-Shin (Pesaran CIPS), which assumes cross-sectional dependence.

Table 4 – Unit Root tests

	AVG_G	***GDP***	***HIPC***	***G***	***PI***	***RI***	***SSR***
Panel A: variables in level (in logarithms)							
Cross-sectionally independent							
ADF-Fisher Chi-square	17.7141	33.3319	28.5680	27.7882	28.3735	14.0295	9.03598
P-value	0.8167	0.0973	0.2368	0.2691	0.2446	0.9460	0.9975
PP-Fisher Chi-square	19.2991	32.5115	49.1701	22.1146	23.6632	10.4295	6.73047
P-value	0.7359	0.1148	0.0018	0.5724	0.4810	0.9925	0.9998
Cross-sectionally dependent							
Pesaran CIPS Stat.	1.92974	-0.91921	-1.91651	-1.63097	-0.95053	-1.31762	-18.47060
P-value	>= 0.10	>= 0.10	>= 0.10	>= 0.10	>= 0.10	>= 0.10	< 0.01
Panel B: variables in first differences (in logarithms)							
Cross-sectionally independent							
ADF-Fisher Chi-square	240.778	270.002	216.163	230.060	375.006	373.388	372.382
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PP-Fisher Chi-square	323.525	254.855	343.565	276.154	371.505	369.032	365.038
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cross-sectionally dependent							
Pesaran CIPS Stat.	-5.92713	-5.28875	-2.69311	-6.93861	-5.46041	-5.54747	-40.02142
P-value	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Source: EVIEWS 12; Notes: All variables are seasonally adjusted; Tests are performed with the constant without trend.

For all tests, the null hypothesis is that the variables have a unit root and the alternative hypothesis is that the variables are stationary. From observation of Table 4, we conclude that, with the exception of SSR, all variables are non-stationary in level while stationary on first-difference, for both type of tests. From the Pesaran CIPS test, SSR is already stationary in level.

Therefore, we will transform variables and take their first difference, to ensure that they become stationary and can be used properly in the estimation stage.

3.3.2 Lag selection test

Akaike Information Criterion (AIC), Schwartz information Criterion (SC) and the Hannan-Quinn information criterion (HQ) are referred in literature as appropriate to the selection of the optimal lag lengths (Adeleke, 2021). Based on PVAR estimations, we performed lag selection tests reported in tables 5 and 6. Table 5 reports tests based on PVAR estimation with the stock market price index variable (PI), while Table 6 reports the same tests with the stock market returns index variable (RI).

The best lag selection criteria is the smallest number of lag terms (parsimony), which in this case is the Schwartz information criteria and the Hannan-Quinn information criterion that give us an optimal lag length of four lags to be chosen for both models as its shown, on Table 5 and Table 6.

Table 5 - Lag selection test with PI

VAR Lag Order Selection Criteria

Endogenous variables: AVG_G, GDP, HICP, G, PI, SSR
Exogenous variables: @EXPAND(@CROSSID)
Date: 10/14/22 Time: 12:19
Sample: 1999Q1 2021Q4
Included observations: 976

Lag	LogL	LR	FPE	AIC	SC	HQ
0	11740.41	NA	1.66e-18	-23.91068	-23.55042	-23.77359
1	11985.34	480.8166	1.08e-18	-24.33880	-23.79842	-24.13318
2	12116.85	256.5676	8.91e-19	-24.53454	-23.81403	-24.26037
3	12238.04	234.9248	7.48e-19	-24.70910	-23.80846	-24.36639
4	12433.24	375.9991	5.40e-19	-25.03533	-23.95456*	-24.62408*
5	12498.09	124.1270	5.09e-19	-25.09446	-23.83356	-24.61466
6	12551.08	100.7552	4.92e-19	-25.12926	-23.68824	-24.58092
7	12615.28	121.2927	4.64e-19	-25.18704	-23.56589	-24.57017
8	12703.73	166.0385*	4.17e-19*	-25.29454*	-23.49326	-24.60912

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Estimation made on the EVIEWS 12; Notes: All variables are in first difference and expressed in natural logarithms with the exception of the shadow short rate.

Table 6 - Lag selection test with RI

VAR Lag Order Selection Criteria

Endogenous variables: AVG_G, GDP, HICP, G, RI, SSR
Exogenous variables: @EXPAND(@CROSSID)
Date: 10/14/22 Time: 12:21
Sample: 1999Q1 2021Q4
Included observations: 976

Lag	LogL	LR	FPE	AIC	SC	HQ
0	11758.71	NA	1.60e-18	-23.94818	-23.58792	-23.81109
1	12010.62	494.5237	1.03e-18	-24.39061	-23.85023	-24.18499
2	12132.60	237.9546	8.63e-19	-24.56679	-23.84628	-24.29263
3	12255.65	238.5452	7.22e-19	-24.74518	-23.84455	-24.40248
4	12452.81	379.7685	5.19e-19	-25.07542	-23.99466*	-24.66417*
5	12519.36	127.3741	4.88e-19	-25.13803	-23.87713	-24.65824
6	12570.55	97.35255	4.73e-19	-25.16916	-23.72814	-24.62083
7	12633.74	119.3937	4.47e-19	-25.22489	-23.60374	-24.60801
8	12720.15	162.1800*	4.03e-19*	-25.32817*	-23.52689	-24.64275

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Estimation made on the EVIEWS 12; Notes: All variables are in first difference and expressed in natural logarithms with the exception of the shadow short rate.

4. EMPIRICAL RESULTS

In this section we analyze the impulse response functions (IRF) from stock market prices to three alternative policy shocks – domestic and external fiscal policy and common monetary policy. The IRF of one variable show the response of that variable to shocks in other variables of the VAR specification. Results are summarized and analyzed for alternative estimation methodologies that correspond to baseline PVAR, GMM correction for endogeneity and a PSVAR correction for cross-sectional dependencies and dynamic heterogeneities in multi-country panels.

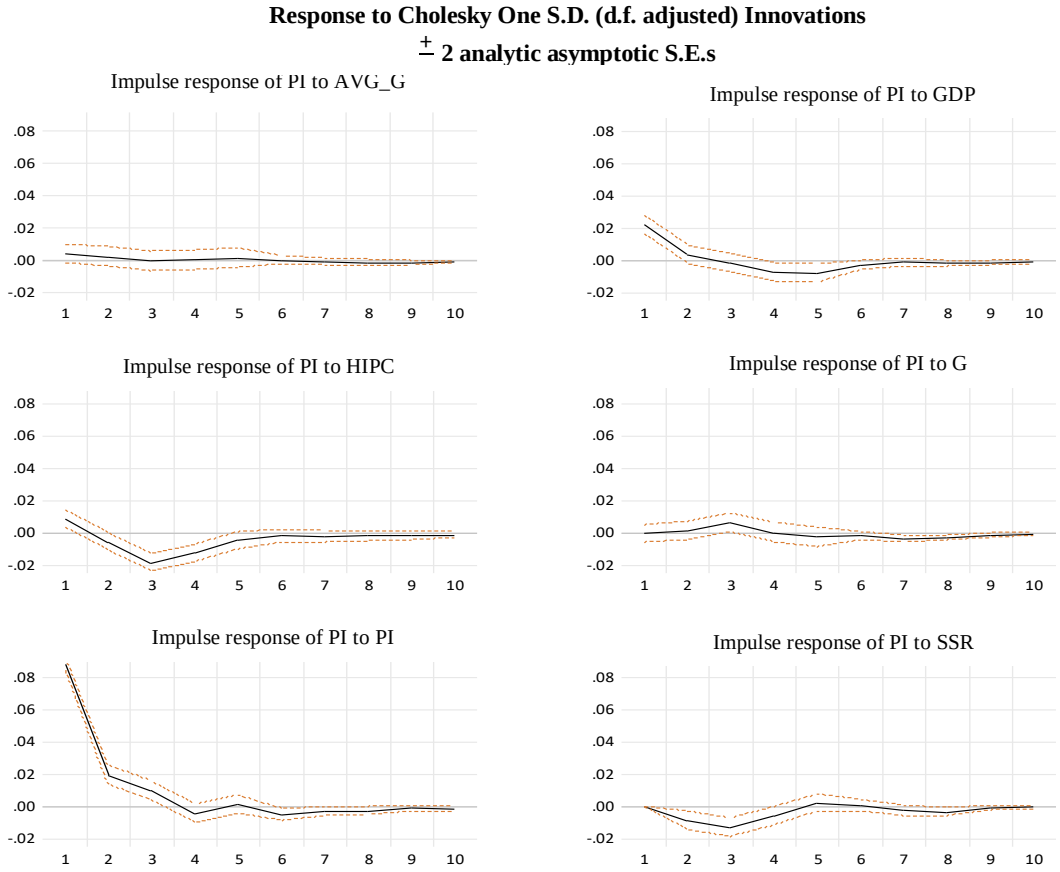
If no restrictions are imposed, the hypothesis are formulated in a way that the order of the variables matter, that is, the variables in the front of a VAR affect earlier variables simultaneously or with a lag (weakly exogenous) and the ones that are on the end only affect the following ones only with a lag. Assuming that the "neither the monetary policy shock nor the stock price shock has any important contemporaneous effect on the other variables" (Bjornland & Leitemo, 2009, p.278), we will use on our ordering for the VARs estimation a similar to the work of Chatziantoniou *et al.* (2013): AVG_G, GDP, HIPC, G; PI (or RI) and SSR.

4.1 Estimations with PI variable

4.1.1. Overview of policy impacts on stock market prices

Figure 1 shows the IRF resulting from the baseline PVAR estimation, using the Cholesky default decomposition, with the ordering defined in chapter 3, section 3.2.1. IRF show how stock markets prices, as measured by PI, react to shocks in AVG_G, G and SSR, and additionally to HIPC and GDP.

Figure 1 – Impulse responses of PI to policy shocks in Euro Area (baseline PVAR)



Source: Estimation made on EVIEWS 12

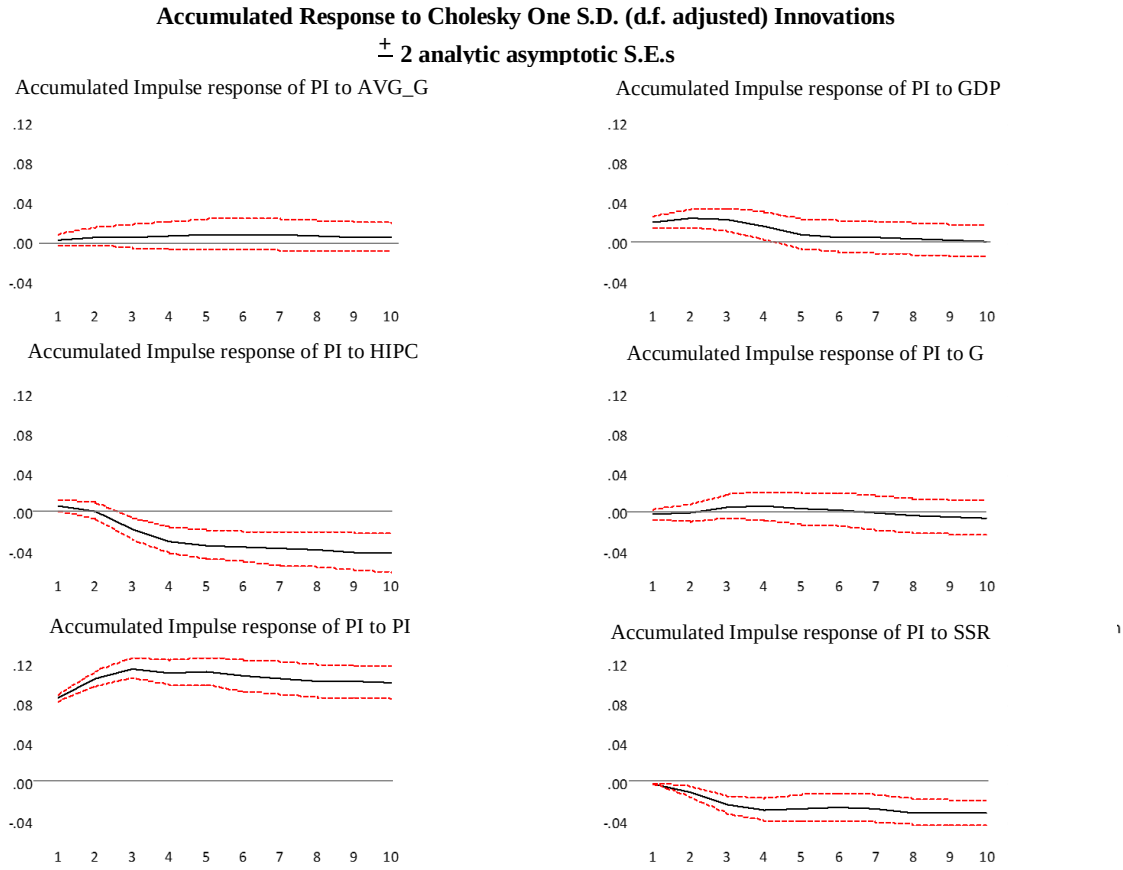
The results on Figure 1 show that monetary policy has a statistically significant impact on stock prices in the selected Euro Area countries, as a whole. A contractionary monetary policy - that makes the interest rate to rise - decreases the stock market prices growth (until 4 quarters). These results are in accordance with the literature, *e.g.*, Stoica and Diaconasu (2012); Lütkepohl and Netšunajev (2018).

In regards to fiscal policy, represented by government expenditures, we analyze both cross-country (AVG_G) and domestic (G) spillovers on stock market prices. As for an international government shock, although exhibiting instant (Q1) positive and significant spillovers on a country's GDP (see Figure 1B, in annex B), effects are non-significant on stock prices (Figure 1) and inflation (Figure 1B). Also, domestic government shocks have no significant impacts on stock prices, except for Q3, with a positive impact; indeed, impacts on GDP are also estimated as close to zero, except on Q4 with a significant positive impact, a pattern similar to what is observed on the HIPC (Figure 1B).

Additionally, focusing on the responses of stock prices to other variables, Figure1 suggests that they react positively to GDP (until Q2), exhibiting also a positive response to a HIPC shock in Q1, then negative on the Q2 and neutral from 5Q onwards.

As for the effects of a stock market shock on fiscal and monetary policy variables, there is evidence of a positive and significant impact on SSR but a non-significant impact on both fiscal policy variables (Figure 1B).

Figure 2 - Accumulated impulse responses of PI to policy shocks in the Euro Area (baseline PVAR)



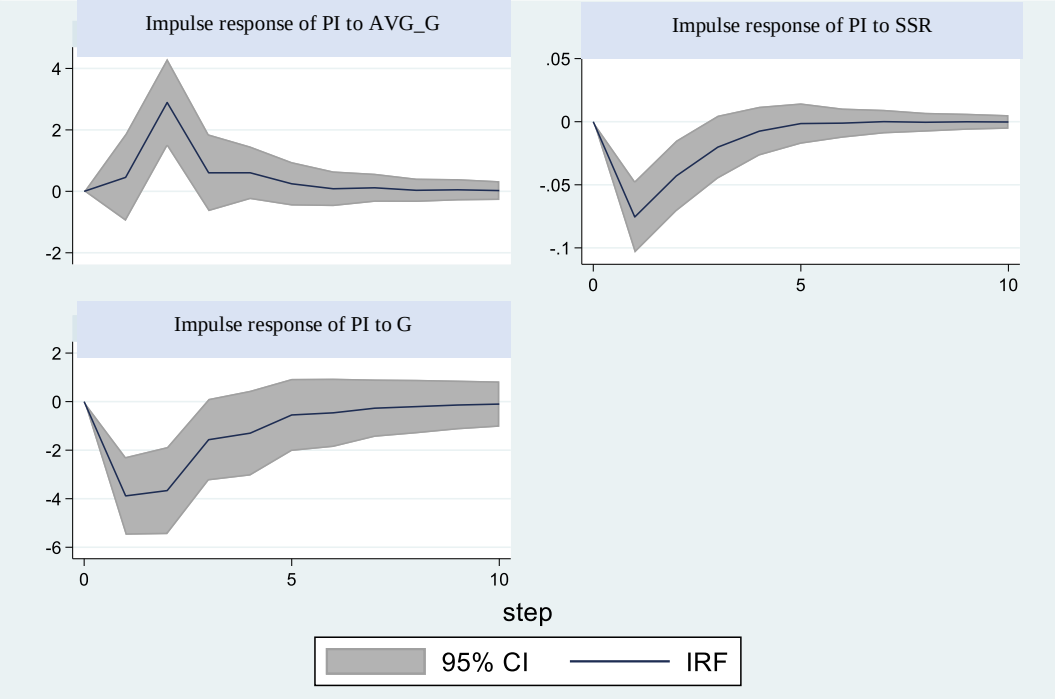
Source: Estimation made on EVIEWS 12

From Figure 2, we see that, although the impact of domestic fiscal policy was significant on Q3, its cumulative impact is close to zero, not affecting the stock market prices. Fiscal policy spillovers are not significant too. In turn, monetary policy affects PI in a gradual and progressively stronger way until Q3. The shock in GDP growth, accelerates stock prices growth, bringing positive effects, relative to steady-state, until Q4; inflation shock, although exhibiting an initial positive impact on PI, average impact was negative and statistically significant.

In order to check the robustness of stock market prices responses to policy shocks, we used alternative estimation methods.

Figure 3 shows the de impulse response of stock prices (PI) to policy shocks, resulting from a PVAR estimation correcting for endogeneity, by using the PVAR GMM estimator proposed by Love and Zicchino (2006) and Abrigo and Love (2016).

Figure 3 – Impulse responses of PI to policy shocks in the Euro Area (GMM PVAR)



Source: Estimation made with STATA 17

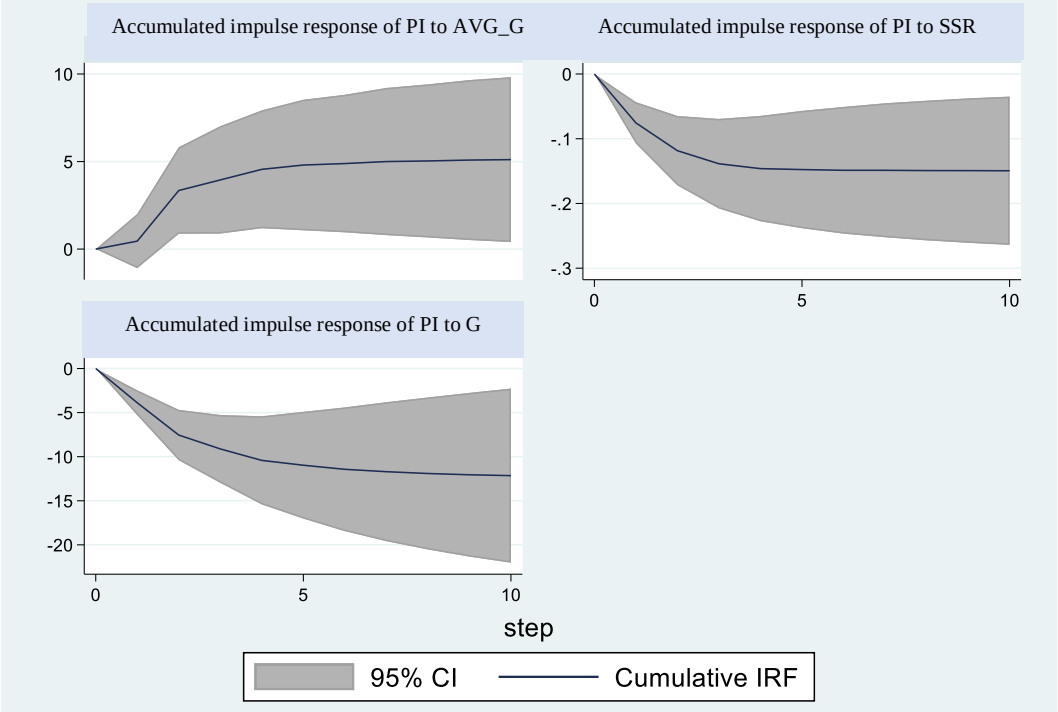
At odds with what happened at the baseline PVAR, here fiscal policy shocks have statistically significant impacts on PI.

From Figure 3, monetary and external fiscal policy have the same qualitative impacts on PI as the ones from the baseline PVAR method. When the monetary policy is contractionary, stock price growth declines (until before Q5 - similar in PVAR). An expansionary fiscal policy, where national government expenditures rise, now depresses stock market prices while the international spillover effect, due to an increase of the external government expenditures, makes the opposite effect, stimulating stock prices.

According to Agnello and Sousa (2010) a positive shock on the internal fiscal policy may impact negatively at the stock market prices because it leads to as increase on the interest rate, potentiating the cost of the debt refinancing. The positive impact of AVG_G shock to

stock market price may be via trade. According to Beetsma *et al*., (2006), domestic fiscal expansions, boosts the output (GDP rises with a shock of G), stimulating the imports of that country and other countries exports (AVG_G rises with a shock of G) and consequently produce positive impact on GDP (GDP rises with a shock of AVG_G) that may rise the PI. The negative impact of national fiscal policy can be explained via interest rate (G immediately rises the SSR) that pull the stock prices down.

Figure 4 – Accumulated impulse responses of PI to policy shocks in the Euro Area (GMM PVAR)

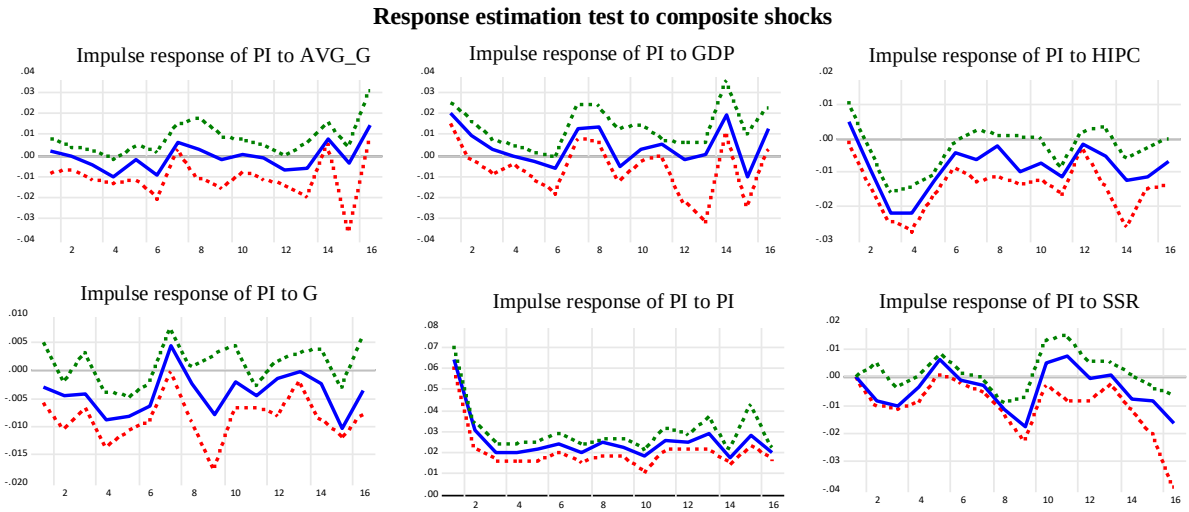


Source: Estimation made with STATA 17

Looking at the accumulated impulse responses of stock prices, Figure 4 shows that the negative effect of national government expenditures and the SSR and, the positive one of international fiscal policy, extend over time, up until around Q5.

Figure 5 shows the response of stock prices, to composite shocks of monetary and fiscal policies, under the estimation of a PSVAR following Pedroni (2013).

Figure 5 – Impulse responses of PI to policy shocks in the Euro Area (Pedroni's PSVAR)



Source: Estimation made on the EVIEWS 12

Blue lines depict median impacts. Green lines depict the top-25% largest responses while red lines refer to the bottom-25% lowest responses; distance between lines are a measure of the degree of heterogeneity of the responses to shocks across selected EMU countries.

Figure 5 confirms the same response of stock prices to a shock on the interest rate by the ECB. Like in the previous alternative estimation procedures, a positive monetary policy shock, depresses stock market prices until Q5; still, PI is rather unreactive to SSR in some countries in the short run.

As for the impacts of fiscal policy on stock prices, the immediate impact of accelerating domestic government spending seems to be negative (same on GMM estimates), possibly due to debt risks; however, effects across countries vary from negative to positive. External fiscal policy seems to have a median positive impact on PI in the short run (similar GMM outcome), but PI may also depress in some countries. Regarding to the effects of composite shocks on PI in the first quarters, Figure 5 shows a positive reaction with the growth of GDP and inflation (first, PI goes up but falls afterwards), similar to results using PVAR.

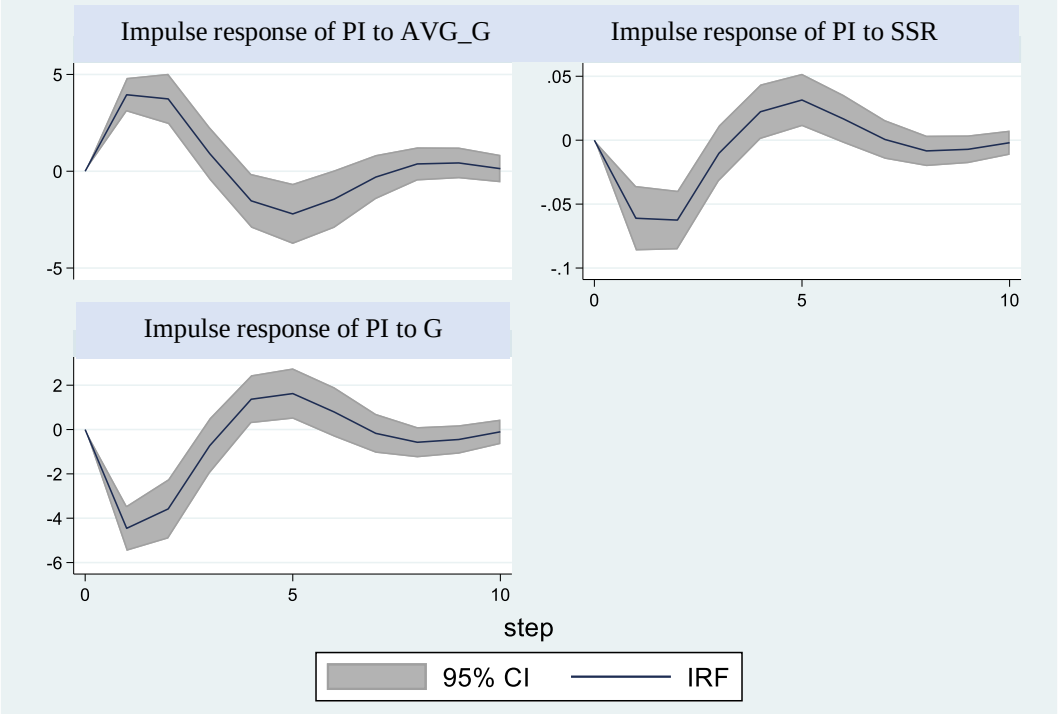
In sum, all estimated models show that when ECB rises the interest rate, stock prices react negatively. These results are expected and in accordance with most empirical literature *(e.g.*, Thorbecke, 1997; Ioannidis & Kontonikas, 2008; Caporale & Soliman, 2013) Results are less robust to fiscal policy spillovers on PI, as in some cases, they are statistically non-significant while, in other cases, they are significant. The origin of the fiscal policy shock seems to be relevant.

Results show that, in general, a positive domestic fiscal shock impacts negatively at stock market prices; while, a positive external fiscal shock has a positive impact but, statistically significant, only in GMM PVAR estimation.

4.1.2. A tentative inspection of heterogeneous effects from policy on stock market prices

Since Pedroni's PSVAR approach highlighted possible heterogeneity of the effects of policy on stock market prices across countries, we propose to test if transmission mechanisms operate the same way in Portugal, Italy, Ireland, Greece and Spain (PIIGS). These countries, after the European debt crisis, were considered economic vulnerable with a growing debt because they had high or growing indebtedness and high public deficit in relation to GDP.

Figure 6 - Impulse responses of PI to policy shocks in the PIIGS (GMM PVAR)



Source: Estimation made with STATA 17

Figure 6 indicates that the responses to both policies seems to be the same. The external fiscal shock shows a that the positive impact has a larger amplitude on the first periods and instead of stabilize when the impact loses its strength, it goes a little lower. We see that effect also in the internal fiscal policy and in the monetary policy, although the immediate impact is less than average-12. After the first negative impact, it goes further up.

4.1.3. The dynamics of other variables

PVAR estimation

Figure 2B (in the annex) plots the accumulated impulse responses for all variables. AVG_G reacts significant negatively to an increase on GDP, on HIPC (from Q4) and on PI (typically reflecting counter-cyclical average fiscal policy); it also reacts, apparently to compensate monetary policy impacts on output, positively to an increase of SSR. G increases with AVG_G (an effect possibly resulting from some cycle synchronization in the Euro Area), GDP and SSR but not significantly to HIPC and to PI. As expected, due to price stability concerns, SSR increases in face of a shock in GDP (until Q5), in HIPC (until Q5) and PI, but reaction is close to zero to AVG_G and G shocks.

Combining the response to the price level of monetary and fiscal policies, the first policy reacts to compensate for impacts on inflation, consistent with the findings of Chatziantoniou *et al*. (2013), while G is neutral and AVG_G reacts negatively. This means that facing inflation, the external government expenditures, has a negative response but, the internal fiscal policy (G), is not significant. In turn, monetary policy behaves contractionary when inflation accelerates. The HIPC, that rises with increases of SSR, can reduce the income of the individuals, boosting savings and postponing consumption (GDP goes down with inflation after Q2).

On the reactions of both policies to GDP, Figure 2B shows similar results to those found for the HIPC shock, with the exception of domestic government expenditures that behaves in a pro-cyclical manner, i.e., when GDP increases, government expenditures rise. These findings suggest that the two policies are behaving as substitutes (Van Aarle, *et al*., 2003). From the analysis of Figure 2B, we can also conclude that fiscal policies are expansionary in face of a contractionary monetary policy, but the SSR seems to be unresponsive to increases in government spending.

GDP reacts positively to AVG_G, PI, G (from Q3) and SSR (although with an initial fall), and moves significantly negatively to a shock in HIPC (from Q4 onwards). There is a positive impact on HIPC to a shock on GDP, G (significant after Q5), PI and SSR, not significant to AVG_G. The acceleration of GDP growth to shocks in domestic and external fiscal policy shocks is in line with the view that the rise in government expenditures leads to an increase in the domestic demand and, consequently, on output; it also pushes pressures on inflation and HIPC also accelerates. Moreover, the positive impact on inflation and output

in face of a shock in stock prices (PI) is consistent with the theoretical mechanism of the Q-Tobin effect and wealth effect through which an increase in real stock prices leads to a positive effect on investment and consumption, respectively, positively influencing aggregate demand.

GMM estimation

Figure 3B shows that inflation decelerates with the growth of SSR and with international government expenditures while accelerating with domestic fiscal policy. Output reacts similarly, with the exception of the impact due to international spillover that makes output to rise initially and then becomes insignificant over time.

Also, from Figure 3B, SSR seems to react negatively to domestic fiscal policies but is neutral to average policy of EMU countries. This negative reaction of the SSR is inconsistent with the crowding-out effect, may due to the fiscal variable chosen, government expenditures instead of public borrowing (Chatziantoniou et al., 2013). Domestic fiscal policy, in turn, appears to decelerate with AVG_G and to be unresponsive to monetary policy. These results differ from the estimates using baseline PVAR.

PSVAR Pedroni estimation

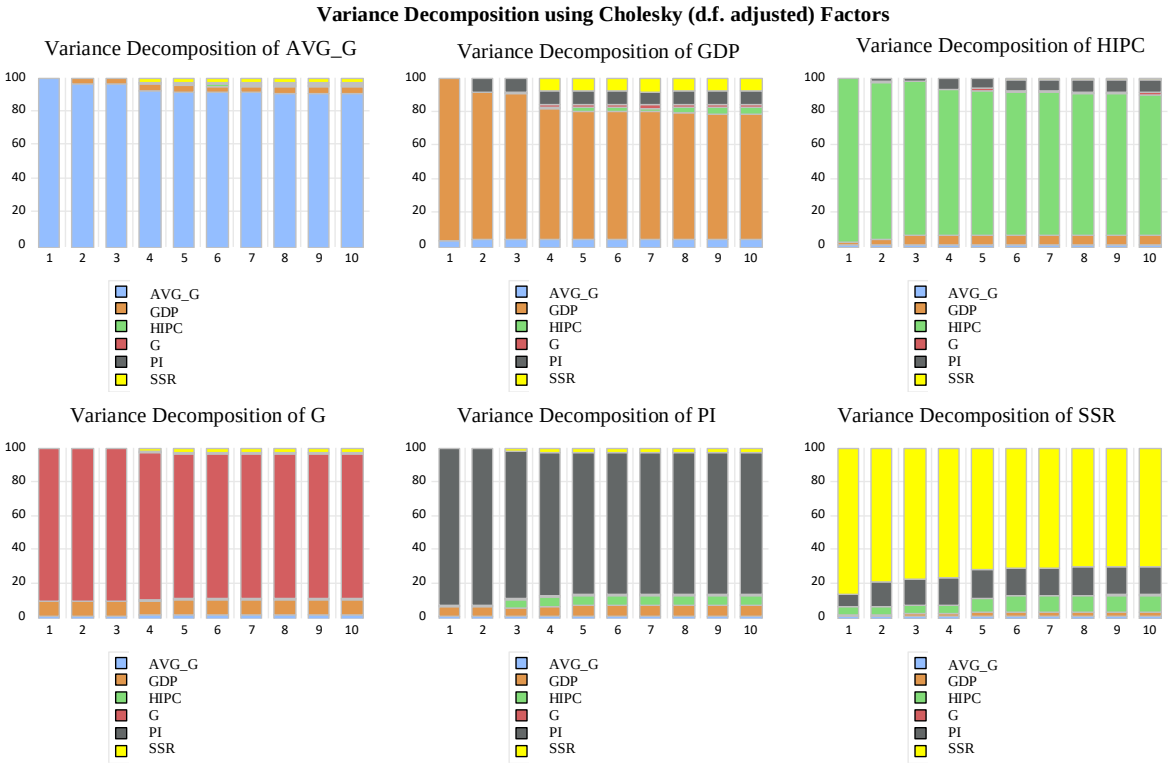
From Figure 5B, looking for the macroeconomic variables that represents the economy, GDP have an immediate negative response to SSR, but over a year, is positive. On inflation, a contractionary monetary policy makes inflation to fall initially. So, a contractionary monetary policy immediately reduces the GDP an HIPC.

A national expansionary fiscal policy reduces the output and temporarily increases the inflation that drops over time. Contrarily, an increase of the government expenditures by the other EMU countries, that rises GDP and is not significant on HIPC. The bidirectional relationship is verified on GDP because impacts positively on both policies (only on the internal component of fiscal policy) and HIPC immediately rises the interest rates, although temporarily, and drops the influence of external fiscal policies. This interaction shows that an enlargement on the size of the economy, potentiates the inflation, which can influence the ECB to raise the interest rate and the national governments to adopt procyclical policies, neutralizing the impact of external fiscal policies. But the raising of the HIPC discourages the positive cross-country spillovers of fiscal policy because it can make the country less attractive or change the bilateral trade.

4.1.4. Variance decomposition

The estimated PVAR variance decompositions show what proportion of the variance of the variables is explained by each variable in the system.

Graphic 1 - Variance decomposition of all variables using the model with PI



Source: Estimation made on the EVIEWS 12

Analyzing the variance decomposition of the stock prices, monetary policy seems to have a rising importance up to 3%, while, in regards to fiscal policy, domestic government spending contributes up to about 0.7% and external spillovers up to 0,35%, on the 10th period. So, policy variability has still short contribution to the volatility in stock market prices. Besides its own, volatility of PI arises most from inflation and output, that are, however, also determined by monetary and fiscal policies, and represent up to 1% and 8% respectively, for the monetary policy and 2% for the national fiscal policy.

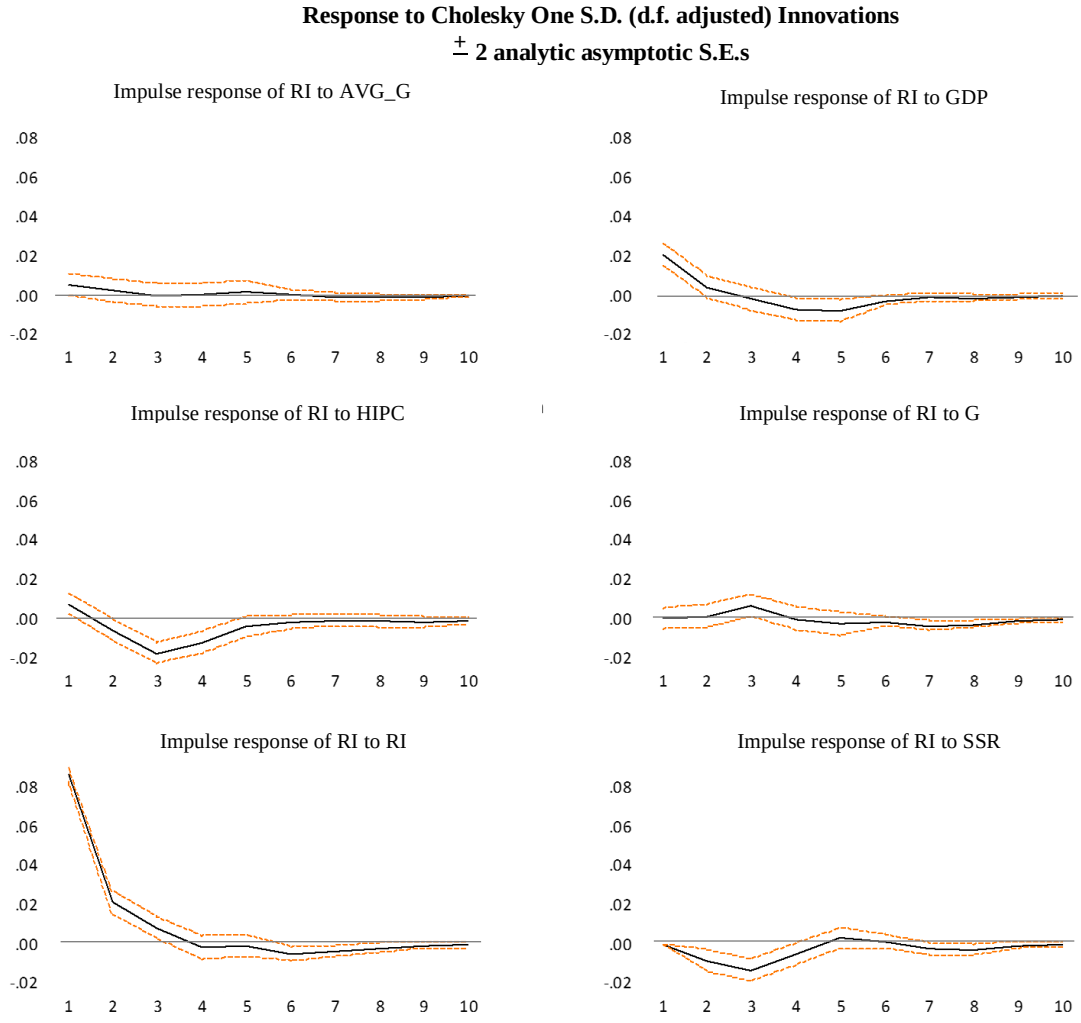
In turn, PI volatility contributes strongly to SSR variability, together with inflation. Lower contribution comes from GDP growth to SSR. Apparently, fiscal policy variance is not crucially determined by PI.

4.2 Estimations with RI variable

In this section we check the robustness of results to alternative stock market variables, substituting the stock market price index (PI) by the stock market returns index (RI). Figures 7, 8 and 9 display the impulse responses of RI to shocks under, respectively, baseline PVAR, GMM PVAR and Pedroni's PSVAR estimations.

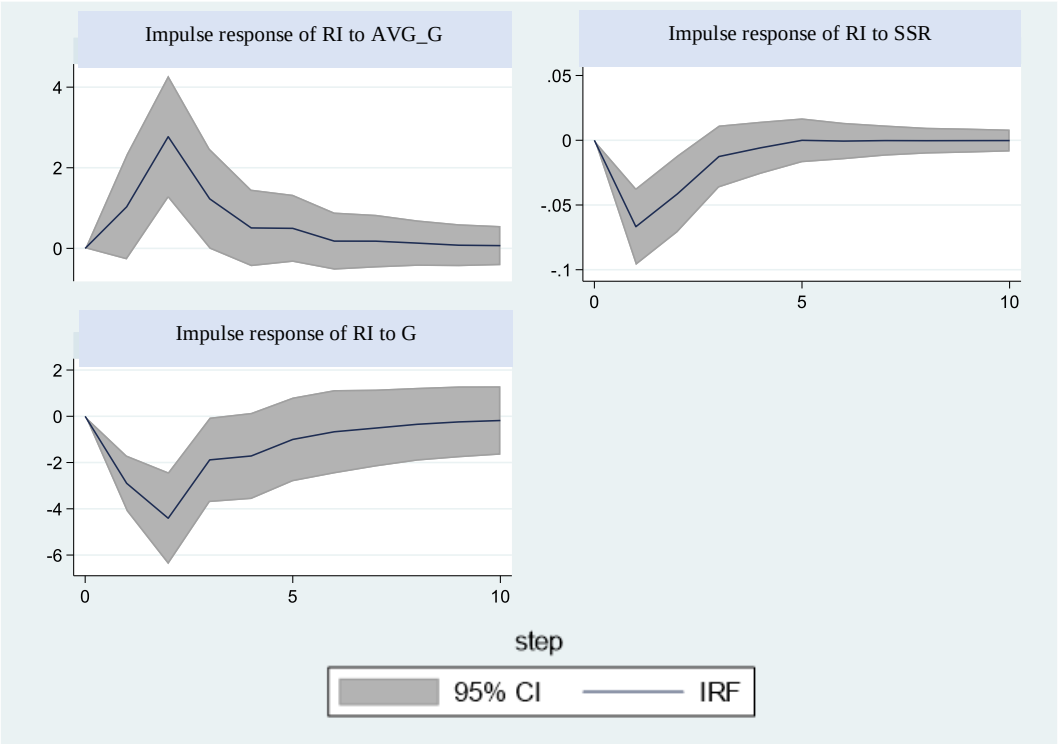
The observation of these figures allows us to conclude that results remain globally the same. In all estimations, a positive shock on the shadow rate depresses the stock market returns index. A positive domestic government spending (G) shock either impacts negatively on RI (GMM and PSVAR) or non-significantly (PVAR baseline). A positive external government spending (AVG_G) shock impacts positively on RI but, only significantly, under the GMM estimation.

Figure 7 – Impulse response of RI to policy shocks in the Euro Area (GMM PVAR)



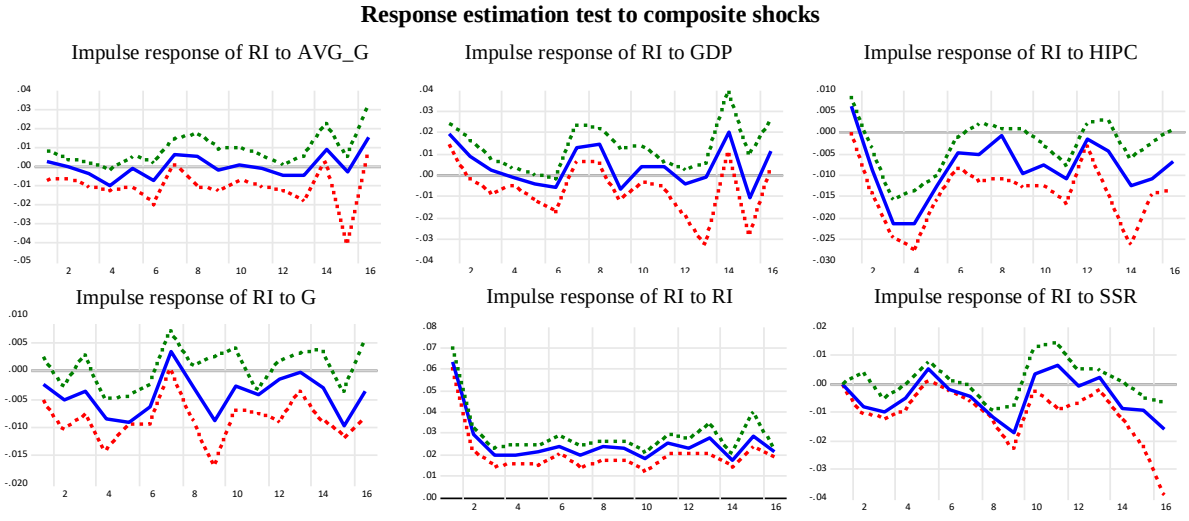
Source: Estimation made on the EVIEWS 12

Figure 8 - Impulse response of RI to policy shocks in the Euro Area (GMM PVAR)



Source: Estimation made with STATA 17

Figure 9 - Impulse response of RI to policy shocks in the Euro Area (Pedroni's PSVAR)



Source: Estimation made on the EVIEWS 12

5. CONCLUSION

With the growing importance of the globalization on financial markets and given the influence of monetary and fiscal policies in affecting macroeconomic outcomes, this study aims at exploring the impact of such policies on stock market prices together with the assessment of cross-country policy spillovers. By using quarterly data from a panel of selected Euro Area countries, 1999-2021, we try to address the following literature gaps: we assess the impacts: i) of demand-side policies as macroeconomic determinants of stock market prices, when literature mostly focus on microeconomic determinants; ii) on the Euro Area as a whole, an economic area featuring specific characteristics such as a common monetary policy that acts as external to each country, the prevalence of individual fiscal policies and of non-negligible international fiscal policy spillovers given the high degree of integration of the countries in the union; iii) of both domestic and international spillovers of fiscal policies on stock market prices.

To achieve these goals, we first make a review of the relevant theoretical literature in order to explain the main transmission mechanisms of fiscal and monetary policy, as well as their international spillovers, to stock market prices. We also provide empirical records in the literature on the assessment of policy impacts on stock market prices.

We then proceed with a PVAR estimation in order to analyze impulse responses of stock prices to policy shocks, using alternative estimation methods: simple, fixed-effects, PVAR, GMM and Pedroni's PSVAR approach.

Results across all methods show that a contractionary monetary policy, as measured by an increase in the interest rate, has a statistically significant negative influence on stock market prices. These results are in accordance with most of the theoretical and empirical literature under review, *e.g.,* Ioannidis and Kontonikas (2008), Lütkepohl and Netšunajev (2018) and Miranda-Agrippino and Nenova (2022).

In regards to fiscal policy, we find that results from two of the alternative methods used, the GMM and PSVAR of Pedroni (2013), show significant and negative effect on stock market prices in the sequence of a domestic government spending shock. Although we cannot find a direct effect of a shock on government expenditures to stock market performance, an indirect channel is shown through rising risk premium. The median positive impact on PI in the short run (GMM and PSVAR of Pedroni) resulting from

spillovers of average expansionary fiscal policy, can be explained, via the trade channel, under which an increase in foreign GDP, can boost exports (Beetsma *et al*., 2006) and the firm's value; or via interest rate channel, in the case of GMM model – as average fiscal policy impacts negatively on SSR -, that can be explained by an accommodation of monetary policy delivering crowding-in effects (Agnello & Sousa, 2013).

Moreover, our results seem to support that there are heterogeneous impacts from monetary and fiscal policies across Euro Area countries on stock market prices. Indeed, impulse responses from PSVAR illustrate somehow different reaction across quartiles, and a tentative inspection, using GMM approach, shows that stock market prices in PIIGS fall by less and exhibits weaker persistence to interest rate increases than average-12, react by less than average-12 to domestic shocks in spending while are more affected by international fiscal policy spillovers.

On the one hand, in this work we were able to explore some comparative limitations, uncovering that it would be useful to study the influence of policies on financial markets with the introduction of more variables capable of better identifying the different intensities of transmission channels of policy spillovers, namely capturing the specific characteristics of each country (*e.g.*, deepness of financial markets, debt-to-output ratios, structure of international trade). On the other hand, it would also be interesting, for future work, to introduce some of the world largest economic blocks, e.g., China, US and Japan to assess how monetary and fiscal policy spillover the Euro Area and vice-versa.

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7. ANNEXES

7.1 Annex 1A - Empirical Literature of Monetary Policy

Autor	Sample	Methodology	Dependent Variable	Independent Variable	Results
Thorbecke (1997)	U.S (1967 - 1990)	VAR estimation	Stock Returns for Portfolio	One-standard deviation shock to Federal Funds Rate and one-standard deviation to log of Nonborrowed Reserves	One-standard deviation positive innovation in the funds rate depressed stock returns and a one-standard deviation positive innovation in nonborrowed reserves increased stock returns.
Ioannidis & Kontonikas (2008)	U.S., UK, Japan, Germany, France, Italy, Sweden, Finland, Switzerland, Belgium, Netherlands, Spain and Canada (jan 1972 – jul 2002)	OLS estimation	Equity Returns (measured in local currency)	Short-Term Interest Rate	A Contractionary Monetary Policy declines stock market value for 80% of the countries under investigation. So, when interest rate increases, decrease stock prices via higher discount rates and lower future cash flows.
Caporale & Soliman (2013)	Germany, U.S and UK (1992Q1 – 2009Q3)	VECM	Real Stock Prices Real Money Balance	Demand for Real Money Balances, Short-Term Interest Rate, Long-Term Interest Rate and Real Stock Prices	Shock to: (1) Real stock prices, rises money demand in all countries - bigger trading volume may require larger amounts of money for transactions; (2) Short-term interest rate, lower stock prices in the US and the UK but, increases in Germany (higher interest rates (i) are positively related with the inflation rate and to mitigate, households tend to invest in the stock markets or, (ii) could signal a recovery in the economy resulting in higher corporate earnings and stock prices.
Lütkepohl & Netšunajev (2018)	Euro Area (1999 – 2014)	SVECM and SVAR Markov-switching model	Real Euro Stoxx 50 Stock Price Index, 3 Month Euribor	Industrial Production, HICP, Non-Energy Commodity Prices, Real Euro Stoxx 50 Stock Price Index, 3 Month Euribor	A Contractionary Monetary Policy (increase in the interest rate), reduces industrial production, the price level, and commodity prices. Such a shock has a long-term negative impact on the stock prices, although is restricted to zero. A stock market shock increases all other variables, although with some delay.
Jonathan & Oghenebrume (2017)	Nigeria (1985 – 2015)	DOLS & FMOLS and ECM	All Share Index	Monetary Policy Rate, Credit to Private Sector, Official Exchange Rate and Broad Money Supply	In a long-run, the monetary policy rate, credit to private sector, exchange rate and broad money are positively related to stock prices, but just the last two are significant. Exchange rate appears to be negatively related to stock prices and statistically significant. The short-run determinants of stock prices are largely from credit to private sector, exchange rate and one-period lagged exchange rate, with a positive relation with stock prices, while the monetary policy rate and broad money supply have a negative relationship.

Hosono & Isobe (2014)	Japan (2001 - 2013) United States, Eurozone and United Kingdom (2007 - 2013)	Event Study Approach and Estimation of equations	Returns of long and short-term government bonds, corporate bonds, short-term interbank loans, stock price index, exchange rates[4]	Surprise Component: Day before the announcements of Unconventional Policies to the day of the announcements (and the three days after the announcement), Anticipated Component: Changes in daily prices of 10-year government bond futures traded on the Stock Exchange[5]	Unconventional policies lowers interest rates (Japan, U.S.), leads to higher stock prices (Japan, U.S. but is negative on the announcement day; Eurozone is negative on surprise component), resulted in a depreciation of the home currency (Japan during the CE/QQE period, U.S. the FED's QE1 policy, and UK) affecting long-term government bonds (Japan, Eurozone negative yields) and the exchange rate in an expansionary manner, in most economies and periods; For some economies and periods, they find an impact on corporate bond spreads (negative in U.S, Eurozone positive effect, reflecting a larger negative impact on the latter; negative in UK)., interbank loan spreads, and stock prices.
Haitsma, Unalmis & Haan (2016)	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain (1999 - 2015)	OLS estimation	Returns on day t of a certain Stock Index or Portfolio i - EURO STOXX 50 index (use only 44)	Dummy that takes a value of zero before the crisis and one thereafter, Conventional Monetary Policy Surprise, Expected Policy Rate Change, Unconventional Monetary Policy Surprise, effects of the monetary policy surprise on stock returns pre-crisis, effects after the start of the crisis; MSCI World Index (excluding Europe) and the crisis dummy (control variables)	For the pre-crisis period an unexpected expansionary monetary policy leads to an increase in stock returns (weak significant), but an expected change has a highly significant negative influence on the stock index. The unconventional monetary policy surprise (asset purchase programs and other measures not related to direct liquidity support to banks) has a highly significant negative influence on the German-Italian yield spread, leading to an increase in the returns of the index. For the crisis period, conventional surprise has a positive influence in EURO STOXX 50 index, but weak. For unconventional the coefficients are significant and mostly negative. The impact of ECB monetary policy surprises on European stock returns differs on the basis of the financial structure of the firms, supporting the credit channel (portfolios based on the coverage ratio, on free cash flow, on leverage and the debt-to-equity ratio.
Stoica & Diaconasu (2012)	Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and UK (Jan 2000 - Feb 2012)	Johansen–Juselius likelihood co-integration, unrestricted VAR, VECM, Granger causality and OLS	Stock Price Index	Short-Term Interest Rate	Over the entire period, there's a long-term relationship between interest rates and stock prices for Netherlands, France, Finland and Italy. But in the crisis period, this dynamic exist in 74,07% of the sample, maybe due to the spillover effect of the crisis and/or the investors' uncertainty regarding the unfavorable macroeconomic environment. In short-run the direction of causation: (1) Bi-directional for Germany, Sweden, France, Italy and Estonia; (2) Uni-directional from the stock to the money market for Greece, Austria, Belgium, Cyprus, Denmark, United Kingdom, Ireland, Luxembourg, Portugal, Czech Republic, Slovenia and Spain; (3) Non-causal to Netherlands, Romania, Hungary, Malta, Bulgaria, Finland, Lithuania, Latvia, Poland and Slovakia. This co-movement is lower during the crisis periods than during the entire analyzed period.

[4] Japanese yen (JPY), the U.S. Dollar (USD), Pound Sterling (GBP), and the Euro (EUR).

[5] Tokyo Stock Exchange (Japan), the Chicago Board of Trade (U.S), the New York Stock Exchange Liffe (U.K.) and 10-year German government bond futures traded on the Eurex Exchange (Eurozone)

Bjørnland & Leitemo (2009)	United States (1983 – 2002)	VAR estimation and standard Cholesky decompositions	log of the S&P500 Stock Price Index	Annual change in the log of Consumer Prices and of the Commodity Price index in US Dollars, the log of the Industrial Production Index and the Federal Funds Rate	Real stock prices drop after a contractionary monetary policy shock, consistent with the rise of discount rate of dividends due to the higher federal funds rate. However, the temporarily decrease of the output with the higher cost of borrowing, possibly reduces expected future dividends. So, as the interest rate falls, increase discounted value of expected future dividends along with the output and profits, driving real stock prices to the average level in the long-run. After a stock market shock where prices go up, consumption increases (wealth effect) and investment (Tobin Q effect), rising aggregate demand, inflation and output in the short run. But, this impact on real price prices can be mitigated, through the interest rate channel, with the intervention of the ECB to control inflation.

Source: own elaboration

7.2 Annex 2A - Empirical Literature of Fiscal Policy

Autor	Sample	Methodology	Dependent Variable	Independent Variable	Results
Ogbulu, Torbira & Umezinwa (2015)	Nigeria (1985 - 2012)	OLS, co-integration, ECM, Granger Causality, IRF and VDC	Nigerian Stock Exchange All- Share Index	Government total Public Expenditure, Domestic Debt Outstanding, Non-Oil Revenue and Broad Money Supply (control variable)	Incorporating the short- and long-run effects, Government's Public Expenditure has a negative and significant impact on stock prices. Debt Outstanding, one-period lagged value of Government's Public Expenditure, Non-Oil Revenue and one-period lagged impacts positively and significantly on stock prices. Broad Money Supply only the two-period and three-period lagged values are significant to stock prices. The authors also found a uni-directional causality from stock prices to Public Expenditure, Domestic Debt and Broad Money Supply respectively and, from Non-Oil Revenue to stock prices. Changings in stock prices lead modifications in Government Public Expenditure and, in domestic borrowing to finance government budget deficits.
Ardagna (2009)	Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Spain, Sweden, UK and U.S (1960 - 2002)	OLS and Event Study Approach	Nominal and Real 10-year Government Bonds Interest Rate, Nominal and Real 3-month Treasury Bills Interest Rate, Discount Rate, Corporate Bonds' Interest Rate, Morgan Stanley MSCI share price index (MSCI) Share Price Index and MSCI Share Price Index Growth Rate (MSCIGR)	Fiscal expansions and contractions	On fiscal contractions, the MSCI share price index and its growth rate increases and with fiscal expansions, decreases, but they are only significant, the MSCI in the case of fiscal contractions and MSCIGR for fiscal expansions. Also, stock market prices are lower before a fiscal contraction than before a fiscal expansion.
				Government Deficit/GDP, Public Debt/GDP, Primary expenditure/GDP, Transfers + government wage payments/GDP, Growth rate of real GDP, Output gap, Inflation Rate, Expenditure/GDP, Growth of the Nominal Effective Exchange Rate, Extent of international integration of capital markets and Financial liberalization	On fiscal contraction, the higher the initial levels of government deficit and/or public debt, bigger the decrease in interest rates and the increase in stock market prices. Also, the same happens with a higher the decline in public debt, when governments are able to reduce the debt-to-GDP ratio, showing that financial markets may react in anticipation of the future path of this ratio and the decrease of public debt. There's a positive correlation between changes in government spending and interest rates and a negative, between primary expenditure-to-GDP ratio or transfers and government wage payments-to-GDP ratio and MSCI or MSCIGR. Consequently, lower interest rates and higher stock market prices are linked to sharper cuts to primary spending and to transfers and governments' wage bills. But, MSCI and MSCIGR are still positive (negative) in fiscal contractions (expansions) when controlling for the discount rate or the 3-month Treasury bills interest rate, suggesting a fiscal effect on the stock market beyond the effect that it has on interest rates. The growth rate of real GDP and output gap is insignificant for MSCI .
Arin, Mamun & Purushothman (2009)	U.S., Germany and Japan (1967 – 2005)	VAR estimation	Real Government Spending, Real Tax Revenue, Inflation, Output growth, the Interbank Interest rate, Excess stock return of the risk-free rate	Fiscal Policy Innovations (Labor Tax, Indirect Tax and Corporate Tax)	A shock caused by: (a) an increase in labor tax, for all countries have a negative impact on stock returns, in the second quarter; (b)indirect tax revenues, have a negative effect on stock market returns, larger than the effects of labor tax shocks, in all countries; (c) corporate taxes, for the sample, in the stock market returns, the response is not statistically significant, but we highlight: U.S.: price level and interest rate, rise temporarily, may due to the financing method of firms, through equity or debt, since interest payments are tax deductible. With corporate tax obligations higher, firms can prefer financing from debt, increasing debt issuance, that rises interest rates as the supply of bonds increases. Japan: the output growth, is significant positive, until the 4Q and government spending on 1Q. The impact on the output growth may be due to the anticipation and perception of added taxes as a permanent obligation, and the mitigation of these future expected interest payments by increasing their output and sales revenue. German: Don't have a real response in inflation rate, interest rate or output growth are significant.

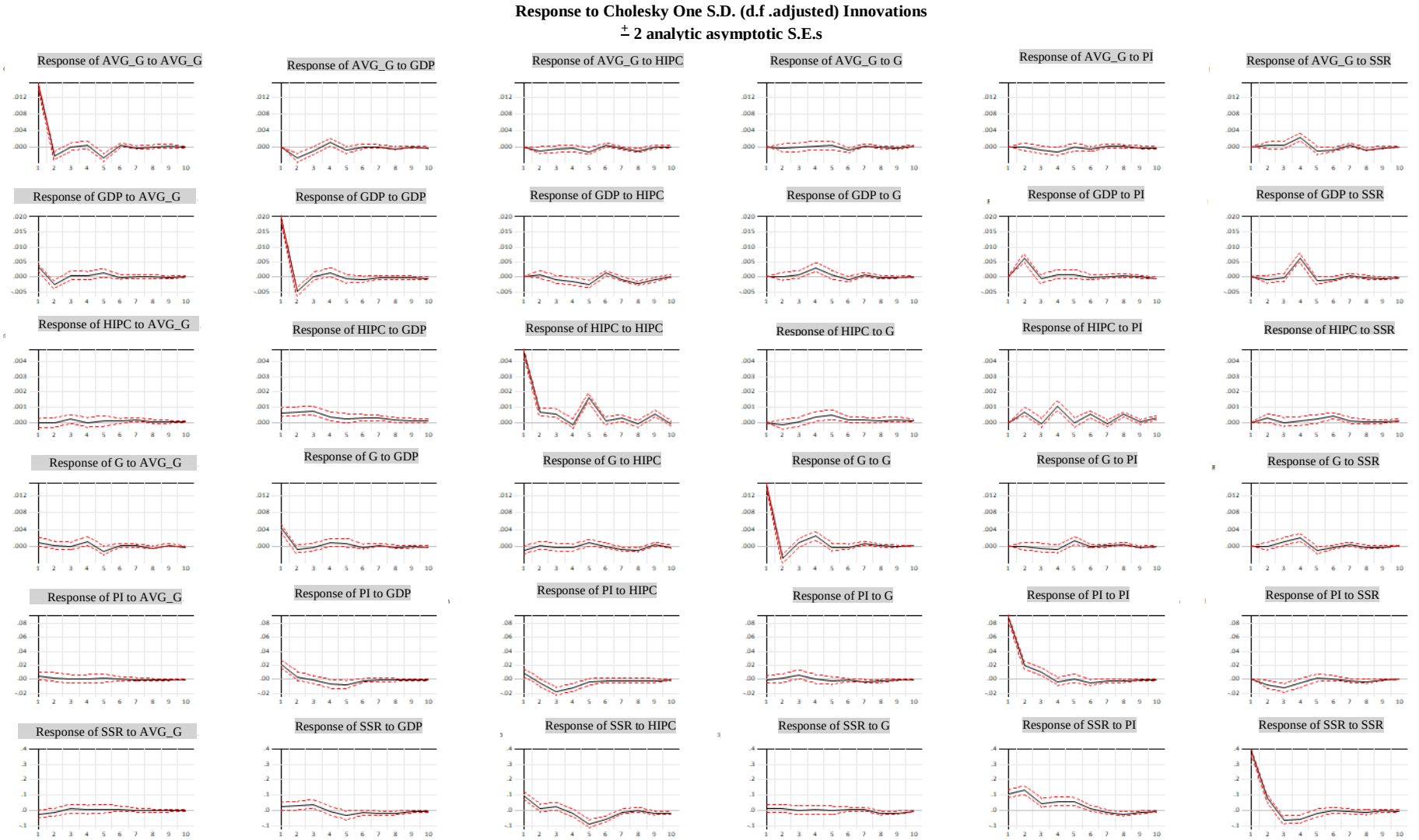
Agnello & Sousa (2013)	10 Industrialized countries, from (1955 – 2007)[6]		Property Price Index, Gross Domestic Product, Price Level, Primary Government Deficit, Interest Rate, Equity Price Index	Budget Deficit	The authors found that fiscal policy is positively related with stock prices and real interest rates increase temporarily and fall gradually and, between deficits and the long-term interest rates. When the evolution on private savings do not cover the rise in the public deficits or there's no compensation by foreign capital inflows, leads to a decrease aggregate savings, increasing the interest rates. Also, with a rising deficit, there are more stock of government debt, making the same effect on the interest rates. On the impulse-response, the effect of fiscal policy on the stock prices is statistically insignificant, quick and temporary. The reduction is immediately because the rising of interest rates, redirects preferences for savings. But, as the policy shock wears off, stock prices recover, anticipating the expansionary effects of fiscal policy on output. So, if governments fund the budget deficit by borrowing on the domestic capital market, pressure up real interest rates, stimulating private savings and "crowds-out" private consumption and investment, reducing aggregate demand. But fiscal policy, can also boost interest rate, with agents expectations, through the effect on domestic interest rates. The evidence suggests that, facing a reduction of government deficit reacts in a larger magnitude then housing prices.
Mbanga & Darrat (2016)	United States (1960 – 2010)	ECM and ECT	S&P 500 index	Budget deficits, Monetary policy, Inflation, Industrial production average, short- and long-term interest rates	There´s no long-run equilibrium relationship between monetary policy and the stock market. In contrast, fiscal policy (budget deficits), industrial production and interest rates have a long-run cointegrating relationship with stock prices been the first two the main significant forces. Also, past US fiscal policy actions also have a statistically significant short-run relation with current stock returns.
Foresti & Napolitano (2017)	11 Eurozone[7] Countries (1999Q1 – 2012Q1)	DOLS	Stock Market Index	Public expenditures and revenues, GDP growth rate, money supply and long-term interest rate	The increase in public expenditures or a reduction in public revenues or an increase in long-term interest rate decrease stock markets index. The rise of the interest rate provokes a reduction in the prices bonds, increasing the demand for bonds and decreasing capital flows to stock markets. Also, a GDP growth rate higher makes stock markets indexes go up due to the economic activity expansion. Under normal macroeconomic conditions, stock markets react negatively to expansionary fiscal policies but, during a financial crisis, they react positively. A possible explanation is that, under financial stress, they require support from the fiscal authorities and react positively to an increase in public primary deficit
Mumtaz & Theodoridis (2020)	United States (1955 – 2015)	SVAR and DSGE model	Real Stock Prices	Government spending news, Real per-capita federal government spending, Real per-capita federal government revenue, Real per-capita GDP	The increase in Real per-capita federal government spending or a decrease in Real per-capita federal government revenue (expansionary fiscal policy), over the period pre-1980 period, increases real stock prices in a short-term but, post-1980, they fall along with the GDP. On the response of the stock market to changes on Real per-capita federal government spending is bigger on government consumption shocks, compared to government investment shocks. On the in Real per-capita federal government revenue, personal tax shocks have a larger impact on Real stock prices than corporate tax shocks.

Source: own elaboration

[6] Belgium and Italy (1980:1-2007:3); Finland (1970:1-2007:4); France (1970:2-2007:2); Germany (1979:1-2007:2); Netherlands (1977:1-2007:1); Spain (1985:1-2006:4); Portugal (1988:1-2007:4); U.K. (1955:2-2007:4); U.S. (1967:2-2007:4)

[7] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain

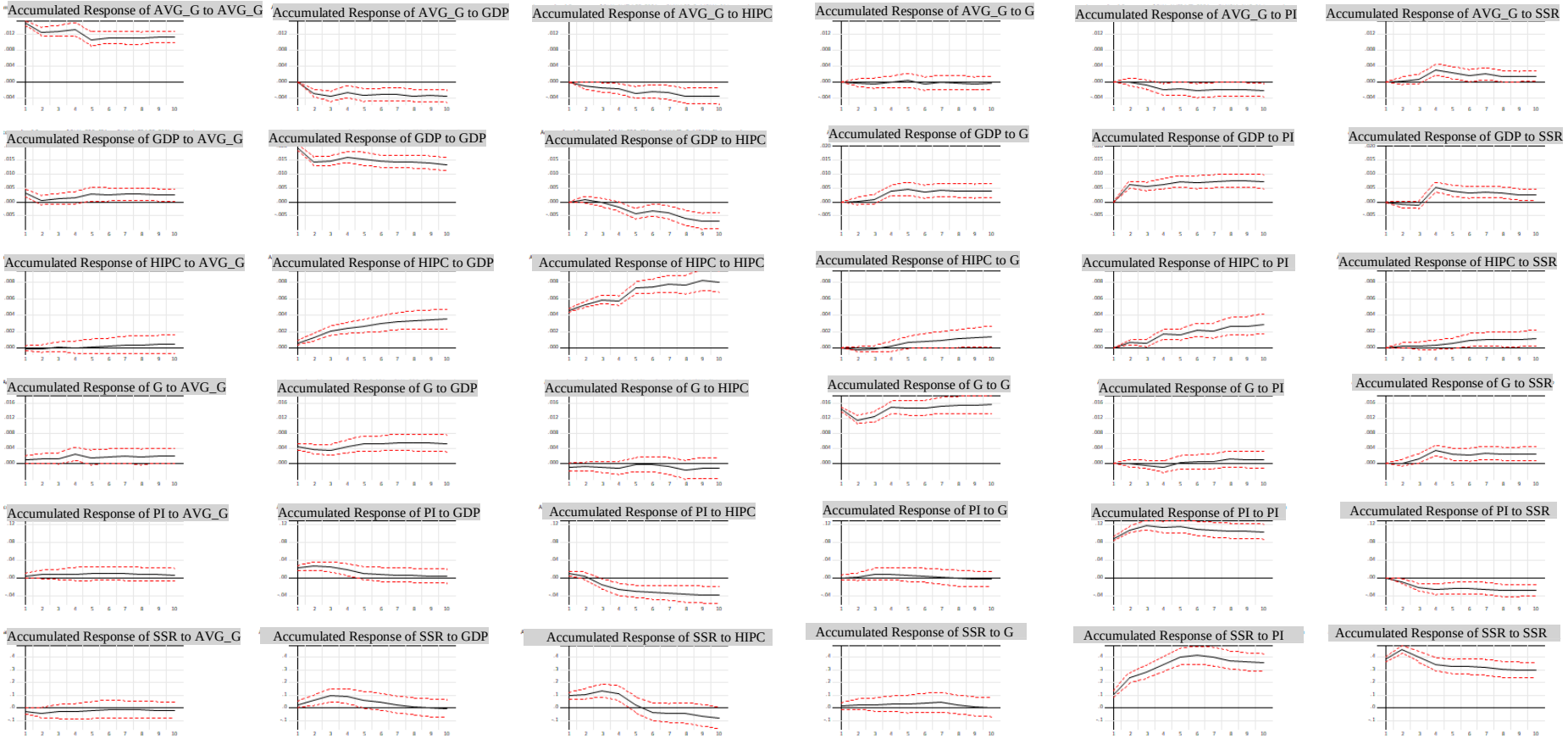
7.3 Annex 1B– Impulse responses to policy shocks in the Euro Area (baseline PVAR) model with PI



Source: Estimation made on the EVIEWS 12

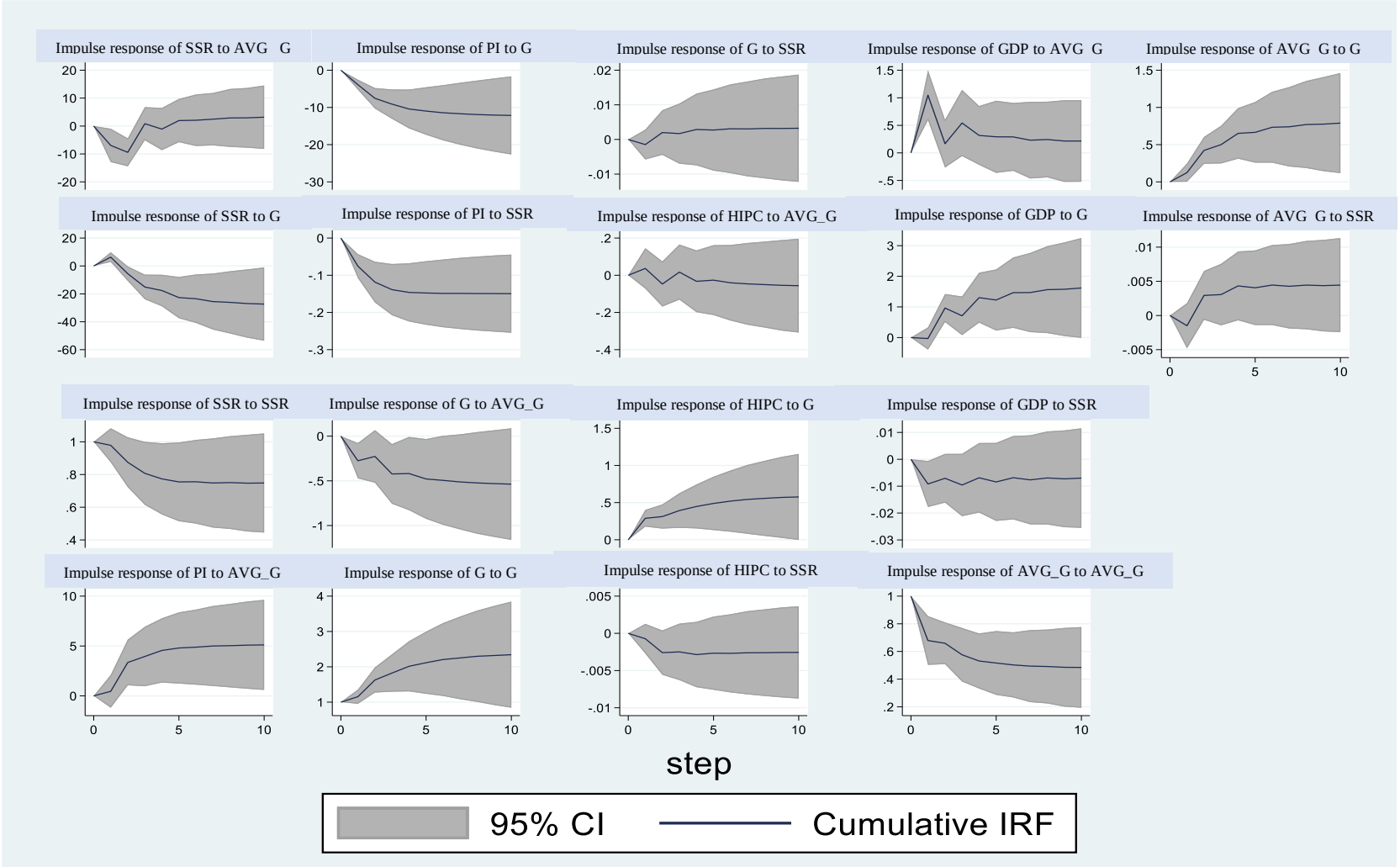
7.4 Annex 2B - Accumulated impulses to policy shocks in the Euro Area (baseline PVAR) model with PI

Accumulated Response to Cholesky One S.D. (d.f .adjusted) Innovations
± 2 analytic asymptotic S.E.s



Source: Estimation made on the EVIEWS 1

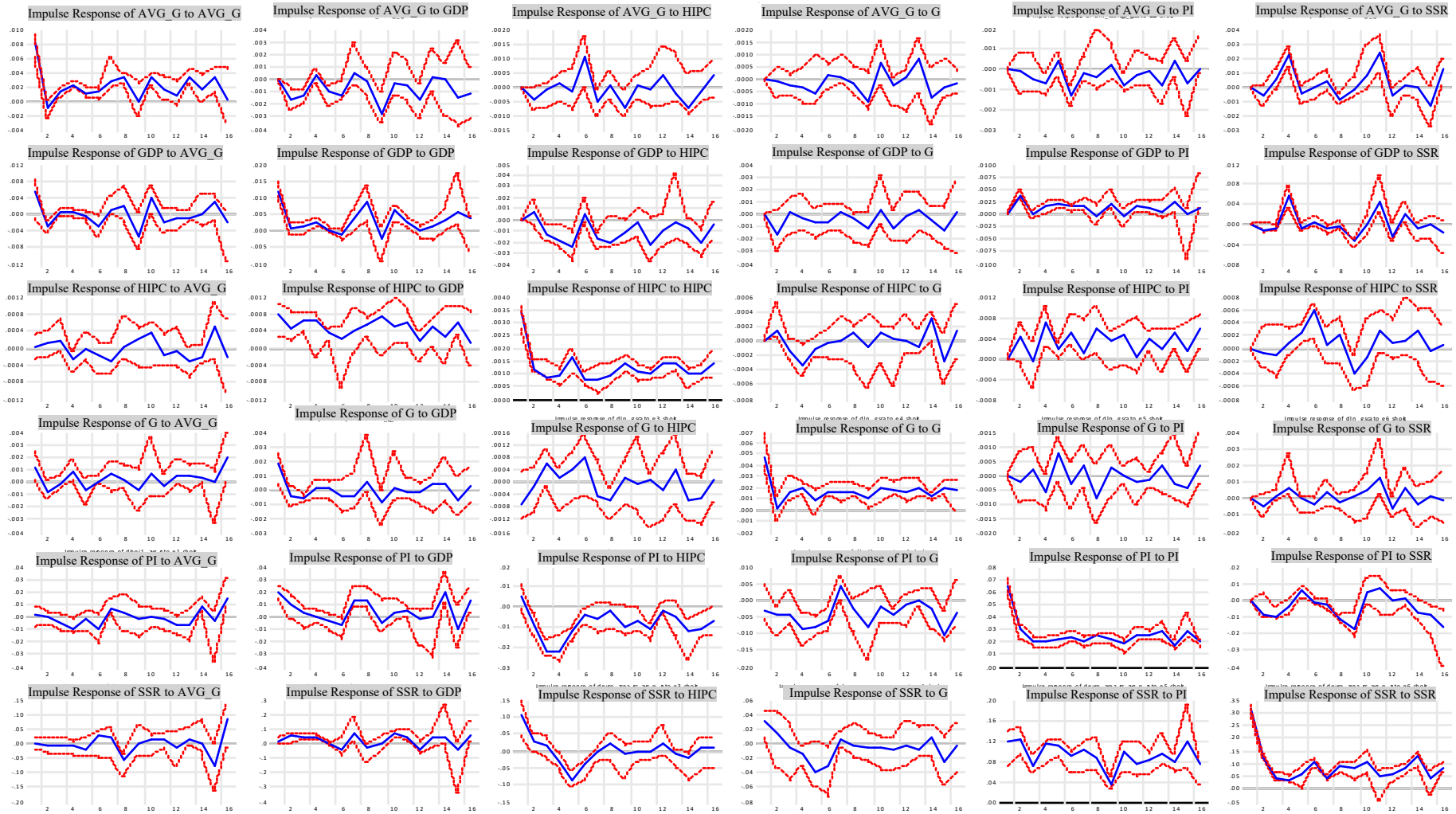
7.5 Annex 3B - Accumulated impulse responses to policy shocks in the Euro Area (GMM PVAR) model with PI



Source: Estimation made with STATA 17.

2.1 Annex 1B - Impulse response to policy shocks in the Euro Area (Pedroni's PSVAR) model with PI

Response estimation test to composite shocks



Source: Estimation made on the EVIEWS 12

7.7 Annex 5B - Variance decomposition of all variables using the model with PI

Variance Decomposition of DLN_AVERAGE_GSCA:

Period	S.E.	DLN_AVE...	DLN_GD...	DLNHICP...	DLN_G_SCA	DLNPI1_A...	DEURO_...
1	0.014833	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.015249	96.63478	2.991343	0.286561	0.017715	9.12E-06	0.069588
3	0.015304	95.93726	3.321536	0.409140	0.020339	0.174908	0.136821
4	0.015595	92.51627	3.746551	0.427323	0.071638	0.664317	2.573905
5	0.015875	91.72086	3.854436	0.852778	0.128475	0.647415	2.796031
6	0.015931	91.16839	3.832539	0.920225	0.351947	0.748856	2.978043
7	0.015947	90.98547	3.826987	0.957127	0.389622	0.768940	3.071854
8	0.015985	90.55122	3.856200	1.239384	0.389023	0.777052	3.187125
9	0.015991	90.51223	3.853554	1.238638	0.422970	0.783359	3.189249
10	0.015995	90.46884	3.869631	1.238344	0.437939	0.793816	3.191429

Variance Decomposition of DLN_GDP_SCA:

Period	S.E.	DLN_AVE...	DLN_GD...	DLNHICP...	DLN_G_SCA	DLNPI1_A...	DEURO_...
1	0.019814	2.657320	97.34268	0.000000	0.000000	0.000000	0.000000
2	0.021544	3.759187	87.58611	0.119178	0.007853	8.364490	0.163187
3	0.021599	3.807779	87.14644	0.301844	0.133315	8.431480	0.179143
4	0.022863	3.420053	78.19582	0.730848	1.960475	7.667404	8.025396
5	0.023120	3.659393	76.56333	2.004868	1.985594	7.647301	8.139516
6	0.023206	3.635283	76.11077	2.309089	2.155929	7.601719	8.187208
7	0.023235	3.628411	75.92578	2.407140	2.248639	7.589161	8.200865
8	0.023343	3.595176	75.23834	3.222450	2.248046	7.549496	8.146495
9	0.023382	3.600708	75.00957	3.416188	2.252421	7.524465	8.196647
10	0.023393	3.597226	74.97705	3.420730	2.255497	7.557090	8.192409

Variance Decomposition of DLNHICP_Q_MEAN_SA:

Period	S.E.	DLN_AVE...	DLN_GD...	DLNHICP...	DLN_G_SCA	DLNPI1_A...	DEURO_...
1	0.004645	0.016239	1.775715	98.20805	0.000000	0.000000	0.000000
2	0.004806	0.018096	3.756467	93.72511	0.096472	2.078134	0.325721
3	0.004902	0.180564	5.929863	91.47075	0.092840	2.012716	0.313266
4	0.005045	0.175379	6.155579	86.45187	0.601224	6.294267	0.321684
5	0.005327	0.174689	5.688101	86.74605	1.312704	5.646465	0.431995
6	0.005380	0.193716	5.871407	85.11996	1.372069	6.458391	0.984458
7	0.005398	0.269620	6.063453	84.78672	1.438555	6.437871	1.003782
8	0.005429	0.273288	6.059143	83.88285	1.478846	7.310218	0.995660
9	0.005461	0.270227	6.016531	83.91583	1.586538	7.225403	0.985470
10	0.005472	0.271064	6.017749	83.60943	1.596343	7.481250	1.024166

Variance Decomposition of DLN_G_SCA:

Period	S.E.	DLN_AVE...	DLN_GD...	DLNHICP...	DLN_G_SCA	DLNPI1_A...	DEURO_...
1	0.015077	0.474920	8.766656	0.357964	90.40046	0.000000	0.000000
2	0.015348	0.499841	8.660892	0.358664	90.47075	0.000291	0.009562
3	0.015425	0.495677	8.600366	0.365348	89.85950	0.047903	0.631206
4	0.015856	1.075281	8.536802	0.375096	87.42783	0.205867	2.379124
5	0.016024	1.470357	8.628450	0.673135	85.61631	0.917176	2.694575
6	0.016030	1.510344	8.629027	0.681800	85.55340	0.918040	2.707391
7	0.016068	1.515927	8.640631	0.808651	85.32624	0.929266	2.779287
8	0.016107	1.547807	8.600672	1.082466	84.92236	1.064511	2.782182
9	0.016117	1.589536	8.591745	1.145585	84.82142	1.070697	2.781017
10	0.016119	1.591240	8.592104	1.147593	84.80765	1.070396	2.791016

Variance Decomposition of DLNPI1_AVG_SA:

Period	S.E.	DLN_AVE...	DLN_GD...	DLNHICP...	DLN_G_SCA	DLNPI1_A...	DEURO_...
1	0.091114	0.266685	5.886616	0.966732	0.000254	92.87971	0.000000
2	0.093864	0.326691	5.713267	1.241537	0.027408	91.90061	0.790483
3	0.097189	0.304768	5.344766	4.625711	0.481264	86.83012	2.413372
4	0.098444	0.302535	5.691487	6.074783	0.469656	84.79244	2.669097
5	0.098910	0.328944	6.238157	6.201177	0.516666	84.01173	2.703324
6	0.099100	0.328395	6.284597	6.204208	0.532692	83.94509	2.705022
7	0.099238	0.331860	6.275873	6.224760	0.642561	83.77712	2.747824
8	0.099384	0.341507	6.276935	6.231001	0.717900	83.59453	2.838130
9	0.099422	0.352606	6.289030	6.251664	0.731570	83.53454	2.840589
10	0.099435	0.354789	6.289734	6.258714	0.733433	83.52351	2.839821

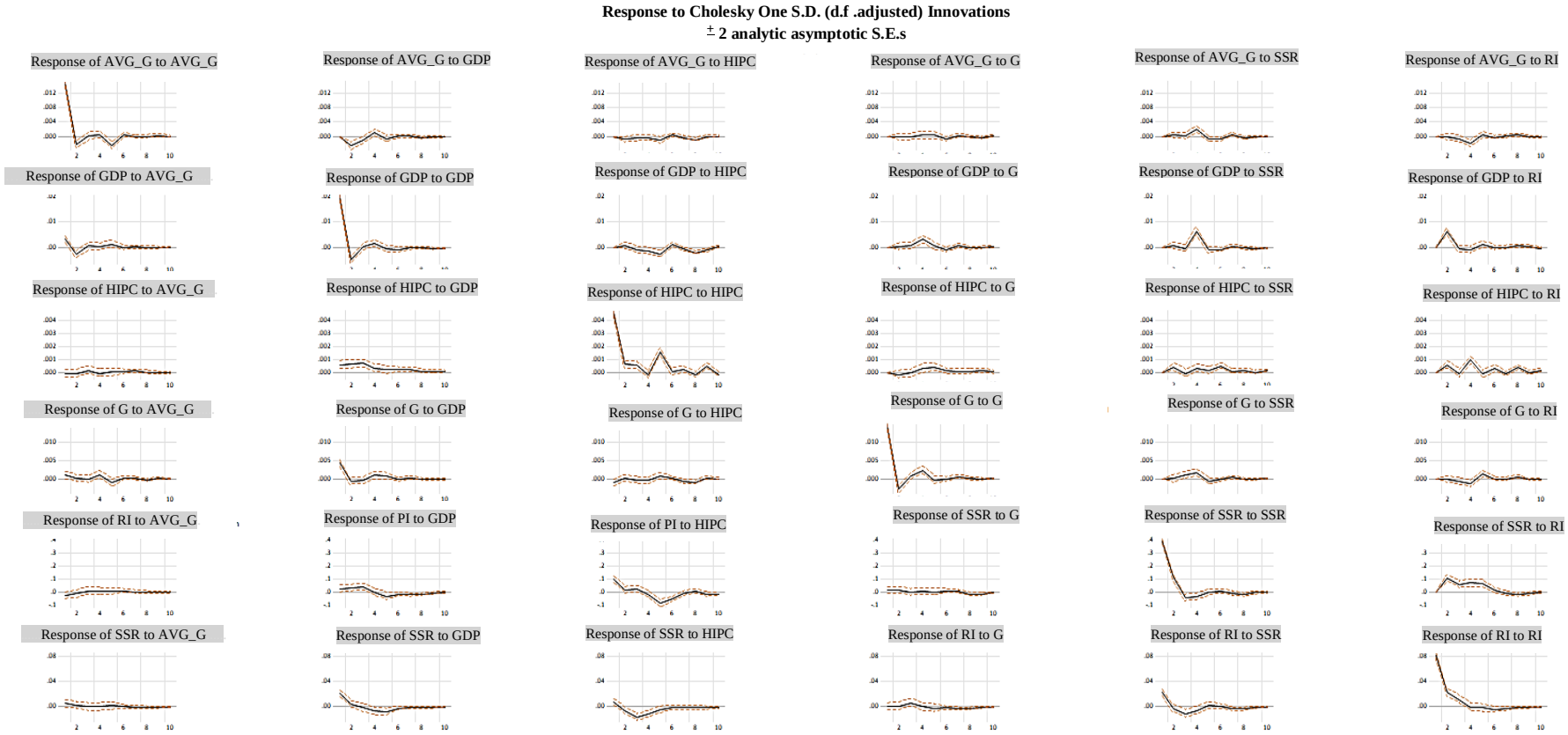
Variance Decomposition of DEURO_AREA_SSR_AVG_Q_SA:

Period	S.E.	DLN_AVE...	DLN_GD...	DLNHICP...	DLN_G_SCA	DLNPI1_A...	DEURO_...
1	0.412746	0.449429	0.422087	5.481291	0.115734	6.889922	86.64154
2	0.441439	0.487492	0.857828	4.859541	0.188602	14.65732	78.94922
3	0.450726	0.513990	1.598650	4.965859	0.184817	15.09930	77.63738
4	0.458488	0.501803	1.555073	4.985716	0.196345	16.26407	76.49699
5	0.472731	0.493629	1.961046	8.377156	0.184721	16.83294	72.15051
6	0.476636	0.522472	2.024178	9.648541	0.204022	16.62643	70.97435
7	0.477429	0.520737	2.185964	9.674395	0.215891	16.63241	70.77061
8	0.479059	0.520827	2.308096	9.612453	0.351876	16.81911	70.38763
9	0.480082	0.521885	2.330256	9.751573	0.474423	16.83001	70.09185
10	0.480536	0.523773	2.335501	9.865338	0.491557	16.81443	69.96940

Cholesky One S.D. (d.f. adjusted)
Cholesky ordering: DLN_AVERAGE_GSCA DLN_GDP_SCA DLNHICP_Q_MEAN_SA DLN_G_SCA DLNPI1_AVG_SA DEURO_AREA_SSR_AVG_Q_SA

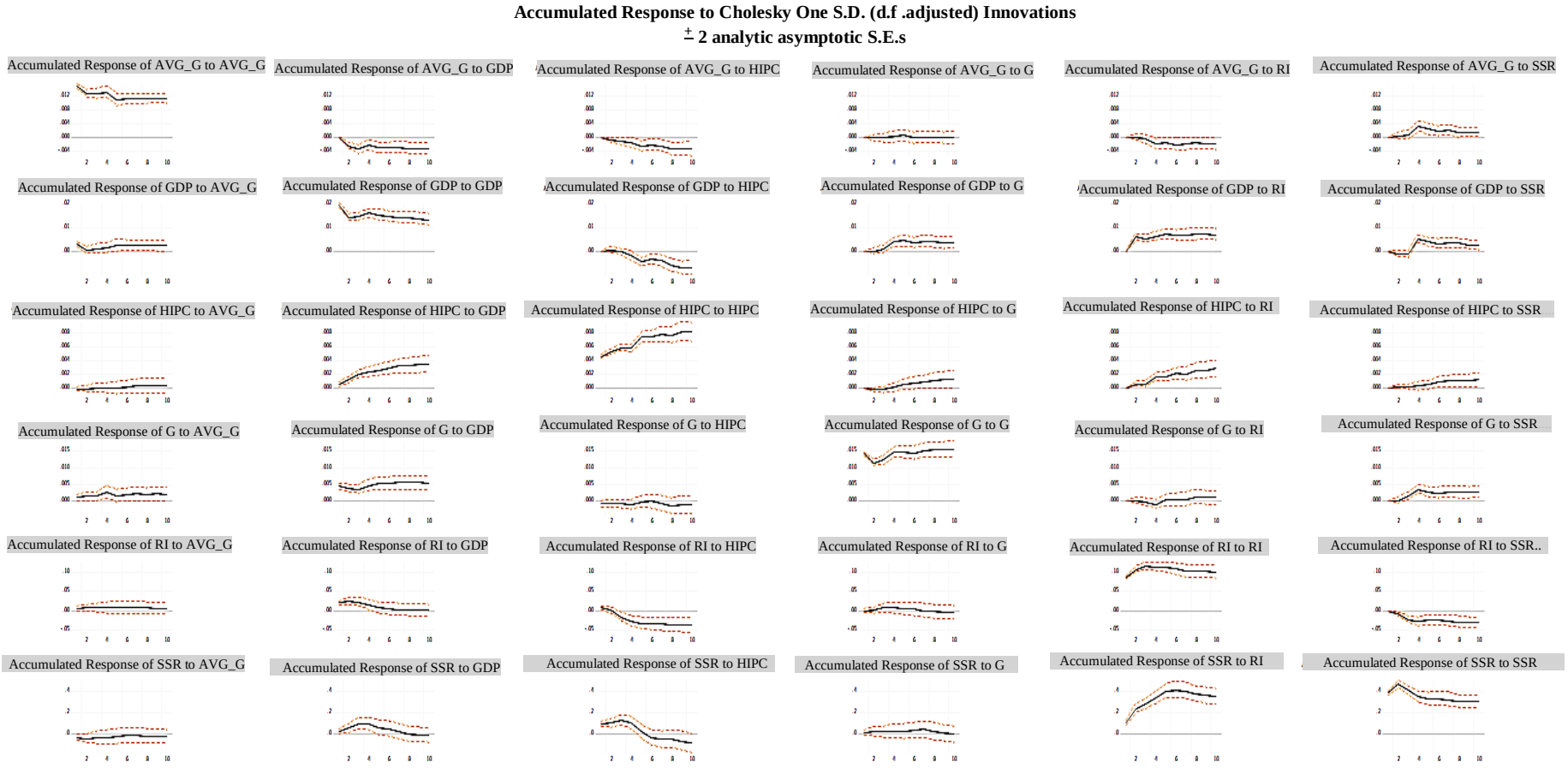
Source: Estimation made on the EVIEWS 12

7.8 Annex 6B – Impulse responses to policy shocks in the Euro Area (baseline PVAR) model with RI



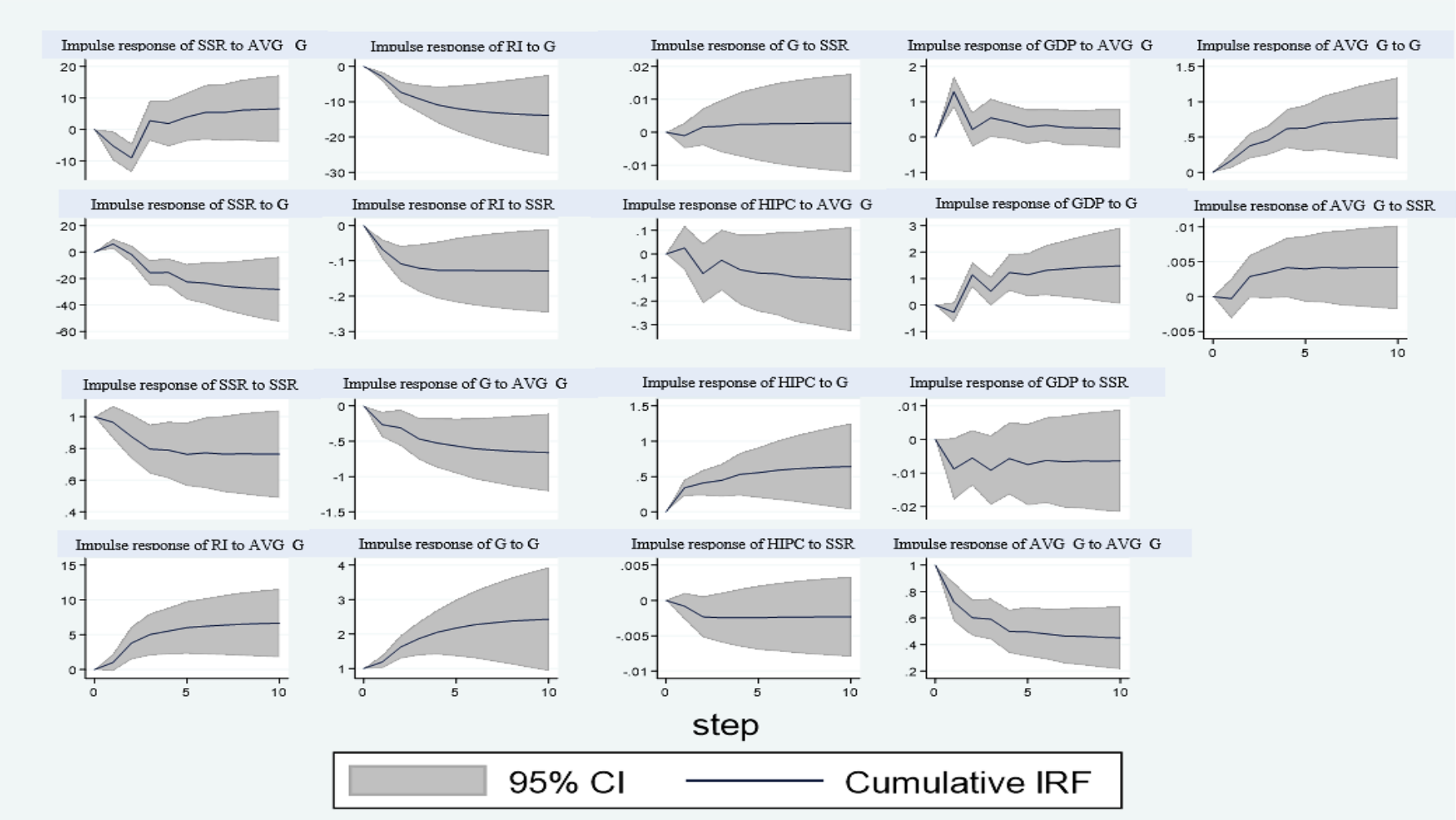
Source: Estimation made on the EVIEWS 12

7.9 Annex 7B - Accumulated Impulse responses to policy shocks in the Euro Area (baseline PVAR) model with RI



Source: Estimation made on the EVIEWS 12

7.10 Annex 8B - Accumulated impulse responses to policy shocks in the Euro Area (GMM PVAR) model with RI



Source: Estimation made with STATA 17