The Fiscal Multiplier in Presence of Unconventional Monetary Policy: Evidence for 17 OECD countries

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Abstract

The 2008 financial crisis forced central banks to lower interest rate to stimulate economic recovery. However, this tool was quickly exhausted, and authorities turned to unconventional monetary policy. Despite these efforts, this change in policy was unable to stimulate aggregate demand. This research argues that fiscal policy is a necessary stabilization mechanism when monetary policy is ineffective. Using a narrative approach and Kitagawa-Blinder-Oaxaca decomposition, we estimate the unconventional monetary-fiscal multiplier for 17 OECD economies considering the Great Recession. The study finds that the monetary-fiscal multiplier is in the range of 1.7 to 5 when unconventional monetary policy is accommodative with respect to fiscal policy. The coordination between monetary and fiscal policies can significantly positively impact the economy, suggesting that policymakers should take into account their interactions while designing stabilization measures.

Keywords: *fiscal policy; zero lower bound; local projections; narrative method.*

JEL Classification: *C32; C54; E52; E58; E62*

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1 Introduction

After the 2008 Great Recession, unconventional monetary policies were introduced due to the official interest rate reaching the zero lower bound (ZLB), making traditional demand-oriented policies ineffective, low inflation expectations and demand have caused inflation to remain below the central bank's target, potentially leading to secular stagnation[1] (Blanchard, Furceri, & Pescatori, 2014; Blanchard, Lorenzoni, & L'Huillier, 2017; Eggertsson, Mehrotra, & Summers, 2016; Hansen, 1938; Summers, 2016). These measures, such as quantitative easing (QE[2]) and forward guidance, aimed to bring inflation back to its target. However, they have not been successful (Cochrane, 2018; Greenlaw, Harris, Hamilton, & Kenneth, 2018; Hamilton, 2018).

With monetary policy using unconventional measures, many turned to fiscal policy to stimulate aggregate demand. In this context, the following questions arise: how effective can monetary-fiscal policy interactions be? What is the size of the monetary- fiscal multiplier? What is the interaction between unconventional monetary policies and fiscal policies and how does it affect including the Great Recession period?

The fiscal multiplier measures the amount of additional output gained from each increase in the fiscal deficit. An increase in government spending leads to an increase in income and consumption, resulting in a larger national income than the initial government spending. This can lead to higher tax revenues, which can help finance the spending. The multiplier effect occurs when the multiplier is greater than 1, indicating that the resulting increase in output is greater than the initial spending. Originally, Keynes (1936) predicted a multiplier of 2.5. Nevertheless, Keynes' prediction has not been found in literature. Gechert (2015) using a meta-regression found that the multiplier is close to one for public spending with higher effects when monetary policy is limited by a zero-interest rate. Also, Ramey (2016) surveys that the multiplier ranges from 0.6 to 1.5 based on a sample prior to 2008 for the aggregate United States.

There is a significant amount of disagreement among economists regarding the effectiveness of expansionary fiscal policy in stimulating economic growth. The literature on the topic is marked by debate regarding the size of fiscal multipliers, with some advocating for contractionary fiscal policies on the premise that they would result in increased output (the so-called expansionary austerity, often associated with negative fiscal multipliers.)

One of the key determinants of the size of fiscal multipliers is the phase of the business cycle. In general, fiscal multipliers are larger during economic downturns, when government spending can help stimulate economic growth. For example, a country with a large amount of unused capacity may see a larger impact from government spending than a country that is already operating at full capacity. Throughout the Great Recession and with monetary policy operating at the zero lower bound this figure captured great research interest, as governments expected greater fiscal multipliers during economic cri-

[1] A persistent low demand in the economy that requires low interest rate to support demand and reach desired potential output.

[2] Which are massive purchases of private and public bonds.

sis compared to "normal" times (Auerbach & Gorodnichenko, 2012; Gechert, 2018). On the other hand, the effectiveness of fiscal multipliers can be limited by other factors, such as the availability of funding for government spending or the potential for government spending to create inflation.

Importantly, the size of a fiscal multiplier also depends on the level of interest rate. When interest rates are low, households and businesses are more likely to borrow and spend, which can lead to a larger fiscal multiplier. On the other hand, when interest rate are high I find a smaller fiscal multiplier. Also, policymakers expected multiplier effects of expansionary fiscal policies when monetary policy was not as effective (Canova & Pappa, 2011; Eggertsson, 2011; Erceg & Lindé, 2014; Gechert, 2015; Jordà, Schularick, & Taylor, 2017). By considering the size of fiscal multipliers, policymakers can determine the optimal mix of government spending and taxation to achieve their economic goals.

Furthermore, estimating the fiscal multiplier is a useful tool for evaluating the empirical relevance of different economic models. Neoclassical models tend to predict small multipliers, while new Keynesian models posit that the size of the multiplier is highly dependent on the state of monetary policy. When the interest rate is constant, the multiplier is predicted to be equal to 1, while counter-current monetary policy is associated with multipliers less than 1. In the case of a liquidity trap, the multiplier is predicted to be greater than 1. In contrast, old Keynesian models with credit-constrained agents predict large multipliers. Our study aims to provide empirical evidence on the size and determinants of the fiscal multiplier in order to inform the debate on the usefulness of different theoretical model predictions.

In this paper, I aim to quantify the fiscal multiplier effect on output in the presence of unconventional monetary policy, with a particular focus on the period following the 2008 financial crisis when nominal interest rate reached the zero lower bound. Building on the findings of prior research by Cloyne, Jordà, and Taylor (2020), I extend the examination of the fiscal-monetary multiplier by incorporating a novel database covering the period from 2016 to 2019, which takes into account fiscal consolidation measures. Our methodology leverages the advantages of the local projection method (Jordà, 2005)[3] and the Kitagawa-Blinder-Oaxaca decomposition to quantify how the fiscal multiplier varies in response to unconventional monetary policy accommodation.

The results of the present study contribute to the empirical literature on fiscal-monetary multipliers and provide a comprehensive overview of the monetary-fiscal multiplier and its role in macroeconomic policy design. Since we are not interested in contributing to the identification method, the major contribution corresponds to elucidating the fiscal-monetary multiplier for the period after the Great Recession of 2008, also using dummy variables to account for this historical milestone, following the papers by Klein and Winkler (2021); Ramey and Zubairy (2018) for identification with local projections, including then a zero lower bound dummy variable and a financial crisis dummy variable.

My findings suggest that coordination between monetary and fiscal policy may result

[3]Local projections deals with impulse response with state-dependence.

in large monetary-fiscal multipliers (2-5 range) including the Great Recession period.

The paper is structured as follows. Section 2 provides a summary of relevant studies in the field. In the Section 3, the sources of data and sample are described, as well as the application of local projections, the model used in the analysis, and the Kitagawa-Blinder-Oaxaca decomposition. The Section 4 presents and discusses the findings. Finally, Section 5 summarizes the key results, discusses their implications for policy and future research, and highlights the limitations of the study and suggestions for future work.

2 Related literature

In October 2012, the International Monetary Fund published its Global Prospects and Policies paper which admitted that their assumptions about fiscal multipliers had been inaccurate. They had predicted a multiplier equal to 0.5. But in the period of the Great Recession, it was between 0.9 and 1.7. This agrees with Blanchard and Leigh (2013): "We find that strong planned fiscal consolidation[4] has been associated with lower than expected growth at the beginning of the crisis. A natural interpretation is that fiscal multipliers were substantially higher than implicitly assumed by the predictors."

The literature on the fiscal multiplier is vast and diverse. Regarding the literature of government expenditure shocks we can find that: the seminal work of Keynes (1936) was the first one stating a value for the multiplier of 2.5. Also, Keynes (1936) stated that in a closed-economy system where the consumption of unemployed individuals is supported by transfers from other consumers, a typical modern community would likely use up almost 80% of any increase in real income. This means that even after accounting for any negative effects, the multiplier effect would be around 5.

Since the Great Recession the fiscal multiplier has capture great research interest: Blanchard and Perotti (2002) found small values of the fiscal multipliers, often close to one. Auerbach and Gorodnichenko (2012) using different methods for identification, calculated that for expansion periods the multiplier varies between -0.3 to 0.8 and for recession between 1 and 3.6. Fazzari, Morley, and Panovska (2015) estimate a large multiplier of 1.6 for a low-utilization regime that accounts for more than half of the sample observations from 1967 to 2012 in the United States. These authors also found that the government spending multiplier is larger and more persistent whenever there is considerable economic slack. Mountford and Uhlig (2009) find a 0.65 multiplier in the case of a deficit-financed increase in public spending, applying sign restrictions on a SVAR. Finally, Ramey (2016) compiles an extensive literature in which the multiplier varies between the range from 0.6 and 1.5, depending on the estimation method, model, country and time. As regards the interaction between policy rates and fiscal policy: theoretically, Galí (2020) uses a DSGE model

[4] Fiscal consolidation is the process of reducing a government's deficit or debt by reducing its spending or increasing its revenue. It is a way for a government to improve its financial health by making sure that it is not spending more money than it is taking in. This can be achieved through a variety of means, such as cutting unnecessary spending, increasing taxes, or implementing other measures to increase revenue. Ultimately, the goal of fiscal consolidation is to put the government's finances on a sustainable path and reduce the risk of future financial problems.

to obtain a contemporaneous effect for the fiscal multiplier (money-financed government purchases) of 1.2 and 1.5, on output and inflation, respectively. The contemporaneous effect for the multiplier, taking into account money-financed tax cuts, is 0.45 and 0.8, on output and on inflation respectively. On an empirical work Cloyne et al. (2020) stated that the fiscal multiplier can be as high as two, if the Central Bank accommodates monetary policy.

In recent years, various studies have attempted to estimate the magnitude of the fiscal multiplier under different macroeconomic conditions. Cloyne et al. (2020) estimate the fiscal multiplier to be as high as 2 when monetary policy is accommodative, which is somewhat closer to Keynes' prediction of 2.5. Cloyne (2011) further finds that a 1% cut in taxes increases GDP by 0.6% on impact and by 2.5% over three years in the UK. On the other hand, Tenhofen, Wolff, and Heppke-Falk (2010) find that direct government expenditure shocks increase output and private consumption, with a multiplier that reaches zero after three years. Pyun and Rhee (2015) observe that the fiscal multiplier was greater than 1 during the global financial crisis but less than 1 prior to the crisis in a Panel VAR of 21 OECD countries. Leeper, Traum, and Walker (2017) use Bayesian prior predictive analysis and find that when monetary policy targets inflation, the output multipliers can exceed one, but investment multipliers are likely to be negative. On the contrary, passive monetary policy produces consistently strong multipliers for output, consumption, and investment. Deleidi, Iafrate, and Levrero (2021) combine Structural Vector Autoregression modeling with the local projections approach in European countries and find that fiscal multipliers are close to 1 on impact and increase in the years after the implementation of a discretionary fiscal policy. Riera-Crichton, Vegh, and Vuletin (2015) use the local projections approach in 29 OECD countries and find that the long-run multiplier for bad times (government spending going up) is 2.3, compared to 1.3 in normal times, and reaches 3.1 in extreme recessions. Finally, Afonso and Leal (2019) use SVAR in Eurozone countries and find that government expenditure has a positive effect on output, with an annual accumulated multiplier of 0.44, while income and wealth taxes and production and import taxes stood at -0.11 and -0.55, respectively. Gechert, Paetz, and Villanueva (2021) calculate the fiscal multiplier of social security transfers and other types of transfers in Germany using a proxy VAR. The results of this study indicate that a reduction in contributions leads to a fiscal multiplier of approximately 0.4 in the short term, but the effect begins to diminish rapidly over time. Conversely, an increase in benefits leads to a higher fiscal multiplier of 1.1, which appears to have a more persistent impact.

Regarding the econometric methodology, there are several papers following Cloyne et al. (2020) that use the Kitagawa-Blinder-Oaxaca decomposition. Hack, Istrefi, and Meier (2022) find that U.S. government spending multipliers range between 0 and 2 when monetary policy does not respond to fiscal shocks. The period considered is 1960-2007[5], which is also the same results as in Cloyne et al. (2020). Herreño and Pedemonte (2022) study regional differences in U.S. monetary policy effects with the Kitagawa-Blinder-Oaxaca de-

[5]The model was tested for robustness by including data up to 2015. The results demonstrated robustness.

composition. They find that price and employment respond strongly to monetary policy in poorer regions. Kurt (2022) analyzes the impact of U.S. corporate taxes on firm-level for the period 1969-2006 altering the effectiveness of monetary policy, finding that monetary policy is more effective on employment, sales and investment for firms facing statutory tax rate relative to those with stable statutory and less effective for those facing marginal tax cuts.

Since we have observed fiscal deficit increases at the same time as expansionary monetary policy, the ceteris paribus assumption is broken. Studying expansionary fiscal and expansionary monetary policy is a more difficult task, although it is closer to reality. For instance, both fiscal and monetary policies are used simultaneously in a crisis. Therefore, we face two different problems: endogeneity and the fact that impulse responses are state-dependent[6]. As recently pointed out in Ghassibe and Zanetti (2022) who show that fiscal multipliers are state-dependent, conditional on the source of fluctuations.

The fiscal multiplier should be higher when interest rate hit the zero lower bound (Canova & Pappa, 2011; Christiano, Eichenbaum, & Rebelo, 2011; Eggertsson, 2011; Gechert, 2015). When there is no interaction with monetary policy, typically the multiplier varies between 0.6 and 1.5 (Ramey, 2016). This is an important result that should be considered in policy options because monetized fiscal policy would be a useful tool to bring up output and inflation.

This is also related with the term "helicopter money". First appeared in Friedman's book (Friedman, 1969), defined as the delivery of money from the Central Bank directly to households. In essence, "helicopter money" is an increase in the monetary base, unlike the current design of monetary policies, which follow the Taylor Rule (Taylor, 1993). After the 2008 crisis, this measure has been proposed, as in Reichlin, Turner, and Woodford (2013) and Bernanke (2016). Additionally, recently Woodford (2022) concludes that the interest rate is not the main variable for stabilizing output, but transfers should be. Also, Buetzer (2022) argues that household transfers from the central bank are more effective and equitable than asset purchases or negative interest rate in reserve currency issuing economies at the lower bound. The author addresses concerns of central bank solvency and equity and distinguishes the differences between debt or money-financed fiscal stimulus, especially in a currency union without fiscal capacity. Kyriazis (2017) expects monetization of debt to have better results than quantitative easing, although it may be less influential on inflation due to moral hazard. Turner (2015) exposes that the effects of "helicopter money" on output and inflation are clear or should be, and it is not implemented due to political issues. Furthermore, it states that monetizing the deficit will always stimulate nominal aggregate demand. In Buiter (2014); Di Giorgio and Traficante (2018) and Galí (2020), a Dynamic Stochastic General Equilibrium (DSGE) model is used to see the response of a fiscal stimulus financed by monetary policy. All of them claim that this measure will boost aggregate demand. Specifically, according to the results of Galí (2020), this increase in demand will be accompanied by a slight increase in inflation, while in Di Giorgio and Traficante (2018),

[6]The state-dependence of the fiscal multiplier means that the effectiveness of government spending and tax policies in boosting economic activity can vary depending on the current state of the economy.

the effect on inflation is considerably expansive. In empirical work, Gábrišová (2016) uses a VAR to analyze the effect of an increase in the monetary base, concluding that it is a pro-inflationary measure, but not sufficient to prevent deflation. Finally, Drescher, Fessler, and Lindner (2020) examine the use of helicopter money as a way to increase demand after the COVID-19 crisis. They found that the marginal propensity to consume ranges between 33% and 57% across euro area countries, decreasing with income but not with wealth. The authors conclude that the effects of helicopter money would vary across and within countries and that lump-sum transfers may be a better option than inequality-preserving transfers. The debate surrounding the efficacy of "helicopter money" assumed particular pertinence in light of the COVID-19 crisis.

3 Methodology

In order to quantify the impact of fiscal policy shocks on economic outcomes, we adopt Ramey (2016) definition of a shock: exogenous with respect to endogenous variables and uncorrelated with other exogenous shocks. This allows us to identify the unanticipated effects of fiscal policy on economic variables and to distinguish them from endogenous responses to other shocks. we can then estimate the impact of fiscal policy shocks using structural system of equations or other methods that exploit rich data sources. There are several challenges in estimating[7] the monetary-fiscal multiplier.

First, the identification problem. For example, a sudden rise in interest rate may be due to a positive demand shock that increases both output growth and interest rate or it may also be due to a monetary policy shock that decreases output and increases the policy rate. Knowing which shock corresponds to is the nature of the identification problem. Therefore, we need to impose restrictions to identify the shocks or identify them with information sources of historical data, etc.[8]

Second, the endogeneity problem. Government deficits are often potentially endogenous (Nakamura & Steinsson, 2014). If public spending were to follow counter-cyclical behavior, governments might systematically spend more when output is low due to other shocks to counteract these other shocks and stabilize the economy. In this context, OLS estimations would be downward biased. On the other hand, pro-cyclically behavior means that balanced budget rules or credit constraints may lead the government to spend more when things are good for other reasons. In this case, OLS estimations would be upward biased. In order to solve both problems, we have extended the dataset of Devries, Guajardo, Leigh, and Pescatori (2011); Gupta, Jalles, Mulas-Granados, and Schena (2018) of fiscal consolidations (narrative approach) that will be used to instrument fiscal deficits.

Third, there is a well-established practice in the economic literature to estimate the fiscal multiplier through econometric regression techniques. The government spending is usually introduced in the regression as a ratio of GDP. Another possibility is to use the

[7]By ordinary leats squares, instrumental variables or other methods.

[8]See Ramey (2016) for a discussion of the different methods of identification and Stock and Watson (2016) for a detailed analysis of identification methods with VARs.

growth rate of government spending as a explanatory variable[9]. However, as noted by Ramey (2016) and Ramey and Zubairy (2018), both methods can result in an upwardly biased multiplier estimate when using narrative instruments. In light of these limitations, Ramey (2016) and Ramey and Zubairy (2018) suggest an alternative approach to determine fiscal multipliers. This approach involves estimating the impact of government spending on GDP and dividing it by the associated change in the deficit-to-GDP ratio. This method provides a more accurate measure of the effects of fiscal policy on economic output, while avoiding the biases associated with the aforementioned method. I adopt this approach, following the recommendations of Barro and Redlick (2011); Hall (2009); Ramey (2016) and Ramey and Zubairy (2018), in our estimation of fiscal multipliers.

And fourth, the effects of fiscal policy interact with monetary policy; thus, the impact of fiscal policy depends on the stance of monetary policy. Cloyne et al. (2020) proposed a new method to decompose these effects. They use Kitagawa-Blinder-Oaxaca decomposition applied to local projections (Blinder, 1973; Kitagawa, 1955; Oaxaca, 1973). Ghassibe and Zanetti (2022), show that fiscal multipliers are state-dependent.

In conclusion, the fiscal deficit is endogenous and I need to find an instrument. In this study, I aim to compute the results of ordinary least squares (OLS) estimation using the cyclically adjusted primary balance (CAPB) as the independent variable and compare them with the instrumental variables (IV) estimation of the CAPB with narrative shocks. This comparison is motivated by the desire to understand the effect of the choice of instrument on the estimates, following a similar logic as the "Hausman test"[10].

3.1 Data

The cyclically adjusted primary balance (CAPB) is a measure of discretionary fiscal policy commonly used in the literature. It is defined as the general government structural fiscal balance in percentage of potential GDP and serves as a proxy for the change in fiscal policy. However, its use is not without controversy[11], as it suffers from measurement errors in the calculation of the deficit elasticities with respect to the output gap, which are usually endogenous[12]. Additionally, changes in the CAPB may respond to changes in the business cycle, creating reverse causality issues. As a result, estimates of fiscal consolidations based on the CAPB can be biased, as demonstrated by studies using the narrative approach (De-

[9]This specification estimates something different such as an elasticity and then converts it to a multiplier by multiplying by the average value of Y/G.

[10]In Appendix E, I estimate by OLS (Newey-West correction for local projections) the main specification versus IV estimation (correcting for auto-correlation) instrumenting the Alesina CAPB and WEO Economic Outlook data by the "narrative" fiscal consolidation shocks. It can be seen that there is expansionary austerity (Alesina data) in the early periods, but when I instrument the variable, I get the true consistent value. When I estimate by OLS the exogenous fiscal shock, I get the true value that in IV.

[11]Milesi-Ferretti (2009); Morris and Schuknecht (2007); Romer and Romer (2010); Wolswijk (2007) discuss the disadvantages of using cyclically adjusted primary balance data.

[12]The equation used to obtain the CAPB is usually as follows: $CAPB = R \cdot \left(\frac{Y_p}{Y}\right)^{\varepsilon_R} - G \cdot \left(\frac{Y_p}{Y}\right)^{\varepsilon_G}$. Where R is the government revenue, Y_p is the potential output, Y is the actual GDP, ε_R is the elasticity of revenue respect to the output gap, G is the government spending and ε_G is the elasticity of government spending with respect to the output gap.

vries et al., 2011; Gechert et al., 2021; Guajardo, Leigh, & Pescatori, 2014; Jordà & Taylor, 2016; Perotti, 2013). Despite these limitations, the CAPB remains widely used as a measure of discretionary fiscal policy, as highlighted by Blanchard and Leigh (2013).

For this same reason, the Devries et al. (2011) database of fiscal consolidations (narrative approach) will be used to instrument the CAPB, which is obtained from Alesina and Ardagna (2010) and from the World Economic Outlook database (I.M.F., 2018) (obtained in 2018 and in 2022). In this way, we will solve both the well-known identification and the endogeneity problem. This instrument is based on the narrative method of Ramey and Shapiro (1998), Ramey (2011b), and Romer and Romer (2010). For the period 1978-2009, I use the Devries et al. (2011) database, then I combine it with the database from Alesina, Barbiero, Favero, Giavazzi, and Paradisi (2015); Alesina, Favero, and Giavazzi (2015) and Gupta et al. (2018) for the period 2009-2015. Finally, I extend the database for the period 2016-2019 from country specific sources and from Stability and Convergence Programs (following Gupta et al. (2018)). We follow the guide proposed in Devries et al. (2011) and we check if the measures are or not implemented, if not we delete them from the database. The logic of these measures is to get fiscal actions primarily motivated by a desire to reduce the deficit (then discretionally) to shore up government financial sustainability[13]. We collect the estimated contemporary budgetary impact of fiscal consolidation measures by governments or the European Commission in the year in which they come into effect. We then scale the budgetary impact of the measures as a percentage of GDP[14].

The data are extended with the Jordà et al. (2017) "Macrohistory Database" and the OECD database from which we extract information on macro variables for the 17 countries in our sample from 1978 to 2019. Data for Austria have been obtained with data from the OECD, World Development Indicators of the World Bank, the Central Bank of Austria (OeNB), the World Economic Outlook of the International Monetary Fund (IMF), Eurostat, International Finance Statistics of the IMF and finally the annual macro-economic database (AMECO) of the European Commission's Directorate General for Economic and Financial Affairs. The data used for the domestic central bank government debt purchase variable are obtained from Sovereign Debt Composition Dataset (Abbas, Blattner, Broeck, El-Ganainy, & Hu, 2014) and Sovereign Debt Investor Base for Advanced Economies (Arslanalp & Tsuda, 2014) updated as of April 30, 2021.

The sample countries for which annual data are available from 1978 to 2019 are 17 OECD countries including Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden, United Kingdom, and the United States[15]. In the period 1978 to 2019, there are a total of 79 episodes of fiscal consolidations spread over 274 years. The mean value of the size of the budgetary impact of deficit-driven fiscal measures is 3.45% of GDP, and the standard

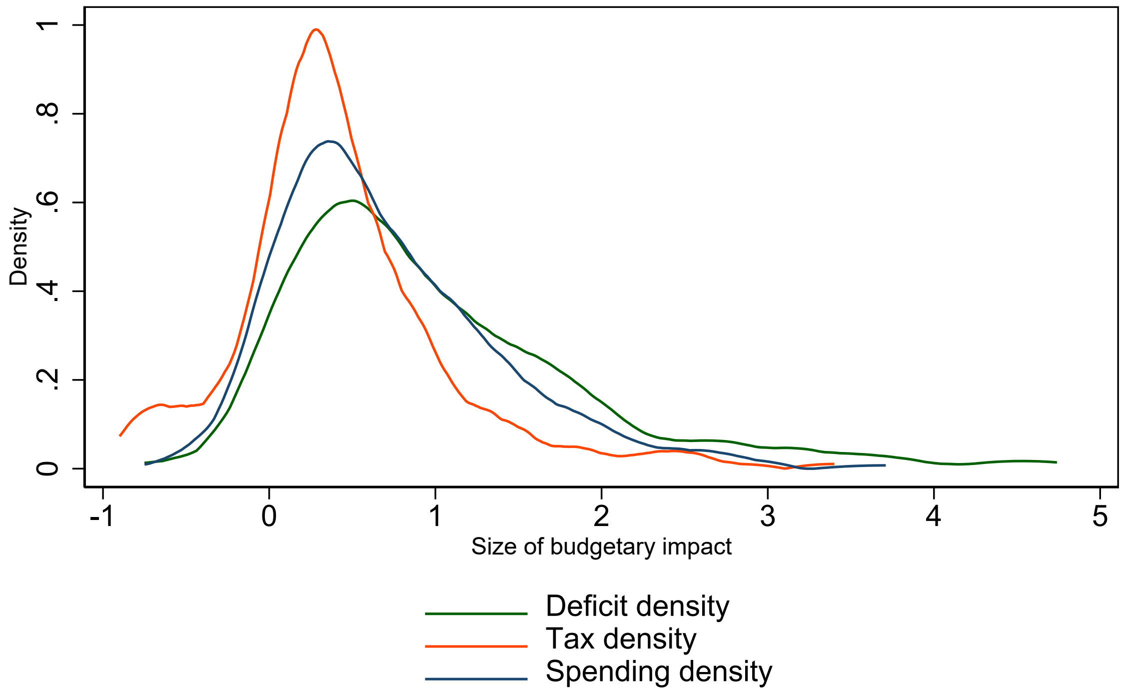
[13]To give an example, if there is a recession, we want to reduce the deficit, if there is an expansion, we want to reduce the deficit. Therefore, this variable would be exogenous by definition since it would be independent of the cycle.

[14]In the Appendix A, we can find the database from 2016-2019, its sources and measures. For more information on the rules followed, see Devries et al. (2011).

[15]Our panel data is strongly balanced with N=17 and T=41.

deviation of the size is 1.71% of GDP[16]. Figure 1 shows the density of the size of the narrative fiscal shock, differentiating between tax-based consolidation and spending-based consolidation[17]. We find that in Gechert (2015), tax policy has a lower multiplier effect than public investment or government spending. In Table 1, we can see the years in which the episodes of fiscal consolidations occur. Canada is the country where fiscal consolidation lasts the longest, about 13 years between 1984 and 1997. It is followed by the United States and Spain, with a fiscal consolidation between 1990 and 1998 of 8 years for United States and between 2007-2019 for Spain. Then, we have Italy and the Netherlands with a duration of 7 years respectively. In the period between 2003 and 2007, Japan had a 5-year fiscal consolidation after the Great Recession, and a 6-year fiscal consolidation before the Great Recession. After the Great Recession, there were also several long-term fiscal consolidations, such as in Canada, the United States, France, Spain, Belgium, Ireland, Italy, and Portugal. In general, it could be said that fiscal consolidations tend to be in packages lasting several years, with an average duration of 3.3 years.

Figure 1: Distribution of deficit-driven fiscal measures consolidations in % of GDP.



[16]Descriptive data: The median is equal to 0.75, the mode is equal to 0.4, the coefficient of variation is equal to 0.5, Fisher's skewness coefficient is 0.8 inferring therefore that the distribution is right skewed, and the Kurtosis coefficient is equal to 3.37 (leptokurtic).

[17]The reason why we make this is differenciation is that in the literature (Gechert, 2015, 2018; Ramey, 2011a), it is not clear what is the best approach for stabilizing the economy, whether it is through tax policy or government spending. Furthermore, there is some differentiation of effects depending on whether it is government spending or taxes.

Table 1: Fiscal consolidation episodes - based on Alesina, Barbiero, et al. (2015); Alesina, Favero, and Giavazzi (2015); Devries et al. (2011); Gupta et al. (2018), own calculations for the period 2016-2019 and the average duration.

Country	Fiscal consolidation episodes	Average duration (in years)
Australia	1985–1988, 1994–1999, 2010–2012, 2014–2018	4
Austria	1980–1981, 1984, 1996–1997, 2001–2002, 2011–2012, 2015	1
Belgium	1982–1985, 1987, 1990, 1992–1994, 1996–1997, 2010–2016	2
Canada	1984–1997, 2010–2015, 2018	6
Denmark	1983–1986, 1995, 2012, 2018	1
Finland	1992–1997, 2011, 2016-2018	3
France	1979, 1987, 1989, 1991–1992, 1995–1997, 1999–2000, 2011–2015	1
Germany	1982–1984, 1991–1995, 1997–2000, 2003–2004, 2006–2007, 2011–2012	2
Ireland	1982–1988, 2009–2015	6
Italy	1991–1998, 2004–2007, 2010–2015	5
Japan	1997–1998, 2003–2007, 2010-2016, 2018-2019	3
Netherlands	1981–1988, 1991–1993, 2004–2005, 2011–2013, 2015-2018	3
Portugal	1983, 2000, 2002–2003, 2005–2007, 2010–2016	2
Spain	1983–1984, 1989–1990, 1992–1997, 2009–2017, 2019	3
Sweden	1984, 1993–1998, 2011, 2015-2018	2
United Kingdom	1979–1982, 1994–1999, 2010, 2012, 2014–2016	2
United States	1978, 1980–1981, 1985–1986, 1988, 1990–1998, 2011, 2013–2018	2

In Figure 2 and Figure 3, we depict the episodes of fiscal consolidation that occurred in 17 countries from 1978 to 2019, plotted against the change in the cyclically adjusted primary balance (CAPB) as defined by Alesina and Ardagna (2010) and World Economic Outlook (obtained in 2018 and 2022), as well as the business cycle, which is proxied by the deviations of the log of real Gross Domestic Product (GDP) from its Hodrick-Prescott trend estimated with a smoothing parameter of $\lambda = 100$ (which, according to the literature, corresponds to annual data), as described in Jordà and Taylor (2016).

The purpose of this graph is to demonstrate the correlation between the cyclically adjusted primary balance (CAPB) and the output gap, as well as to illustrate the seemingly random distribution of fiscal consolidation episodes, represented by the shaded gray areas. The graph highlights a strong relationship between the evolution of the CAPB and the business cycle represented by the output gap as estimated through the Hodrick-Prescott filter, indicating the likely endogeneity of the two variables. To address this issue, it is necessary to impose restrictions or instrument the CAPB variable using additional information. In the subsequent section, we will outline the chosen identification strategy to overcome this issue.

Figure 2: Evolution of Change in CAPB (Alesina & Ardagna, 2010), business cycle and fiscal consolidation episodes (in grey areas).

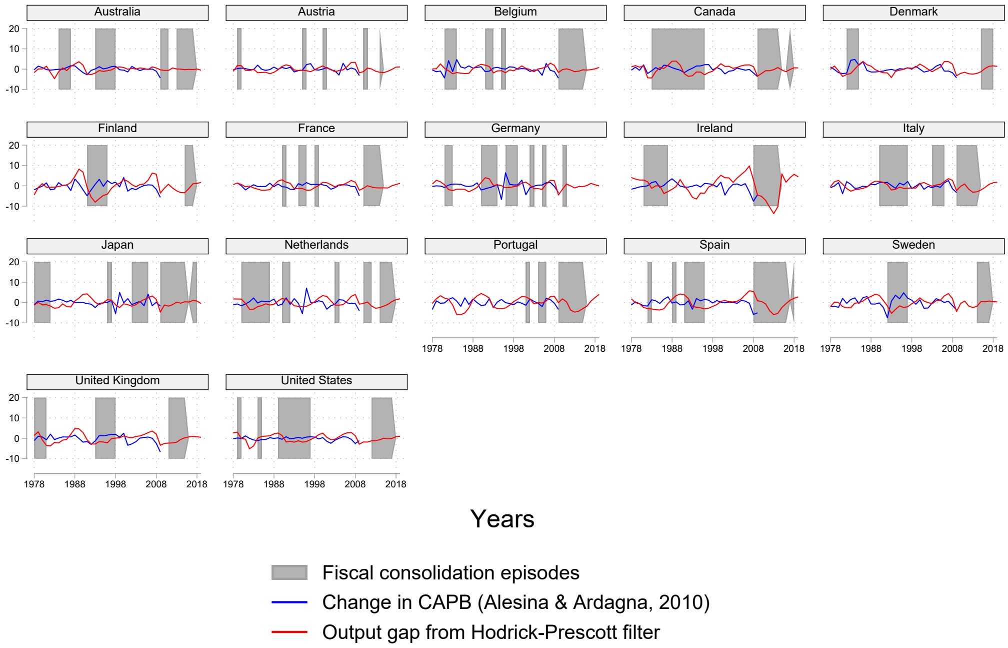
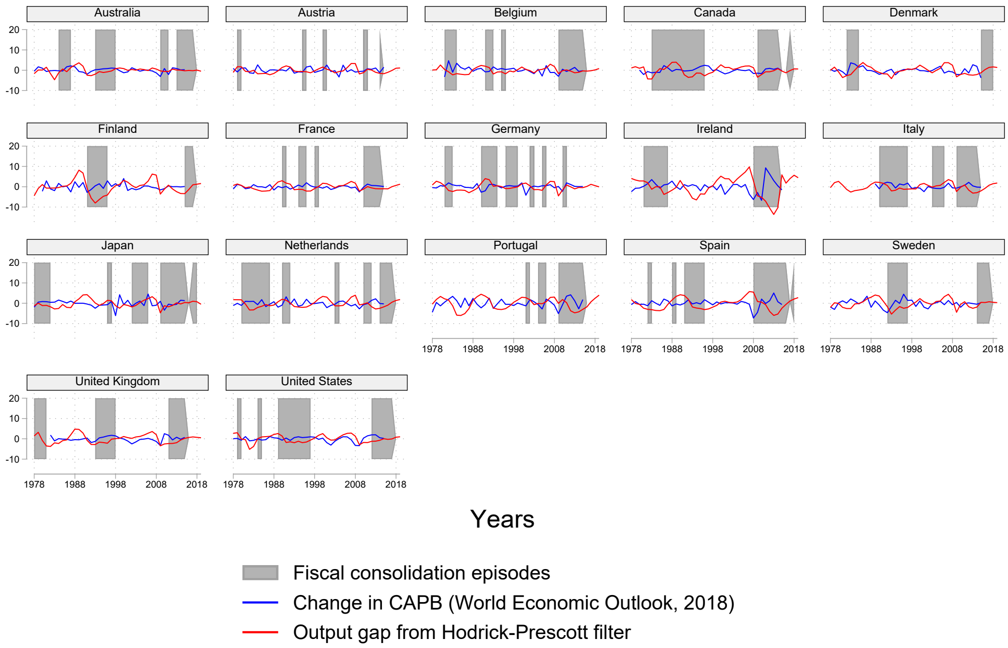


Figure 3: Evolution of Change in CAPB (WEO, 2018), cycle and fiscal consolidation episodes (in grey areas)



3.2 Identification problem

The identification problem in economics refers to the challenge of determining the cause-and-effect relationship between variables in a model. In macroeconomic models, this problem arises due to the presence of simultaneous relationships between variables. Sims (1980) did a great contribution to the field of macroeconomics, promoting the use of autoregressive vector models to overcome the limitations of large models with many equations. To address the identification problem, Sims (1980) introduced short-run recursive restrictions, known as Cholesky restrictions, to identify shocks.

Subsequently, Blanchard and Perotti (2002) imposed restrictions on the contemporaneous coefficients of fiscal policy, where they set them equal to zero in the Cholesky order. This was based on the intuition that contemporaneous effects are delayed by policy decisions or other adjustment costs. On the other hand, other contemporaneous restrictions are based on economic theory or on parameter estimates outside the vector autoregressive (VAR) model, as demonstrated in the work of Blanchard and Watson (1986).

The method of long-run parameter restrictions has been used by Galí (1999) to identify productivity shocks. Some papers are based on how economic theory predicts whether a variable reacts positively or negatively to shocks. In this way, Bayesian methods are used to impose beliefs or priors on how the endogenous variable reacts, thus restricting the responses of the endogenous variables and being able to identify the effects. This method is called sign restrictions and was introduced by Uhlig (1997). Bernanke, Boivin, and Eliasz (2005) consider that the few variables introduced in the VAR do not contain the relevant information to capture the effect, introducing more than five variables in the VAR generates a lot of variance and is counterproductive, therefore they propose to use the dynamic factor models of Stock and Watson (2002) together with the VARs, called factor augmented vector autoregressions (FAVAR). Molteni and Pappa (2018) use this method to estimate the effects of fiscal policy in times of expansion and recession. Some papers use high-frequency data, such as the effect of monetary policy press conferences in a thirty-minute window in the financial futures market (daily data). The additional assumption to say that these data are exogenous is that in daily data they will not be affected by other variables, and we can capture the true effect of monetary policy. Nakamura and Steinsson (2018) use this method, as well as Gertler and Karadi (2015) in order to identify monetary policy shocks.

The narrative approach is a valuable tool for macroeconomic analysis that utilizes historical data obtained from a wide range of sources, such as speeches, press releases, political documents, and other documents that provide information on discretionary policy changes. This method seeks to isolate the effects of political decisions, business cycle fluctuations, and other endogenous factors that may impact the variables of interest.

By using instrumental variables, high-frequency data, and other techniques, this approach can provide robust and reliable estimates of macroeconomic relationships. The narrative approach has a long and distinguished history, with notable contributions from economists such as the seminal work of Friedman and Schwartz (1963), who documented the monetary policy events in the United States over the period 1867-1960. Another example of the narrative approach's usefulness is seen in Romer and Romer (2010) where they utilized the narrative approach to identify tax shocks and measure their impact on the economy.

The use of instrumental variables (IVs) is gaining popularity as a means to extract information from sources outside the vector autoregression (VAR) model. The method relies on the identification of relevant and exogenous instruments that can be used to estimate the impact of variables of interest on the outcome of interest. Relevance requires that the instrument chosen is related to the variable being instrumentalized, while exogeneity requires that the chosen series is not correlated with other structural shocks.

The literature have employed IVs to analyze a range of economic phenomena. For example, Stock and Watson (2008) applied the method to analyze macroeconomic time series data, which was further extended in Stock and Watson (2012) and additionally, in Mertens and Ravn (2013).

It is important to note that the validity of IV estimates depends on the validity of the assumptions of relevance and exogeneity of the instruments chosen.

The chosen method then will be the narrative approach and the instrumental variables method, so we will follow Devries et al. (2011); Guajardo et al. (2014); Jordà and Taylor (2016); Romer and Romer (2010) and finally Cloyne et al. (2020). The advantage of the "narrative approach" is that it allows reconciling this technique with the instrumental variable's method, without the need to impose any restriction or rely on any economic theory or assumption (the only requirements that must be fulfilled are the two conditions of the instrumental variables). In addition to this, it is very easy to implement in the local projections approach (Cloyne et al., 2020; Jordà, 2005; Jordà & Taylor, 2016).

The study by Cloyne et al. (2020) provides an empirical approach to estimate the monetary-fiscal multiplier. This paper expands upon previous efforts by covering a longer time period (1978 to 2019, specifically the years after the 2008 Great Recession) and considering the impact of unconventional monetary policies. To capture these policies, the study uses a variable such as long-term interest rate or the share of public debt held by the central bank[18]. Additionally, a dummy variable is included to account for the zero lower bound episodes and accurately identify monetary shocks (as defined by Bonam, Haan, and Soederhuizen (2022) and Klein and Winkler (2021) as "when the short-term interest rate is less than or equal to 1 percent").

Following the previous definition of ZLB episodes, we obtain 166 periods of ZLB episodes, that is 22% of our sample. Considering the rest of periods as non-ZLB periods. The average duration of a ZLB episode is 9.76 years, with a standard deviation of 4.30[19]. In the period considered ZLB episodes last many years, much longer even than a recession

[18]See Rossi (2021) for a discussion of the variables and the methods used to estimate unconventional monetary policies.

[19]The country with the longest duration of the ZLB is Japan, with a duration of 24 years while Australia does not touch the ZLB in any period. This coincides with Australia not having done unconventional monetary policy, as it did not find its unconventional monetary policy dampened (this will be important in identifying unconventional monetary policy shocks).

could last, so in the period we consider ZLB is considerably important, both for the fiscal multiplier, as well as for the identification of unconventional monetary policy shocks (as found in the literature).

We will use the method based on local projections (Klein & Winkler, 2021; Ramey & Zubairy, 2018)[20] to identify unconventional monetary policy shocks, namely the response of 10-year government bond interest rate (as a robustness check we will also use the percentage of government bond purchases by the domestic central bank) of different countries to fiscal consolidation when we are in the ZLB period.

3.3 Local Projections

The estimation of the monetary-fiscal multiplier is a crucial aspect of macroeconomic analysis, and it requires the use of adequate methods to capture its behavior over time. To achieve this goal, I will adopt the approach of local projections, as proposed by Jordà (2005). The impulse response function (IRF) is an essential tool in this framework, as it provides information about the dynamic response of the system to exogenous shocks.

The IRF can be defined as the difference between two forecasts, the first one being the expected value of y_{t+h} when the shock $u_t = \delta$ occurs and the second one being the expected value of y_{t+h} when the shock does not occur $u_t = 0$. This concept can be formalized as follows: $R(h) = E\left[y_{t+h} \mid u_t = \delta, x_t\right] - E\left[y_{t+h} \mid u_t = 0, x_t\right]$[21].

The local projections technique (Jordà, 2005) allows for estimating impulse response functions estimating "directly" the object of interest instead of recursively. It requires a simpler inference instead of applying the delta method, estimating equations using usual methods as it is a single equation. It can be extended to panel data, and it is easier to include non-linearities such as state-dependence. By accounting for past shocks, it exhibits autocorrelation, which can be corrected using the Newey-West estimator. The impulse response function is similar to that produced by a VAR model as demostrated by Plagborg-Møller and Wolf (2021) if the same variables and lags are used in local projections. However, in local projections, the invertibility condition, which is required by Wold's representation theorem in VAR context, may not be satisfied.

Following Cloyne et al. (2020); Jordà, Schularick, and Taylor (2020); Jordà and Taylor (2016), the impulse response function closely resembles the average treatment effect (ATE) in microeconometrics[22]. For now, we assume that if $s \mid x$ is randomly assigned our model would be:

$$\begin{gathered} y_{t+h} = \left(1 - s_t\right)\left(\mu_0 + \beta_0 x_{t+h}\right) + s_t\left(\mu_1 + \beta_1 x_{t+h}\right) + u_{t+h} \\ s_t \in \{0, 1\} \end{gathered} \tag{1}$$

[20] Jordà and Nechio (2022) used the method to estimate the effect of transfers in the United States on inflation and wage growth since the outbreak of the pandemic.

[21] A comprehensive derivation of this concept can be found in Hamilton (1994).

[22] The average treatment effect (ATE) is a measure of the effect of a treatment or intervention on an outcome of interest, averaged over a population. It represents the difference in the expected outcome between individuals who received the treatment and those who did not, holding all other variables constant.

This is a simple linear regression model with a binary treatment indicator variable, where y_{t+h} is the dependent variable, which represents the outcome of interest at time $t+h$; s_t is the binary treatment indicator variable, which takes a value of 1 if the treatment is applied to the unit at time t and 0 otherwise; x_{t+h} is the independent variable, which are the set of control variables that affect the outcome; μ_0 and μ_1 are the intercept terms for the control and treatment groups, respectively; β_0 and β_1 are the response of coefficients for the control variables and treatment variables, respectively; u_{t+h} is the error term, which represents the unobserved factors that affect the outcome but are not included in the model. In this model, the coefficient (β_1) represents the different response facing the same characteristics of the control variables for the treatment group. The intercept terms (μ_0 and μ_1) represent the expected outcome for the control and treatment groups when the control variables are equal to zero.

$$\begin{aligned} ATE = E\left(y_{t+h} \mid s_t = 1; x_{t+h} = x\right) - E\left(y_{t+h} \mid s_t = 0; x_{t+h} = x\right) = (\mu_1 + \beta_1 x) - (\mu_0 + \beta_0 x) \\ = \mu_1 - \mu_0 \quad \text{if} \quad \beta_0 = \beta_1 = \beta \end{aligned} \tag{2}$$

Then, this $\mu_1 - \mu_0$ will be equal to γ_h, in the specification of local projections provided that the response to the same explanatory questions is the same.

Is the assumption of $\beta_0 = \beta_1 = \beta$ reasonable? For example, in the face of fiscal intervention it may be that those countries that have incurred fiscal consolidation are going to respond to the same characteristics differently than those that have not had fiscal consolidation[23]. In our case, does it make sense that the different central banks of those countries that have had fiscal consolidation respond differently than those countries that have not? For this reason, it is important to identify the monetary policy framework by country, and its sensitivity or response to fiscal consolidation. In the context of a VAR this assumption should always be met. But with the Kitagawa-Blinder-Oaxaca methodology we can relax this assumption.

Jordà's approach is similar to utilizing the impulse response functions of a VAR (Plagborg-Møller & Wolf, 2021). It has certain benefits such as the ability to estimate with OLS and other methods (2SLS, etc.), the requirement for simpler inference, and the robustness to data-generating process misspecification and nonlinearities (Jordà, 2005) such as state-dependence and the interaction of unconventional monetary policy and fiscal policy. However, as Jordà's approach involves forecasting past shocks, it can result in autocorrelation in each year that should be corrected using the Newey-West estimator (Newey & West, 1987).

[23] In a simpler example, such as the wage differential between men and women. The difference in means would be the gender wage bias. But women respond differently than men to the same characteristics of men. In an example drawn from Jann (2003, 2008) using data from the Swiss Labor Market Survey 1998, he obtains that the wage bias between men and women is 0.17 (this would be the difference in means). While women would have a wage increase of 0.085 if they had the same characteristics of education, experience, and seniority as men (this would be the indirect effect and, as can be seen, they do not respond in the same way).

3.4 Model

We aim to estimate the fiscal multiplier by holding long-term interest rate constant. However, it is important to note that this approach may not accurately reflect the relationship between fiscal policy and interest rate in reality, as interest rate may endogenously respond to fiscal interventions due to the influence of monetary policy. Specifically, a stronger monetary regime may cause an expansion prior to a deficit cut or a contraction in response to an contractionary fiscal policy, potentially offsetting the impact on GDP. As a result, it is important to consider the potential interaction between monetary and fiscal policy when estimating the fiscal multiplier.

Following Cloyne et al. (2020) and Ramey and Zubairy (2018), we can postulate a simple structural equation model example:

$$y_{i,t} = \lambda f_{i,t} + \alpha_1 r^{long}_{i,t} + \alpha_2 r^{short}_{i,t} + \beta X_{i,t} + u^y_{i,t} \tag{3}$$

$$\begin{aligned} r^{long}_{i,t} = &\left(\bar{\Theta}_A f_{i,t} + \Theta_{A,i} f_{i,t} + \Theta^y_A u^y_{i,t} + \delta_A X_{i,t}\right) I_{i,t-1} + \\ &+ \left(\bar{\Theta}_B f_{i,t} + \Theta_{B,i} f_{i,t} + \Theta^y_B u^y_{i,t} + \delta_B X_{i,t}\right)(1 - I_{i,t-1}) + u^r_{i,t} \end{aligned} \tag{4}$$

Tthe model includes two equations: one for $y_{i,t}$ and one for $r^{long}_{i,t}$. In the model, $y_{i,t}$ is the dependent variable, the GDP; $f_{i,t}$ is the fiscal shock; $r^{long}_{i,t}$ is the long-term interest rate; $r^{short}_{i,t}$ is the short-term interest rate; $X_{i,t}$ is a set of explanatory variables that may include additional control variables; λ is the coefficient on the $f_{i,t}$ variable, which represents the effect of $f_{i,t}$ on $y_{i,t}$; α_1 is the coefficient on the $r^{long}_{i,t}$ variable, which represents the effect of the long-term interest rate on $y_{i,t}$; α_2 is the coefficient on the $r^{short}_{i,t}$ variable, which represents the effect of the short-term interest rate on $y_{i,t}$; β is the coefficient on the $X_{i,t}$ variable, which represents the effect of the control variables on $y_{i,t}$; $u^y_{i,t}$ is the error term for the $y_{i,t}$ equation. It represents the influence of all other factors that are not included in the model on $y_{i,t}$; $I_{i,t-1}$ is a dummy variable that takes value equal to 1 if the country i is in the ZLB period and value equal to zero if country i is outside the period of the ZLB; $\bar{\Theta}$[24] is the coefficient on the $f_{i,t}$ variable in the $r^{long}_{i,t}$ equation, which the mean effect of $f_{i,t}$ on $r^{long}_{i,t}$; which the mean effect of $f_{i,t}$ on $r^{long}_{i,t}$; Θ_i is the idiosyncratic coefficient[25] on the $f_{i,t}$ variable in the $r^{long}_{i,t}$ equation; Θ^y is the coefficient on the $u^y_{i,t}$ variable in the $r^{long}_{i,t}$ equation, which represents the effect of other economics shocks on $r^{long}_{i,t}$; δ is the coefficient on the $X_{i,t}$ variable in the $r^{long}_{i,t}$ equation; $u^r_{i,t}$ is the error term for the $r^{long}_{i,t}$ equation. It represents the influence of all other factors that are not included in the model on $r^{long}_{i,t}$.

Substituting $r^{long}_{i,t}$ in the equation of the output $y_{i,t}$, we can obtain the reduced form:

$$\begin{aligned} y_{i,t} = \lambda f_{i,t} + \alpha_1 (&\left[\bar{\Theta}_A f_{i,t} + \Theta_{A,i} f_{i,t} + \Theta^y_A u^y_{i,t} + \delta_A X_{i,t}\right] I_{i,t-1} \\ + &\left[\bar{\Theta}_B f_{i,t} + \Theta_{B,i} f_{i,t} + \Theta^y_B u^y_{i,t} + \delta_B X_{i,t}\right](1 - I_{i,t-1}) + u^r_{i,t}) + \alpha_2 r^{short}_{i,t} + \beta X_{i,t} + u^y_{i,t} \end{aligned} \tag{5}$$

[24] The subindex A or B denotes if corresponds with the ZLB period or the non ZLB period respectively.
[25] Country-specific coefficient.

After some algebra:

$$
\begin{gathered}
y_{i,t} = \lambda f_{i,t} + \alpha_1 \bar{\Theta}_A f_{i,t} I_{i,t-1} + \alpha_1 \bar{\Theta}_B f_{i,t}(1 - I_{i,t-1}) + \alpha_1 \Theta_{A,i} f_{i,t} I_{i,t-1} + \alpha_1 \Theta_{B,i} f_{i,t}(1 - I_{i,t-1}) + \\
+ \alpha_1 \Theta_A^y u_{i,t}^y I_{i,t-1} + \alpha_1 \Theta_B^y u_{i,t}^y (1 - I_{i,t-1}) + \alpha_1 \delta_A X_{i,t} I_{i,t-1} + \alpha_1 \delta_B X_{i,t}(1 - I_{i,t-1}) + \\
+ \alpha_1 u_{i,t}^r + \alpha_2 r_{i,t}^{short} + \beta X_{i,t} + u_{i,t}^y
\end{gathered}
\tag{6}
$$

Simplifying and arranging terms, we get the output equation:

$$
\begin{gathered}
y_{i,t} = (\lambda + \alpha_1 \bar{\Theta}_A I_{i,t-1} + \alpha_1 \bar{\Theta}_B (1 - I_{i,t-1})) f_{i,t} + (\alpha_1 \Theta_{A,i} I_{i,t-1} + \alpha_1 \Theta_{B,i} (1 - I_{i,t-1})) f_{i,t} + \\
+ \alpha_2 r_{i,t}^{short} + (\beta + \alpha_1 \delta_A I_{i,t-1} + \alpha_1 \delta_B (1 - I_{i,t-1})) X_{i,t} + \\
+ \alpha_1 u_{i,t}^r + (1 + \alpha_1 \Theta_A^y I_{i,t-1} + \alpha_1 \Theta_B^y (1 - I_{i,t-1})) u_{i,t}^y
\end{gathered}
\tag{7}
$$

Where $y_{i,t}$ is the endogenous variable, $f_{i,t}$ is the fiscal stimulus, $r_{i,t}^{long}$ is the long-term interest rates, $r_{i,t}^{short}$ is the short-term interest rates, $X_{i,t}$ the set of control variables and $u_{i,t}$ the error[26]. Provided that fiscal shocks are well identified (as should be the case since the shocks must be exogenous) the effect of $f_{i,t}$ would be the direct effect of the shock plus the mean of the monetary responses $(\lambda + \alpha_1 \bar{\Theta}_A I_{i,t-1} + \alpha_1 \bar{\Theta}_B (1 - I_{i,t-1}))$. And when we are in the period of the ZLB, the direct effect plus the mean of the monetary responses would be equal to $(\lambda + \alpha_1 \bar{\Theta}_A)$. We cannot separate these two effects in the data using only the fiscal shocks.

Monetary policy responsiveness depends on the country. This heterogeneity of responses across countries (due to an idiosyncratic component) that exists in the data allows us to identify and separate the effects. For example, an expansionary fiscal policy may affect more if the central bank governor is a dove[27]. The heterogeneity that exists in each country allows us to identify whether Jerome Powell is a hawk or a dove. For this reason, we will use a proxy for the monetary regime that can be used as an identifier of the monetary regime. We manage to separate these effects by arbitrarily varying the mean of the monetary responses.

To have the same format as Kitagawa-Blinder-Oaxaca, the local projections can be extended as follows using equations (1) and (2), however we will now relax the assumption that $\beta_0 = \beta_1 = \beta$:

$$
\begin{gathered}
y_{i,t+h} = (1 - s_{i,t}) \left(\mu_{i,0} + \beta_0 x_{i,t+h}\right) + s_t \left(\mu_{i,1} + \beta_1 x_{i,t+h}\right) + u_{i,t+h} \\
s_{i,t} \in \{0, 1\}
\end{gathered}
\tag{8}
$$

[26]The upper index indicates if the error term corresponds to the output equation or to the long-term interest rate equation.

[27]"Dove" and "hawk" are terms used to describe different perspectives on monetary policy. Doves believe that the central bank should prioritize boosting economic growth and reducing unemployment, even if it means allowing inflation to rise above its target. On the other hand, hawks believe that the central bank should prioritize controlling inflation, even if it means restricting economic growth and keeping unemployment high. In other words, doves are more willing to take a loose approach to monetary policy, while hawks favor a tighter monetary policy stance

$$
\begin{aligned}
ATE &= E\left(y_{i,t+h} \mid s_{i,t}=1; x_{i,t+h}=x\right) - E\left(y_{i,t+h} \mid s_{i,t}=0; x_{i,t+h}=x\right) \\
&= \left(\mu_{i,1} + \beta_1 E\left(x \mid s_{i,t}=1\right)\right) - \left(\mu_{i,0} + \beta_0 E\left(x \mid s_{i,t}=0\right)\right)
\end{aligned}
\tag{9}
$$

Now we add and subtract: $\beta_0 E\left(x \mid s_{i,t}=1\right)$:

$$
\begin{aligned}
ATE &= \left(\mu_{i,1}-\mu_{i,0}\right) + \beta_1 E\left(x \mid s_{i,t}=1\right) - \beta_0 E\left(x \mid s_{i,t}=1\right) + \beta_0 E\left(x \mid s_{i,t}=1\right) \\
&= \left(\mu_{i,1}-\mu_{i,0}\right) + (\beta_1-\beta_0) E\left(x \mid s_{i,t}=1\right) + \beta_0\left(E\left(x \mid s_{i,t}=1\right) - E\left(x \mid s_{i,t}=0\right)\right)
\end{aligned}
\tag{10}
$$

Recall:

$$
ATE = \underbrace{\left(\mu_{i,0}-\mu_{i,1}\right)}_{\text{direct}} + \underbrace{\left(\beta_1-\beta_0\right) E\left(x \mid s_{i,t}=1\right)}_{\text{indirect}} + \underbrace{\beta_0\left(E\left(x \mid s_{i,t}=1\right) - E\left(x \mid s_{i,t}=0\right)\right)}_{\text{composition}}
\tag{11}
$$

This is Kitagawa-Blinder-Oaxaca decomposition that allows us to identify three effects:

- direct: effect of a fiscal intervention on the variables of output under random assignment.
- indirect: treatment spillovers on covariate effects. For instance, the effect of policy interventions can modify how other variables (e.g., interest rate or bond purchases) affect the dependent variables. In our case, fiscal multipliers may be higher if there is a fairly aggressive expansionary monetary policy.
- composition: failure of random assignment (for example, small sample that generate bias). Allows us to quantify any bias due to an imperfect identification of shocks. If fiscal interventions are truly exogenous, the mean value of the control variables should be the same regardless of whether there is an exogenous fiscal intervention.

Note that if $\beta_0 = \beta_1 = \beta$, the indirect effect is equal to 0. The composition effect should be equal to zero if our shocks are well identified.

Using Kitagawa-Blinder-Oaxaca, we can identify the direct effect λ and the indirect effect $\alpha_1\bar{\Theta}_A$ of equation (7). With simulations, in which we vary the the response of interest rate to fiscal policy ($\bar{\Theta}_A$), we can obtain how the fiscal multiplier changes in response to the responsiveness of unconventional monetary policy. The Cloyne et al. (2020) methodology takes into account nonlinear, state-dependent effects simply by using conventional simple linear estimators.

Extension applied to local projections:

$$
y_{i,t+h} = \mu_i^h + \gamma_0^h\left(x_{i,t}-\bar{x}_i\right) + \beta^h f_{i,t} + \theta_x^h\left(x_{i,t}-\bar{x}_i\right) f_{i,t} + \omega_{i,t+h} \quad h=0,1,\ldots,H
\tag{12}
$$

where $y_{i,t}$ is the dependent variable, for example log GDP, the deficit-to-GDP ratio, inflation rate or the long-term interest rate; t refers to the time and i refers to the country; μ_i^h is a country fixed effect; $f_{i,t}$ is the fiscal policy intervention, in our case the country-specific fiscal consolidation "narrative" shock, $x_{i,t}$ is the vector of additional covariates, with mean $\bar{x}_i$; h is the horizon of the impulse response.

- direct effect: β^h.

- indirect effect: $\theta_x^h (x_{i,t} - \bar{x}_i)$.

- composition effect: $\gamma_0^h (x_{i,t} - \bar{x}_i)$.

- total effect: $\beta^h + \theta_x^h (x_{i,t} - \bar{x}_i) + \gamma_0^h (x_{i,t} - \bar{x}_i)$.

The β^h could be interpreted as one measure of a fiscal multiplier. But later we compute cumulative multipliers from the IRFs of GDP and the fiscal variable to consider the full dynamic path of GDP and the fiscal variables. As we have stated in Section 3, the fiscal multiplier is the division between the response of GDP and the response of deficit-to-GDP ratio. We will follow the approach proposed by (Ramey, 2016) as the 2SLS estimate of the multiplier is equivalent to computing the raw effect on the level of GDP and dividing it by the response of the endogenous fiscal variable (in our case, the CAPB or the fiscal deficit).

In our baseline model $x_{i,t}$ includes two lags of real GDP growth, two lags of the deficit-to-GDP ratio, two lags of the change in the long-term interest rate, two lags of the change in the short-term interest rate and two lags for the output gap to control for the state of the cycle, as in Jordà and Taylor (2016). For the dependent variables, the response of the deficit-to-GDP ratio is need to compute the fiscal multiplier, but the variable is not available in the Guajardo et al. (2014) dataset, then we obtain it from OECD database.

Following the specification of Devries et al. (2011) and Guajardo et al. (2014), we estimate the same model with the same covariates (as in Cloyne et al. (2020)) but instead of a proxy VAR, we use the sequence of local projections instrumentalizing the CAPB measure of deficit with the “narrative” fiscal consolidation shocks for the period 1978-2019. This will constitute our baseline results. We included the response of long-term interest rate as well as the response of the percentage of public debt held by domestic central bank (% of GDP):

$$\Delta Y_{i,t} = \mu_i + \lambda_t + \sum_{s=1}^{k} \gamma_s \Delta Y_{i,t-s} + \sum_{s=0}^{k} \beta_s \Delta F_{i,t-s} + v_{i,t} \tag{13}$$

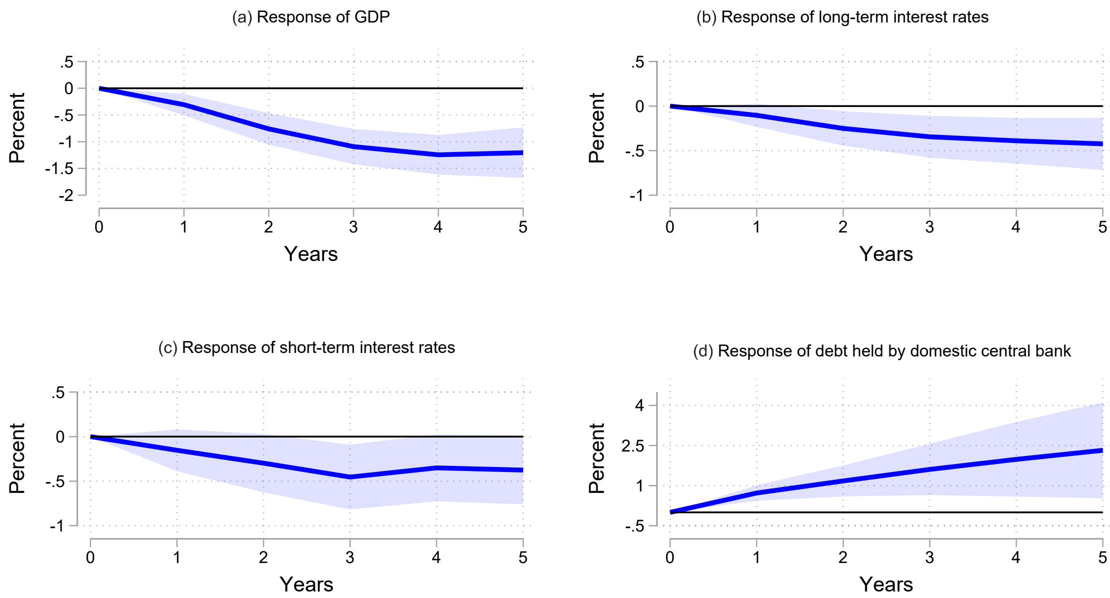
The dependent variables in this model, denoted as $\Delta Y_{i,t}$, include output, long-term interest rate, short-term interest rate, and the percentage of public debt, μ_i are the country fixed effects, λ_t are time effects, $\Delta Y_{i,t-s}$ are the lagged dependent variables, γ_s are the coefficients associated with the lagged dependent variables, $\Delta F_{i,t-s}$ is the change in the CAPB that we will instrument with the ”narrative” fiscal consolidation shocks, β_s is therefore the coefficient of interest of our treatment and $v_{i,t}$ is the error term.

4 Results

In Figure 4, we present the results of the impulse response functions estimated from equation (13), following the approach described by Guajardo et al. (2014) and as reported by

Cloyne et al. (2020). It can be seen that in the GDP response (panel **(a)** in Figure 4), a fiscal deficit reduction of 1% of GDP, reduces GDP by 1% at 3 years, with a peak in year 4 around 1.25% fall in GDP. The GDP response is a bit steeper, although very similar to that obtained by Guajardo et al. (2014) and in Cloyne et al. (2020), despite the sample going from 1978 to 2019. However, a difference is found with respect to Cloyne et al. (2020), as the response of short-term interest rate is not significant (panel **(c)** in Figure 4) given that conventional monetary policy in the period considered from 2008 onwards remains constant and close to zero. Also, the fact that unconventional monetary policy came into play reducing the longer-term interest rate in order to affect the short-term interest rate[28] with the objective of stimulate borrowing, spending, and investment, which can help to boost economic activity and overcome the economic slowdown.

Figure 4: Response of variables to 1% shock fiscal consolidation[29].



Notes: 90 percent confidence bands

Following our approach, one can see how long-term interest rate react on average to fiscal consolidation by reducing[30] and the purchase of government debt by the monetary authority respond to fiscal consolidation by increasing[31]. The precise amount of the decline will depend on the degree of monetary policy accommodation in each country at the time; that is, whether or not it responds slightly to such fiscal consolidation. For example, if the central bank responds very slightly, we may see a much larger effect on GDP. What we see in Figure 4 are only the average effects. We are interested in seeing the decomposition of this mean, characterizing the embedded heterogeneity in the response of the monetary

[28]By reducing the cost of borrowing.

[30]Possibly to mitigate the negative impact of the deficit reduction on GDP, the monetary authority reduces interest rate.

[31]This is what drives down longer-term interest rate.

authority in each country. Including one covariate more to capture the monetary regime in a specific country, we get:

$$y_{i,t+h} = \mu_i^h + \gamma_0^h (x_{i,t} - \bar{x}_i) + \beta^h f_{i,t} + \theta_x^h (x_{i,t} - \bar{x}_i) f_{i,t} + \underbrace{\theta_f^h \Theta_{i,t} f_{i,t}}_{\text{monetary-fiscal interaction.}} + \omega_{i,t+h} \quad (14)$$

In order to address the identification challenge and the endogeneity issue, we must effectively instrument the coefficient $\Theta_{i,t}$. To achieve this, we will utilize the differential response of each country's long-term interest rate[32] when they enter the zero lower bound period, as unconventional monetary policies were implemented. By utilizing panel data, we can capture the richness of country-specific information, such as differences in monetary policy committees, central bank objectives, institutional factors, or the timing of entrance into the ZLB due to an earlier financial crisis, all of which affect the response of fiscal consolidation to long-term interest rate movements after the Great Recession.

The problem, of course, is that this response is not directly observed. Therefore, we must construct a proxy based on the average cross-country differences in the response or sensitivity to an exogenous fiscal consolidation when we are in ZLB period. In that sense, it will be $\Theta_{i,t} = \Theta_i$[33].

Our objective is to identify a reliable proxy that will serve as an instrument in the second-stage regression. To achieve this, we will follow the methodology established by leading economists, such as Guren, Alisdair, Nakamura, and Steinsson. (2021); Nakamura and Steinsson (2014, 2018) and Cloyne et al. (2020), by estimating a Taylor rule for unconventional monetary policy that differentiates between the zero lower bound (ZLB) period and the non-ZLB period.

We will use a difference-in-differences approach to examine the change in long-term interest rate in response to country-specific fiscal consolidation, taking into account the ZLB period when unconventional monetary policy comes into play. Our approach builds on the work of Cloyne et al. (2020); Jordà (2005); Jordà and Taylor (2016) on local projections and Klein and Winkler (2021); Ramey and Zubairy (2018) on estimating state-dependence with local projections. The event of interest is the ZLB period and the treatment group will be those countries undergoing fiscal consolidation. Our choice of variables and the post-ZLB period is informed by the work of Rossi (2021). The coefficient of interest is $\tilde{\Theta}_{A,i}^h$.

The following sequence of local projections is estimated:

[32] For robustness check exercise, we are going to use the percentage of public debt held by the domestic central bank of each specific country. In Appendix B, you can find the data on interest rate at 10 of the public debt and the percentage of public debt held by the domestic central bank.

[33] As in Cloyne et al. (2020).

$$R_{i,t+h}^{long} = I_{i,t-1} \underbrace{\left[\alpha_{A,h} + \gamma_{A,0}^{h} (x_{i,t} - \bar{x}_i) + \sum_{j=1}^{N} \tilde{\Theta}_{A,i}^{h} \cdot f_{i,t} \cdot I[i=j] \right]}_{\text{ZLB period}} + \\ + (1 - I_{i,t-1}) \underbrace{\left[\alpha_{B,h} + \gamma_{B,0}^{h} (x_{i,t} - \bar{x}_i) + \sum_{j=1}^{N} \tilde{\Theta}_{B,i}^{h} \cdot f_{i,t} \cdot I[i=j] \right]}_{\text{non ZLB period}} + \mu_i^h + \omega_{i,t+h} \tag{15}$$

where $R_{i,t}^{\text{long}}$ is long-term interest rate (under control of the monetary authority during ZLB period) in country i in time t; $I_{i,t-1}$ is a dummy variable that takes value equal to 1 if the country i is in the ZLB period and value equal to 0 if country i is outside the period of the ZLB; α_A is the constant term for the ZLB period and α_B is the constant term for the non-ZLB period; $x_{i,t}$ are additional covariates (output gap, inflation and lagged long-term interest rate to capture persistence[34]; $\bar{x}_i$ are covariates demeaned values, γ_0^h the set of covariates coefficients; $f_{i,t}$ is the exogenous "narrative" fiscal consolidation shock; $I[i=j]$ is a country variable dummy, allowing the coefficient to vary by country; μ_i^h are country fixed effects term; and $\omega_{i,t+h}$ is the error term.

In our analysis, we use a two-stage regression approach to examine the country-specific responsiveness of domestic central banks to fiscal consolidations during the period of the zero lower bound (ZLB). Our primary focus is the parameter $\tilde{\Theta}_{A,i}^{h}$[35], which represents the average responsiveness of a central bank to an exogenous fiscal consolidation in the ZLB period, and $\tilde{\Theta}_{B,i}^{h}$, which represents the average responsiveness outside the ZLB period.

In the first stage, we estimate the values of $\widehat{\tilde{\Theta}_{A,i}^{h}}$, and then demean them to obtain the deviation from the average $\left(\left(\widehat{\tilde{\Theta}_{A,i}^{h}} - \overline{\widehat{\tilde{\Theta}_{A,i}^{h}}} \right)^{36} \right)$, which we then use as a state variable in the main equation:

$$y_{i,t+h} = \mu_i^h + \gamma_0^h (x_{i,t} - \bar{x}_i) + \beta^h f_{i,t} + \theta_x^h (x_{i,t} - \bar{x}_i) f_{i,t} + \underbrace{\theta_f^h \widehat{\tilde{\Theta}_{A,i}^{h}} f_{i,t}}_{\substack{\text{monetary-fiscal} \\ \text{interaction}}} + \omega_{i,t+h} \tag{16}$$

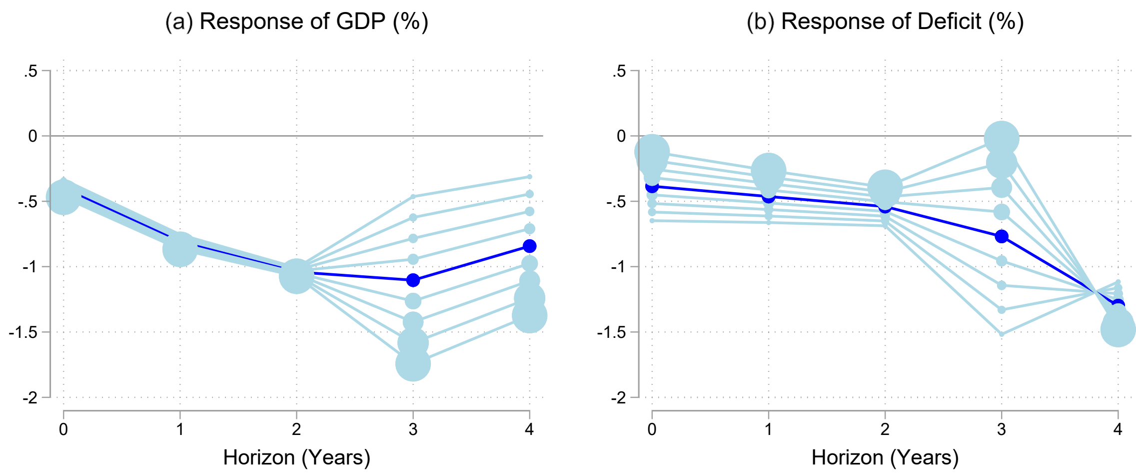
The intuition behind this approach is that the country-specific response of long-term

[34]Since our interest is not to estimate "unconventional Taylor rule" parameters, we maintain the specification parsimonious without including other additional covariates. If we include them, we get the exact same coefficients for our key parameter $\tilde{\Theta}_{A,i}^{h}$. Eventually, it is not necessary to include covariates to identify our "monetary regime" proxy for ZLB period.

[35]For years 0, 1, 2, 3 and 4, the average response of the country-specific long-term interest rate for the ZBL period is -0.08, -0.18, -0.17, -0.19 and -0.46 respectively.

interest rate to fiscal shocks is idiosyncratic[37], and on average, uncorrelated with other shocks in the economy. Thus, the second stage regression captures the effect of unconventional monetary policy heterogeneity on the fiscal multiplier. By incorporating the fitted value $\widehat{\widetilde{\Theta}^h_{A,i} f_{i,t}}$ as a state variable, we can then estimate the response of GDP (and deficit) to fiscal shocks, taking into account the heterogeneity of monetary policy regimes as the sensitivity instrument (Cloyne et al., 2020; Guren et al., 2021; Nakamura & Steinsson, 2014, 2018).

Figure 5: Response of interest variables to 1% shock fiscal consolidation by monetary responsiveness (simulated experiments).



Notes: Scenarios varying the unconventional monetary policy responsiveness

The Kitagawa-Blinder-Oaxaca decomposition is employed to estimate the main equation in Figure 5, which illustrates the results of the impulse response function. A range of scenarios were considered, in which the sensitivity of the long-term interest rate to fiscal shocks was altered by varying the parameter $\widetilde{\Theta}^h_{A,i}$ by one standard deviation, from -0.5 to 0.5 standard deviations. This produced an average long-term interest rate response of 80 basic points over the period of the ZLB, as described in Appendix F.

The size of the circular markers in Figure 5 serves to indicate the contractionary or expansionary nature of unconventional monetary policy, with larger markers indicating a more restrictive monetary policy. It can be observed that if the monetary authority implements unconventional monetary policy in line with fiscal consolidation, the multiplier will increase. Conversely, a monetary policy that is at odds with fiscal consolidation leads to a reduction in the multiplier, although not to the same extent as the previous scenario.

Appendix F provides further insight into the response of interest rate as the degree of monetary accommodation is varied. A expansionary monetary policy results in a negative response of interest rate.

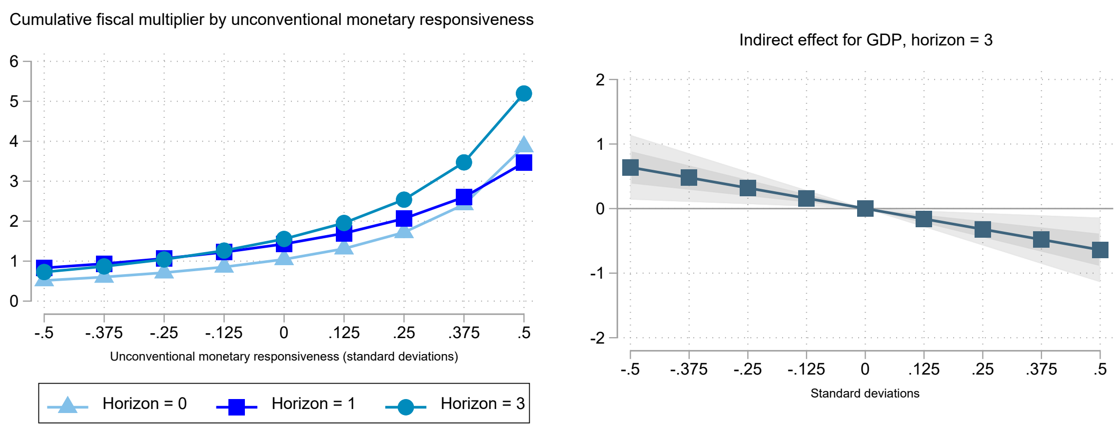
[37]The richness of panel data in our study enables us to identify the country-specific response of long-term interest rate, accounting for factors such as differences in monetary policy committees, central bank objectives, institutional factors, or the timing of entrance into the ZLB due to an earlier financial crisis.

The impulse response function of GDP[38] and the deficit to a fiscal consolidation of 1% of GDP is depicted in panel **(a)** in Figure 5. The direct effect of this fiscal consolidation, as estimated by the β^h coefficient, is indicated by the blue line in Figure 5 and is comparable to the results of the linear model presented in Figure 4. As seen in Figure 4, GDP decreases by approximately 1% after 2-4 years.

To examine the impact of unconventional monetary policy, the indirect effect from the Kitagawa-Blinder-Oaxaca decomposition was varied. With monetary policy aligned with fiscal consolidation, the response of GDP reaches a peak close to 2% in year 3[39]. Panel **(b)** in Figure 5 displays the response of the deficit, showing that fiscal consolidation leads to a reduction of -0.5% in the current year and 1.25% in year 4. This occurs because it takes time for the effects of fiscal consolidation to be realized and monetary policy can affect the rate at which the deficit reduces.

In general, there is limited state-dependence in the first few years for both GDP and deficit, with state-dependence becoming more pronounced in year 3 and 4 for GDP and year 3 for the deficit. This could indicate that unconventional monetary policy has not produced the expected outcomes with respect to increase in GDP, as noted in prior research such as Cochrane (2018, 2020); Fabo, Jančoková, Kempf, and Pástor (2021); Greenlaw et al. (2018) and Hamilton (2018).

Figure 6: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

The indirect effect is significant for GDP in year 3 as evidenced by the second graph of Figure 6, since the confidence intervals remain distinct from zero. As for the fiscal multiplier, we can comment that point 0 on the x-axis would correspond to the multiplier when there is no effect of monetary policy on it and is the one normally estimated throughout the literature when linear models are used. In our case, the multiplier at that point is between 1 and 1.25 (close to 1). So it is something that is found in the literature (as in Cloyne

[38]Sample is extended from 2016 to 2019 with self-developed data. See Appendix A for sources.

[39]In table of Appendix D, we find the estimates of the coefficients β^h (direct effect), θ_f^h (indirect effect) and the estimated standard errors.

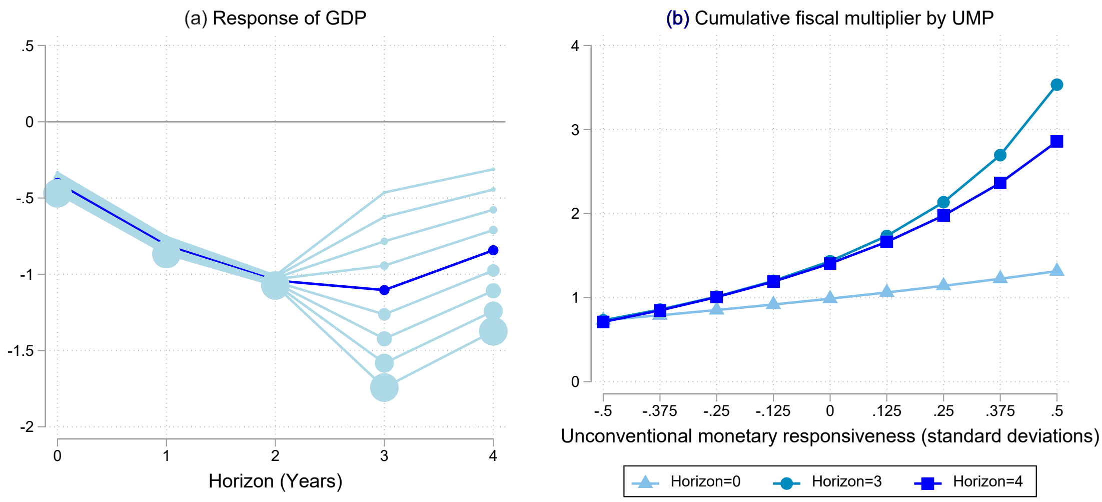
et al. (2020); Gechert (2015, 2018, 2022); Ramey (2016)). For the case that unconventional monetary policy goes against the grain of fiscal policy, it causes this to be reduced by not affecting the multiplier too much (although it does cause it to be less than one). Moreover, these effects are linear. In the case where the monetary authority raises interest rate (and goes in line with fiscal policy), non-linear effects are seen in the multiplier, finding a multiplier ranging from 2 to 5 in year 3. It is much higher than normally estimated in the literature when the period after the Great Recession is introduced in the sample and much greater than 2 in year 3 (The one obtained by Cloyne et al. (2020)). Therefore, if there is coordination between monetary policy and fiscal policy we could find unusually large monetary-fiscal multipliers (from 2 to 5) when we take into account a period in which the zero lower bound is hit.

5 Extensions and robustness checks

5.1 Extensions

5.1.1 Other deficit variable

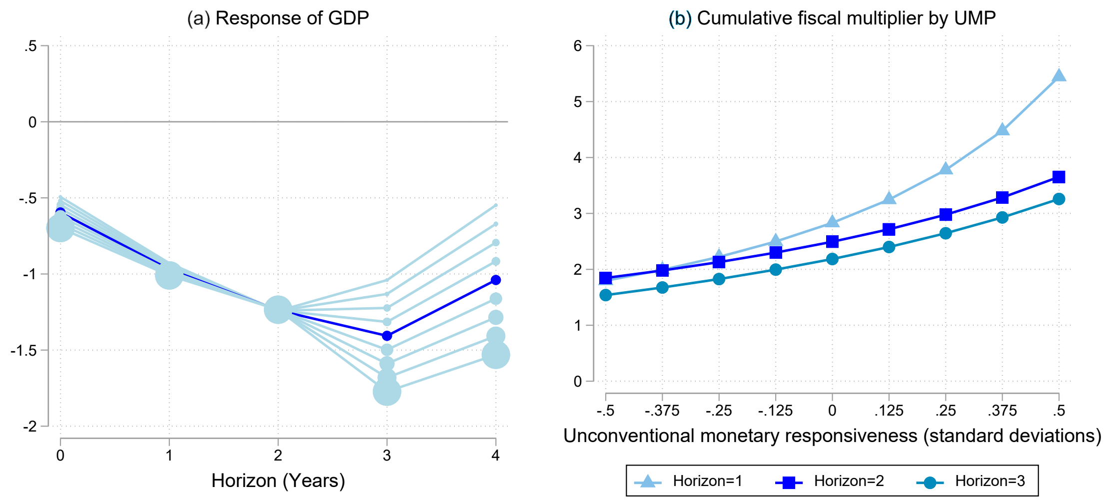
Figure 7: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

5.1.2 More lags

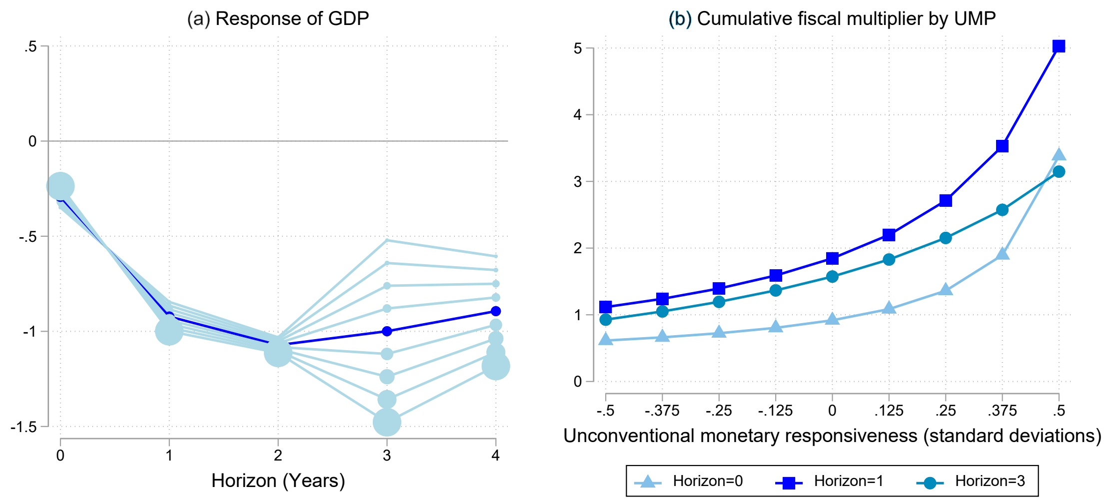
Figure 8: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

5.1.3 Fiscal consolidation composition

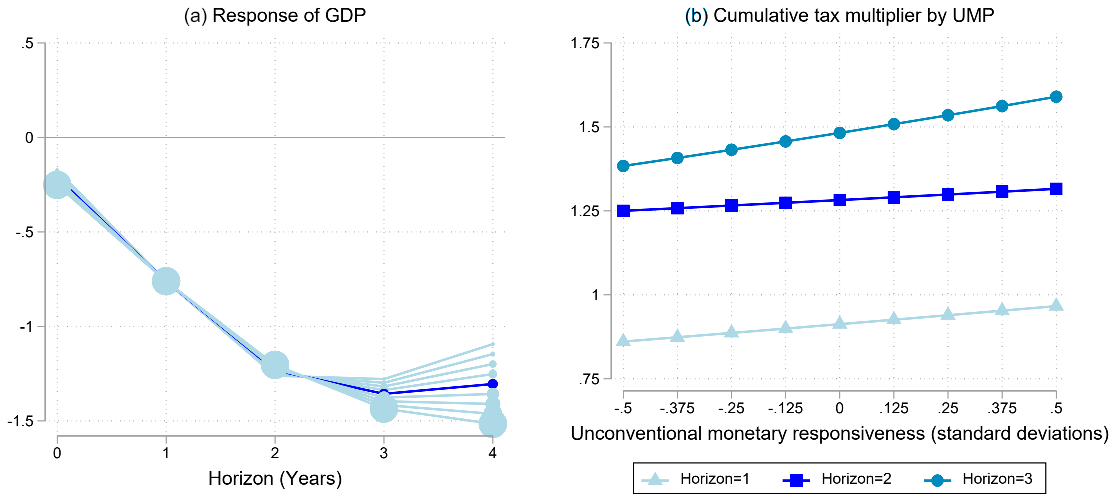
Figure 9: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

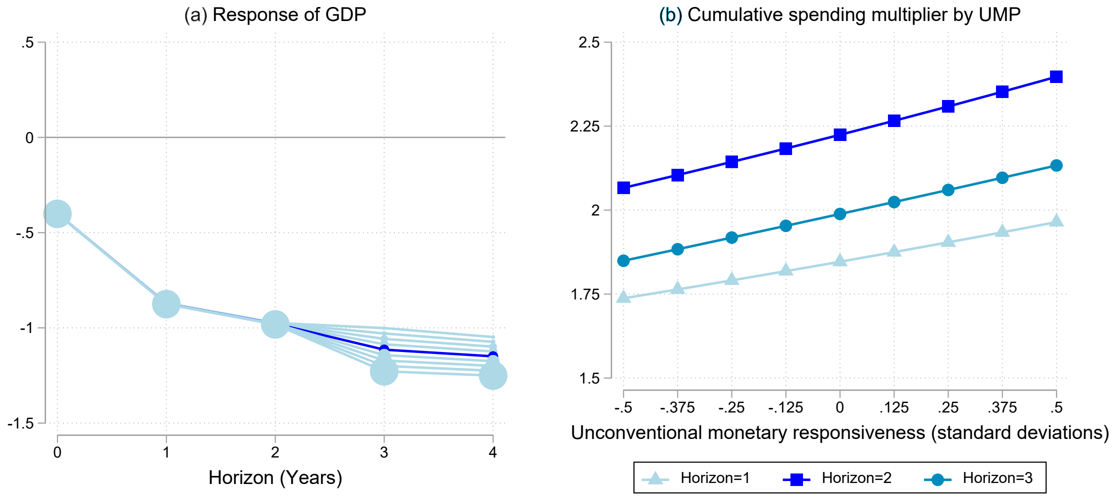
5.1.4 Tax-led versus spending-led

Figure 10: Unconventional monetary-fiscal multiplier and indirect effects.



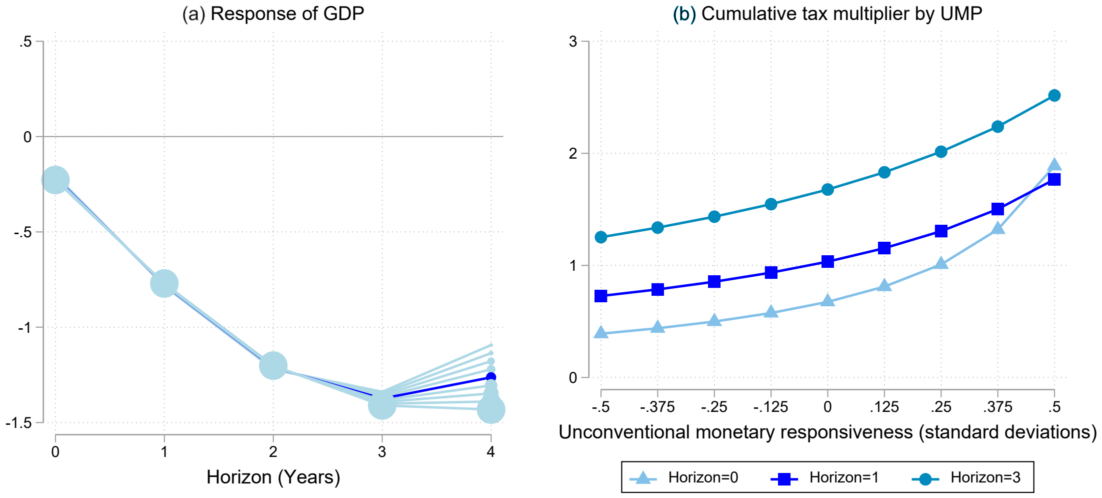
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 11: Unconventional monetary-fiscal multiplier and indirect effects.



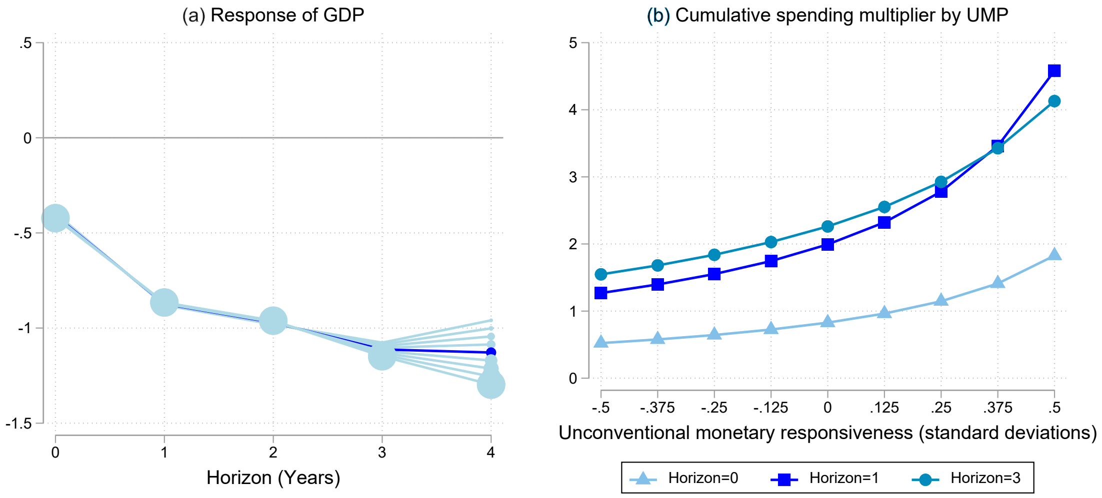
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 12: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

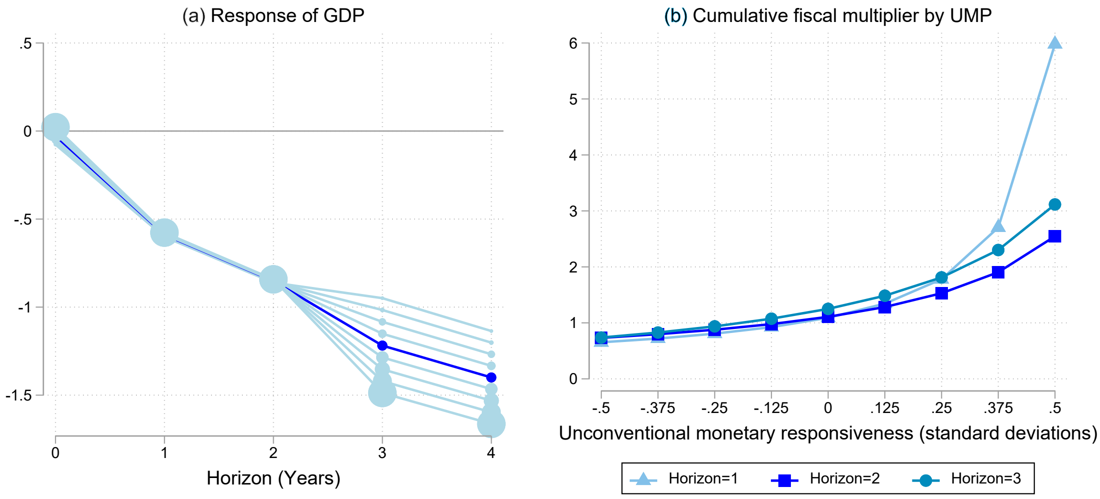
Figure 13: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

5.1.5 Time fixed effects

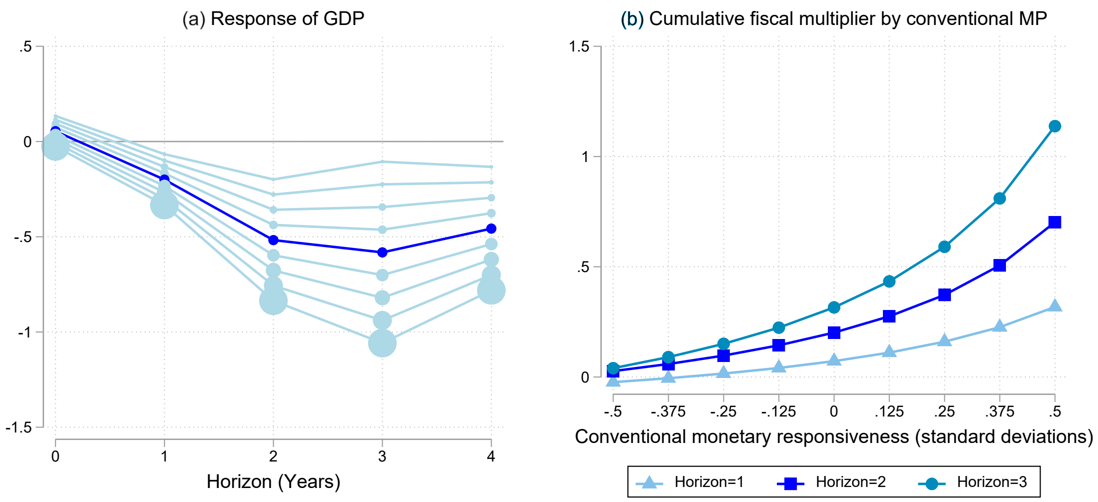
Figure 14: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

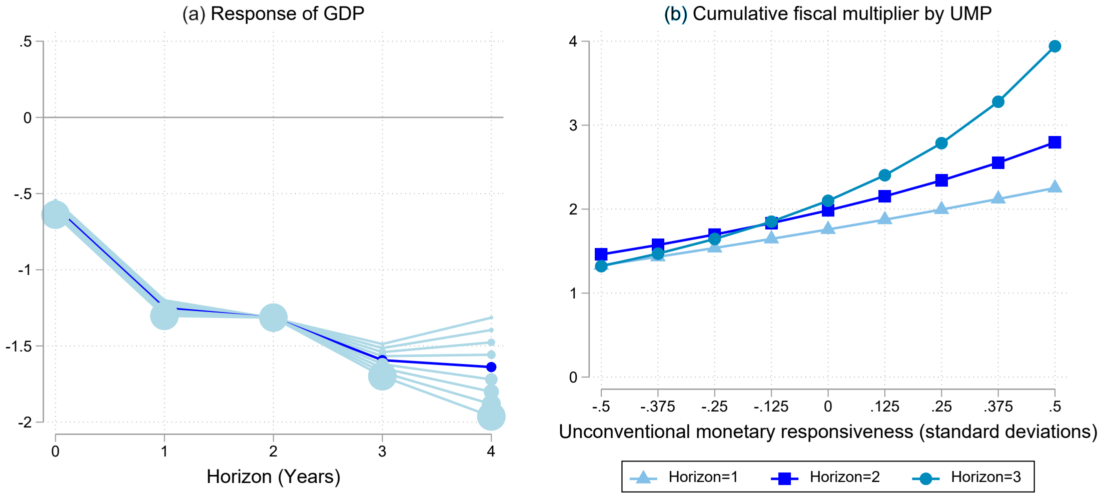
5.1.6 Before/after GFC

Figure 15: Conventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

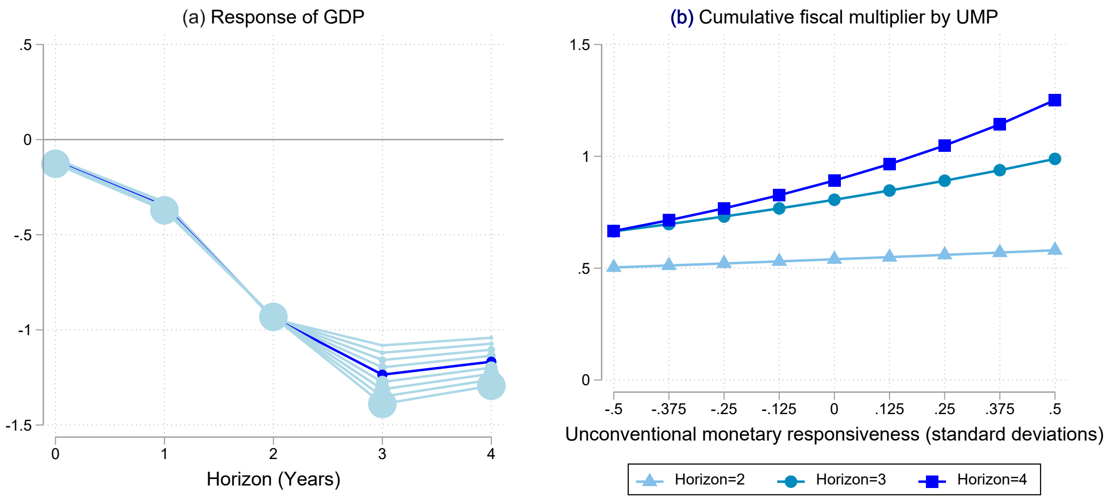
Figure 16: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

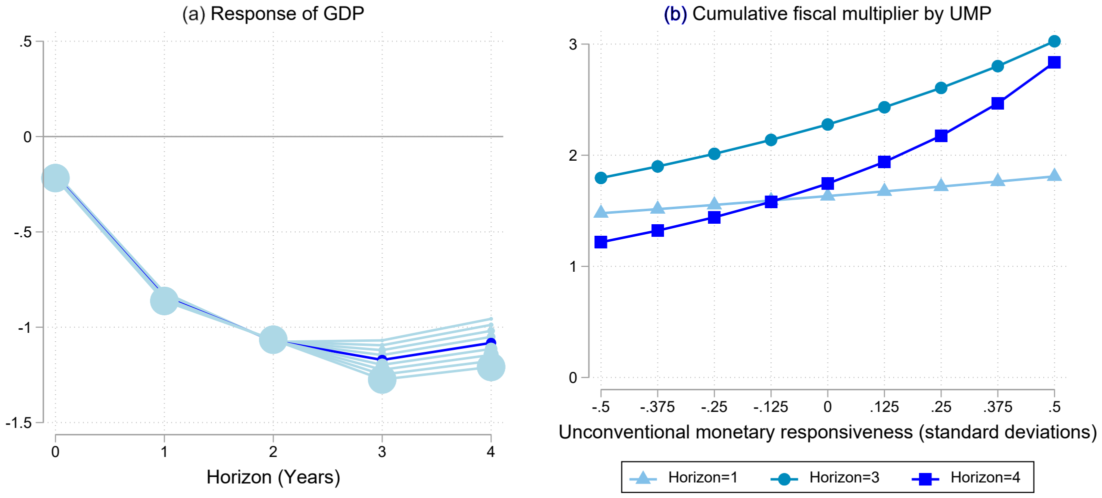
5.1.7 Boom versus slump

Figure 17: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

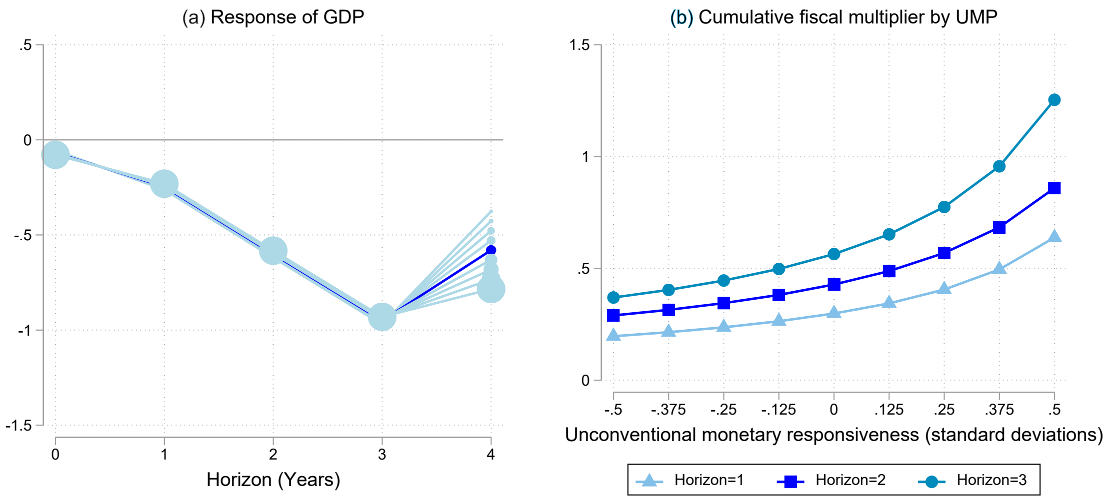
Figure 18: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

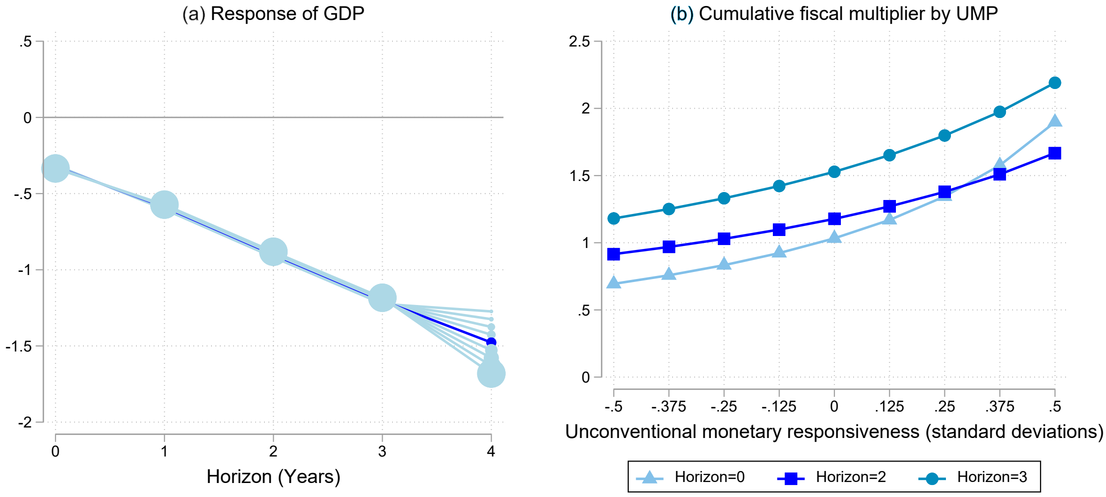
5.1.8 Output gap

Figure 19: Unconventional monetary-fiscal multiplier and indirect effects.



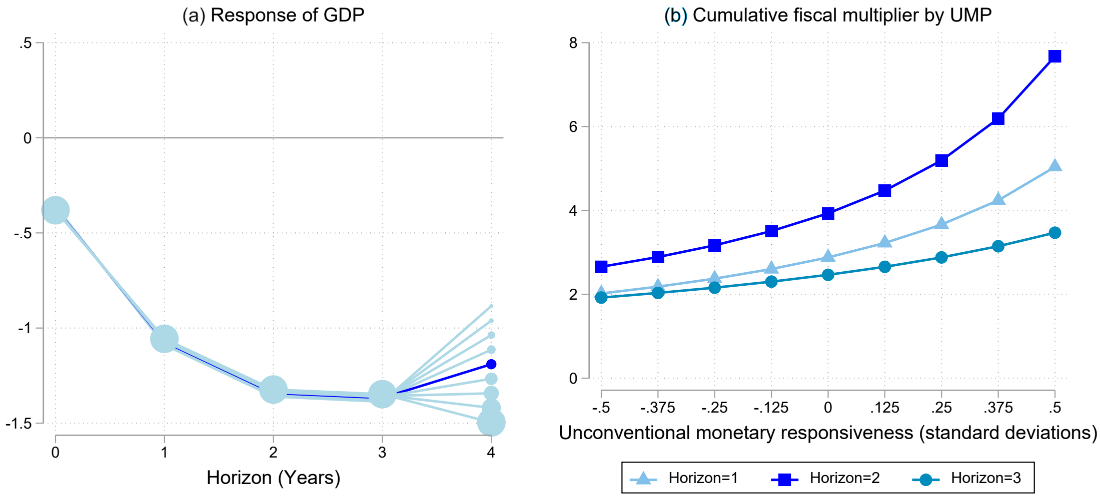
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 20: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

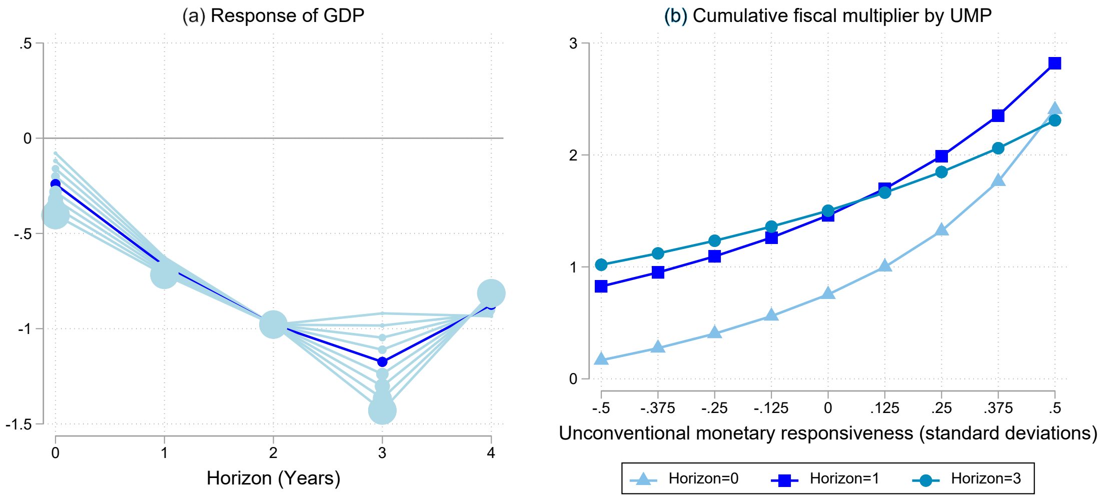
Figure 21: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

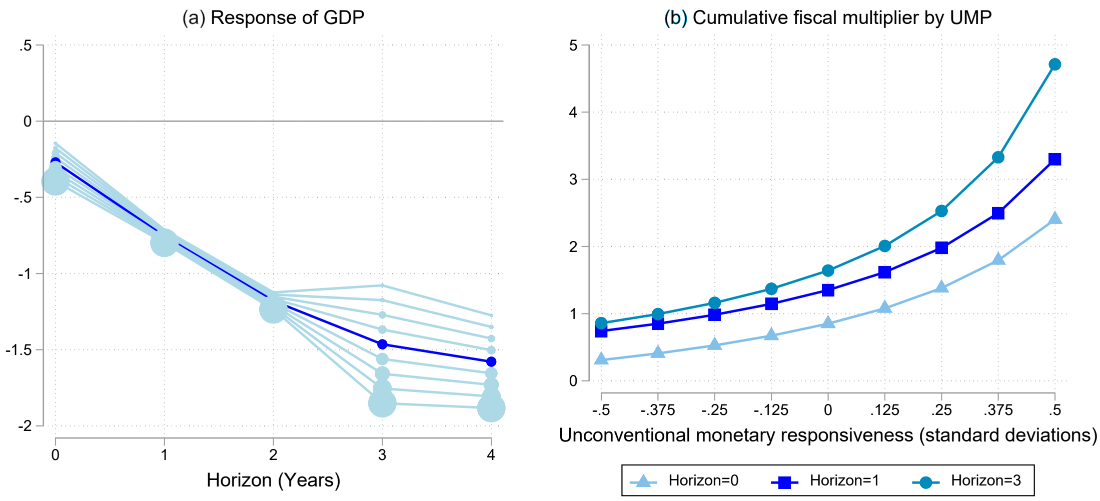
5.1.9 Eurozone versus Non-eurozone countries

Figure 22: Unconventional monetary-fiscal multiplier and indirect effects.



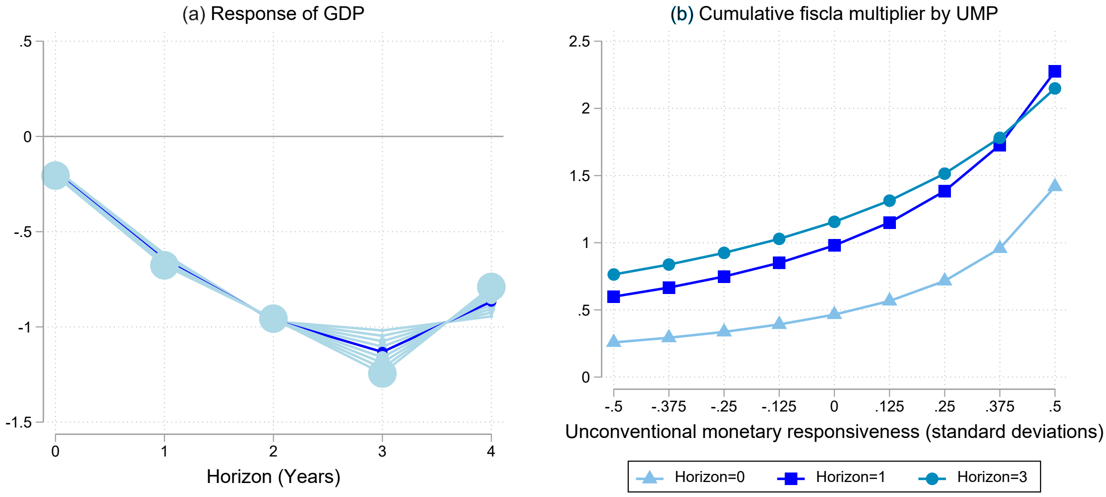
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 23: Unconventional monetary-fiscal multiplier and indirect effects.



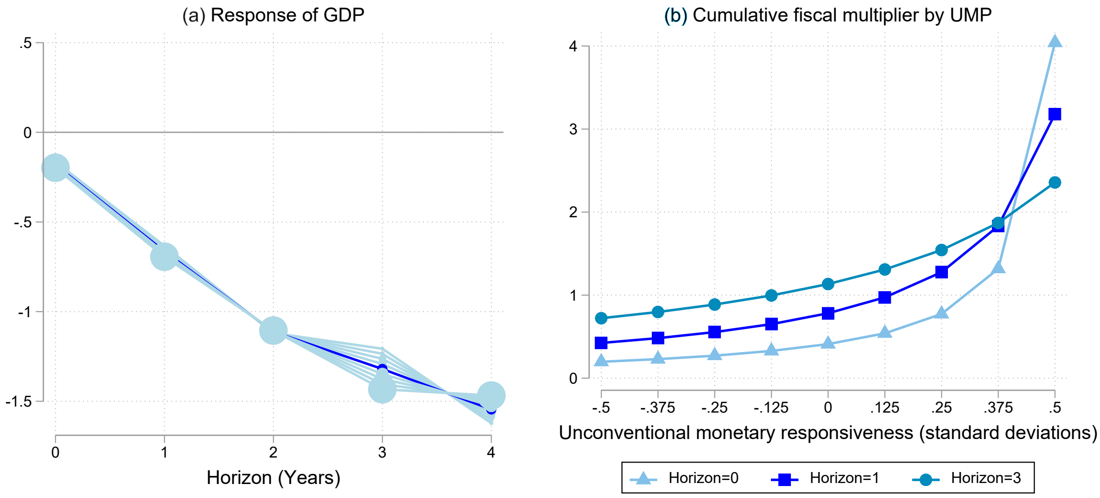
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 24: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

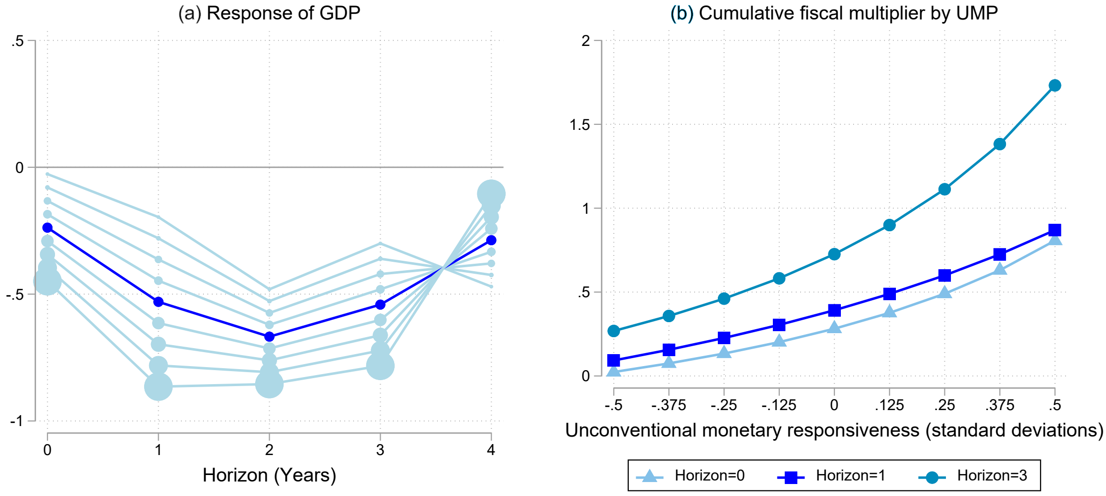
Figure 25: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

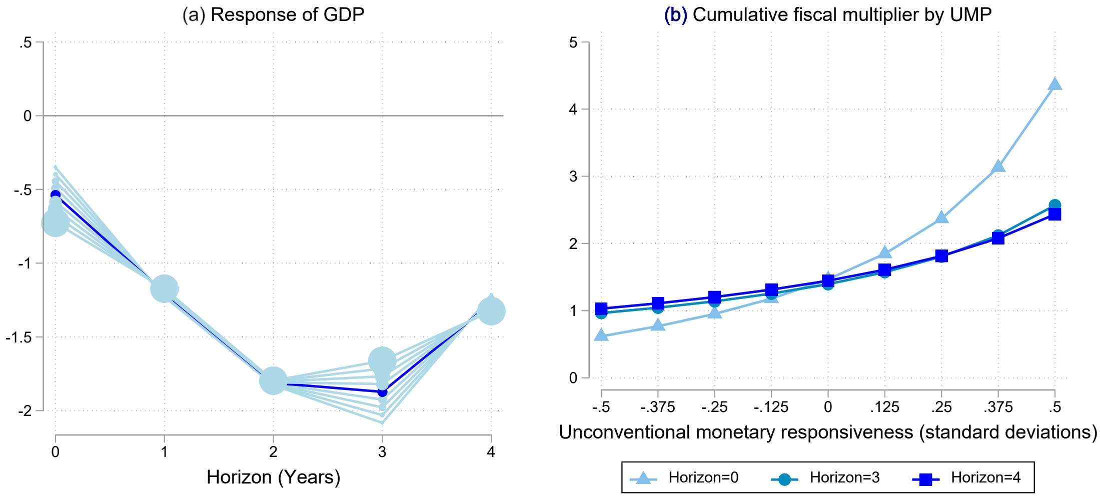
5.1.10 Peripherial versus core countries

Figure 26: Unconventional monetary-fiscal multiplier and indirect effects.



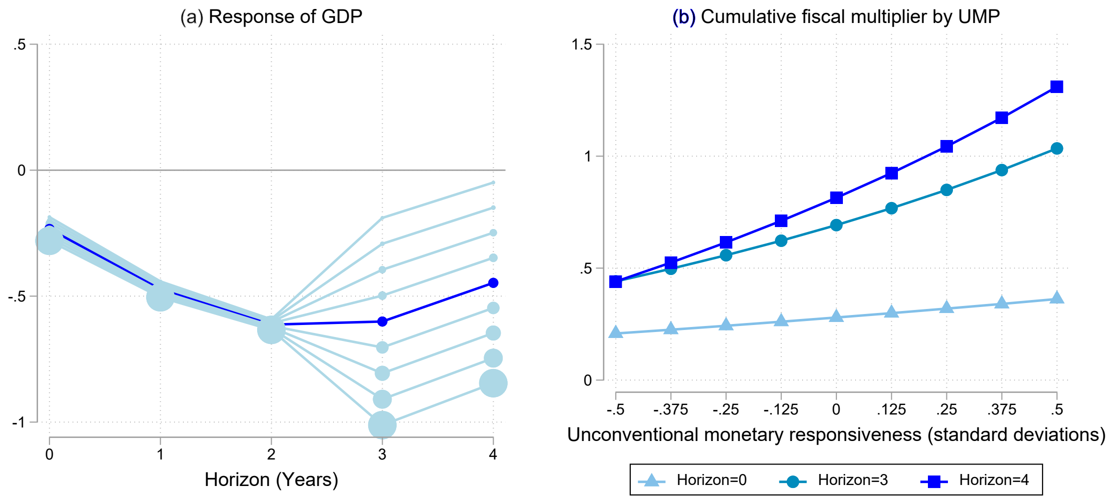
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 27: Unconventional monetary-fiscal multiplier and indirect effects.



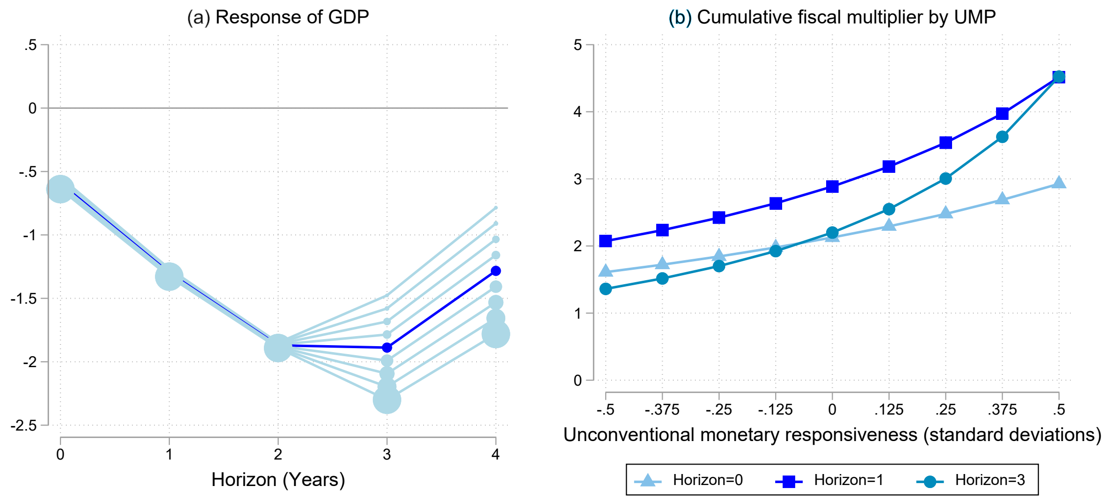
Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 28: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

Figure 29: Unconventional monetary-fiscal multiplier and indirect effects.

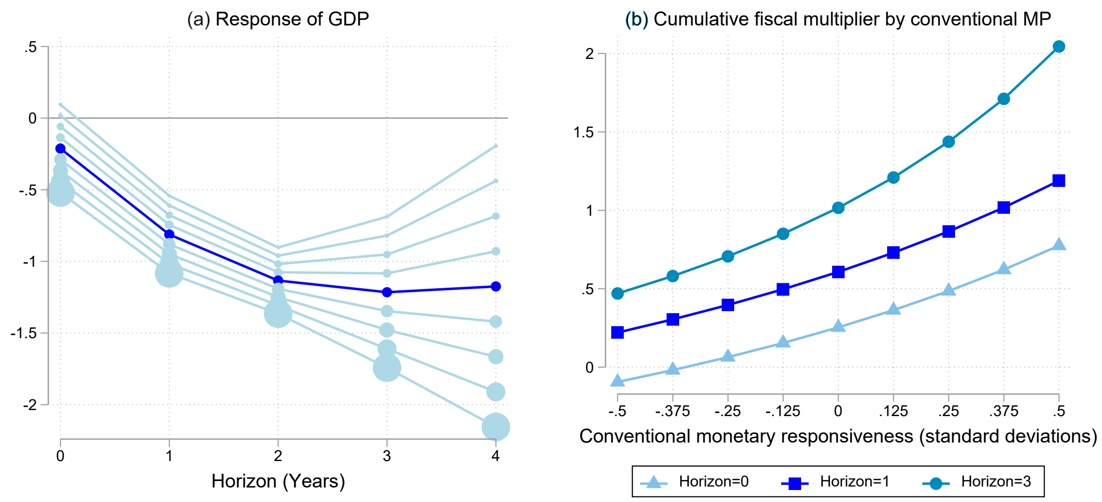


Notes: Scenarios varying the unconventional monetary policy responsiveness

5.2 Identification

5.2.1 Conventional Monetary Policy

Figure 30: Conventional monetary-fiscal multiplier and indirect effects.

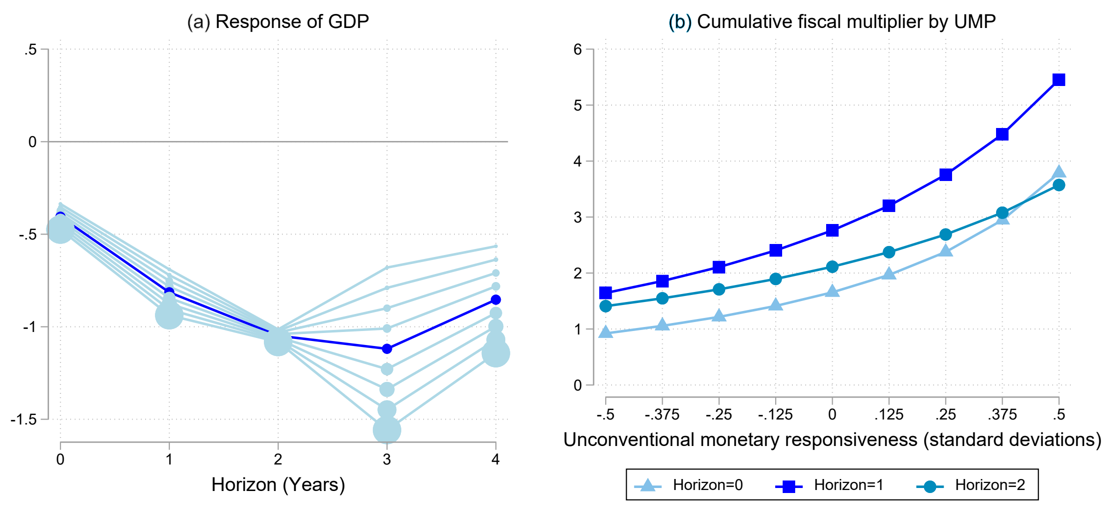


Notes: Scenarios varying the unconventional monetary policy responsiveness

5.3 Global Financial Crisis

5.3.1 Long-term interest rate

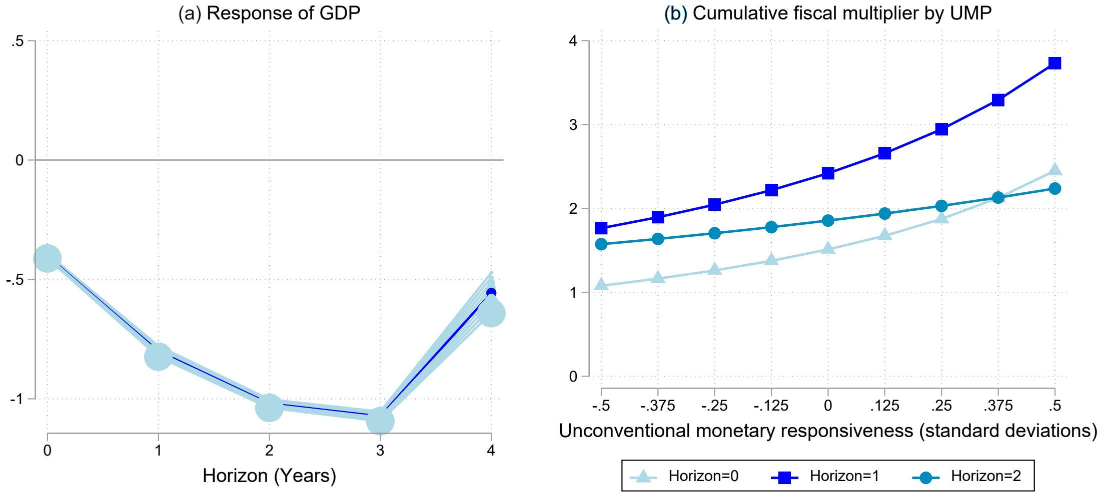
Figure 31: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

5.3.2 Share of Public Debt held by Central Bank

Figure 32: Unconventional monetary-fiscal multiplier and indirect effects.

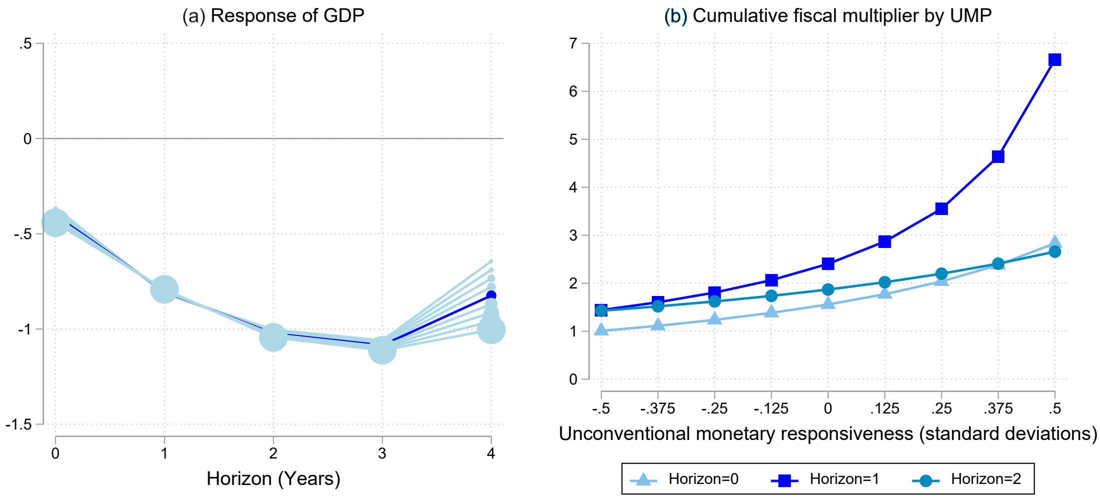


Notes: Scenarios varying the unconventional monetary policy responsiveness

5.4 Zero lower bound

5.4.1 Share of Public Debt held by Central Bank

Figure 33: Unconventional monetary-fiscal multiplier and indirect effects.



Notes: Scenarios varying the unconventional monetary policy responsiveness

6 Discussion and Conclusion

This paper investigates the impact of unconventional monetary policy on the fiscal multiplier during the period of 1978-2019. To address the identification issues arising from the Great Recession (2016-2019), we employed both the local projections approach and the Kitagawa-Blinder-Oaxaca decomposition, and a novel narrative database of fiscal consolidation. Additionally, we performed simulations to explore different scenarios that modify the interaction between fiscal and unconventional monetary policy.

Our results indicate that when unconventional monetary policy operates against fiscal policy, it reduces the fiscal multiplier without significantly affecting its size. Conversely, when unconventional monetary policy is aligned with fiscal policy, the fiscal multiplier increases significantly, ranging from 2 to 5 in year 3. Closer to the prediction of Keynes (1936) where the multiplier will be 5 in a closed economic system where the consumption of unemployed individuals is supported by transfers from other consumers. This is much greater than the values found in the literature. Much greater that the one found by Cloyne et al. (2020) which is near 2 when monetary policy is aligned with fiscal policy in year 3. This research highlights the importance of coordination between monetary and fiscal policy. In conclusion, this study provides valuable insights into the relationship between unconventional monetary policy and the fiscal multiplier. The findings suggest that there is a need for coordination between monetary and fiscal policy to achieve optimal outcomes and maximize the impact of monetary-fiscal measures.

The rationale for this increased monetary-fiscal multiplier is four-fold. Firstly, we include the period of the Global Financial Crisis, which had a significant impact on the economy. Secondly, this period was characterized by a low short-term interest rate and the liquidity trap (zero lower bound). Thirdly, there is coordination between the fiscal and monetary policy. Finally, it can be seen as a central bank financed fiscal policy without financing it with debt or taxes. Indeed, recent research using HANK model by Angeletos, Lian, and Wolf (2023) demonstrates that fiscal deficits can be self-financing. Specifically, deficits can stimulate a demand-driven Keynesian expansion, leading to an increase in real economic activity which enlarges the tax base for given tax rates, resulting in a reduction of the relative size of the deficit. Such research has compelling implications for the assessment of the multiplier effect, with potential justification for a higher multiplier, such as 5.

We suggest several avenues for future research to enhance the robustness of our findings. Firstly, it would be beneficial to calculate the effect of monetary-fiscal measures on inflation to better understand the limitations of this stabilization tool. Secondly, country-specific monetary-fiscal multipliers for each country in the Euro area would be helpful to determine whether there is convergence between countries in the monetary-fiscal multiplier. Additionally, we propose several robustness checks to further validate our results, such as differentiating the effects of tax-based versus spending-based fiscal measures and differentiating between recession, expansion, and normal times. Moreover, we suggest including additional lags in the econometric model to determine if the results are robust to changes in the model specification. Finally, we will estimate the monetary-fiscal multiplier specifically for the Great Recession period to examine whether the multiplier varies across different economic conditions and estimate the time-varying fiscal multiplier. Ultimately, we aim to provide a theoretical model to justify our findings of the greater monetary-fiscal multiplier.

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Appendix A "Narrative Approach" data.

Table 2: Sources of narrative fiscal consolidations.

Country	Year	Source
Australia	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Commonwealth of Australia Budget
Austria	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Belgium	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Canada	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Canada's Economic Action Plan Budget
Germany	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Denmark	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Spain	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Finland	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
France	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
United Kingdom	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme

Ireland	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Italy	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Japan	1978-2009	Devries et al. (2011)
	2010-2019	Budget of the Ministry of Finance
Netherlands	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Portugal	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
Sweden	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Stability and Convergence programme
United States	1978-2009	Devries et al. (2011)
	2010-2015	Gupta et al. (2018)
	2016-2019	Budget of the U.S. Government

Appendix B Some graphs.

Figure 34: Long-term interest rate

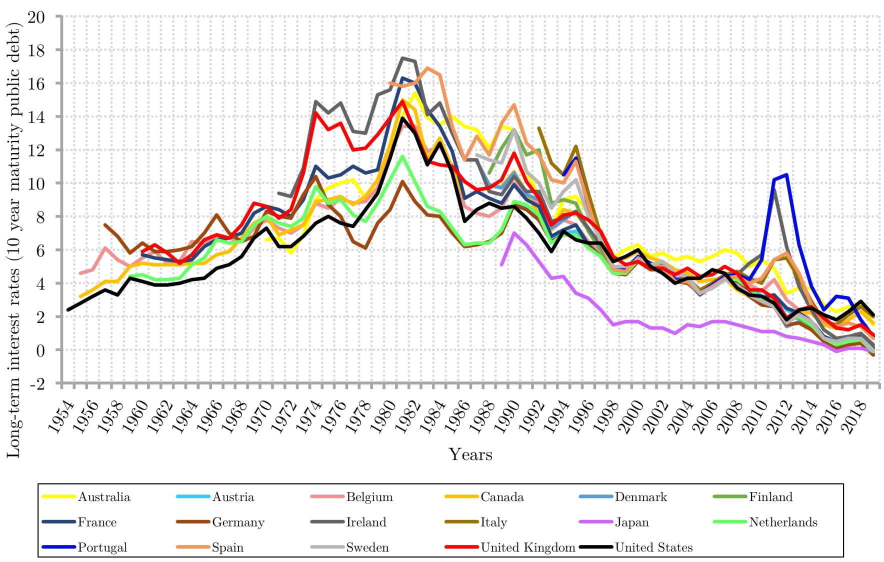
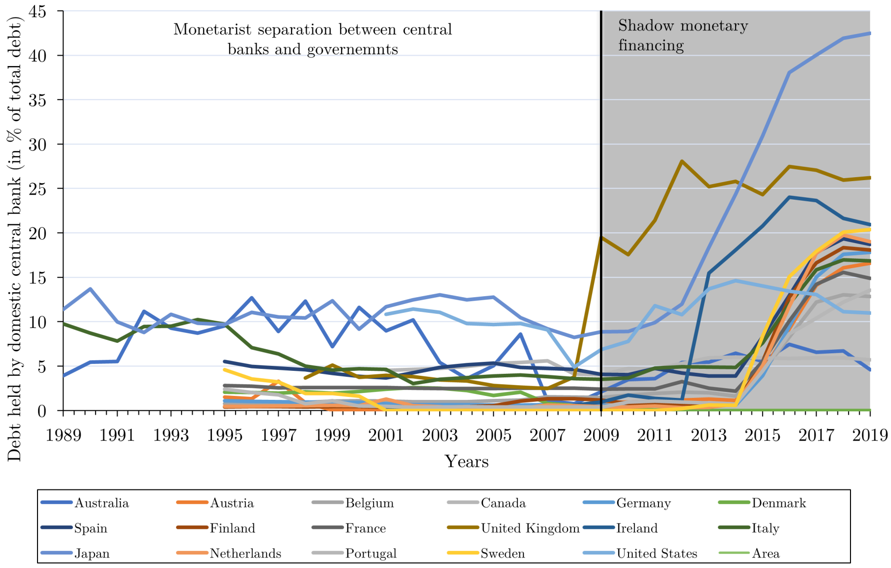
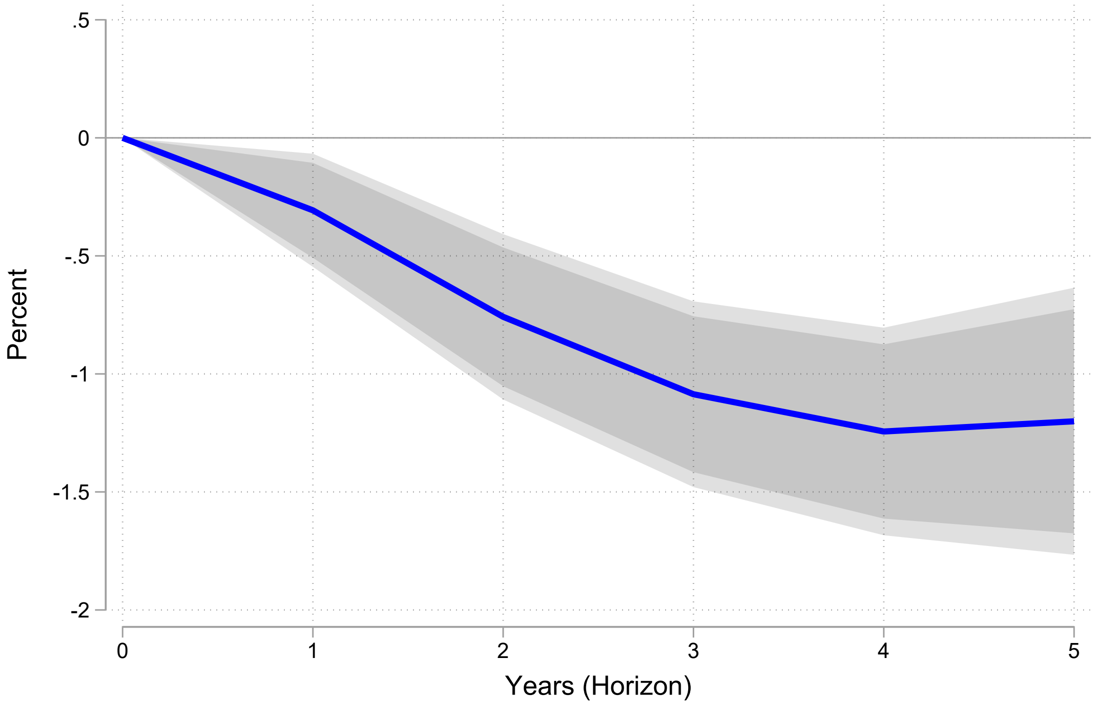


Figure 35: percentage of public debt held by domestic central bank



Appendix C Significance of direct effect.

Figure 36: Response of GDP to 1% shock fiscal consolidation (narrative method).



Appendix D Coefficient estimates.

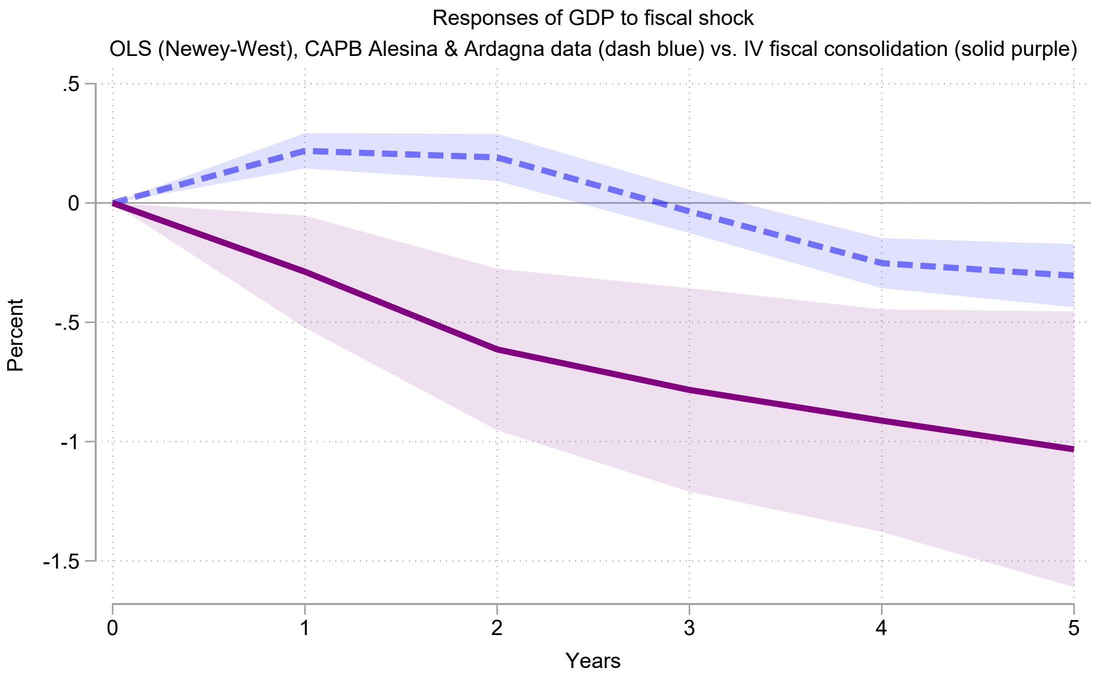
Table 3: Estimates for the direct and indirect effects (for GDP).

Horizon (Years)	β^h	θ_f^h
0	-0.40***	-0.36
	(0.15)	(0.38)
1	-0.81***	-0.32
	(0.23)	(0.35)
2	-1.04***	-0.24
	(0.32)	(0.28)
3	-1.10***	-0.40
	(0.36)	(0.32)
4	-0.84**	-0.41*
	(0.34)	(0.26)

Notes: Standard errors estimates in parenthesis. *** means significant at 1%; ** means significant at 5% and * means significant at 10%.

Appendix E Endogeneity of the data of Alesina and Ardagna (2010) vs“narrative” fiscal consolidations.

Figure 37: OLS vs IV, Alesina and Ardagna (2010) data



Notes: 90 percent confidence bands

Figure 38: OLS vs IV, WEO data

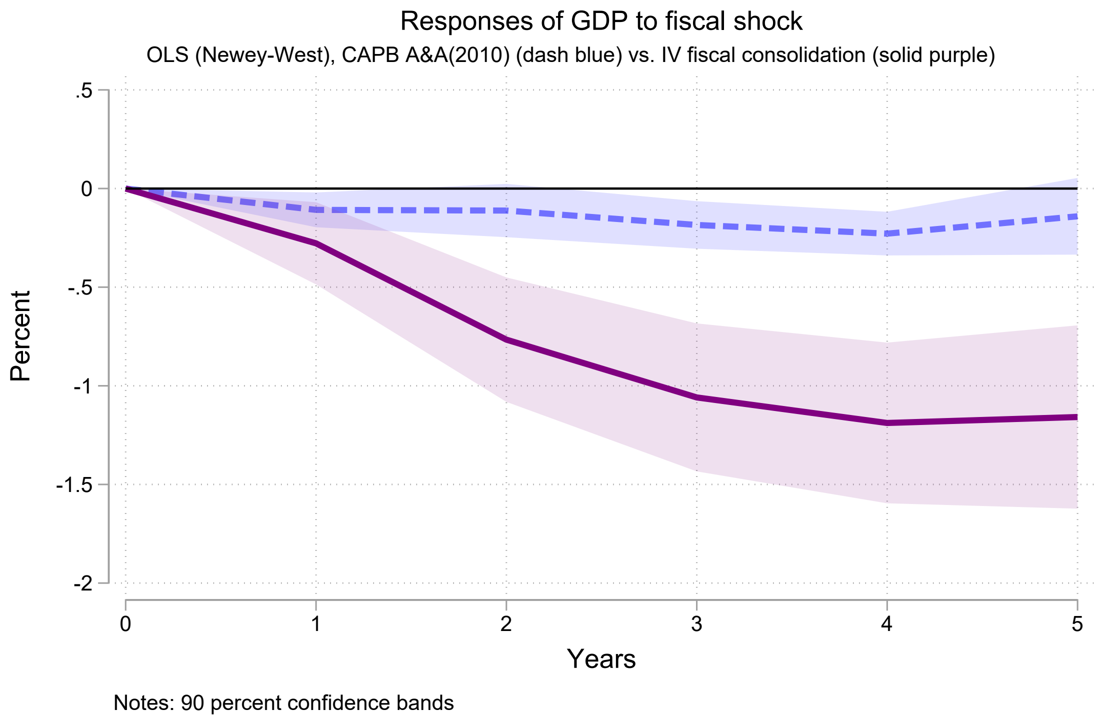


Figure 39: OLS = IV, WEO data

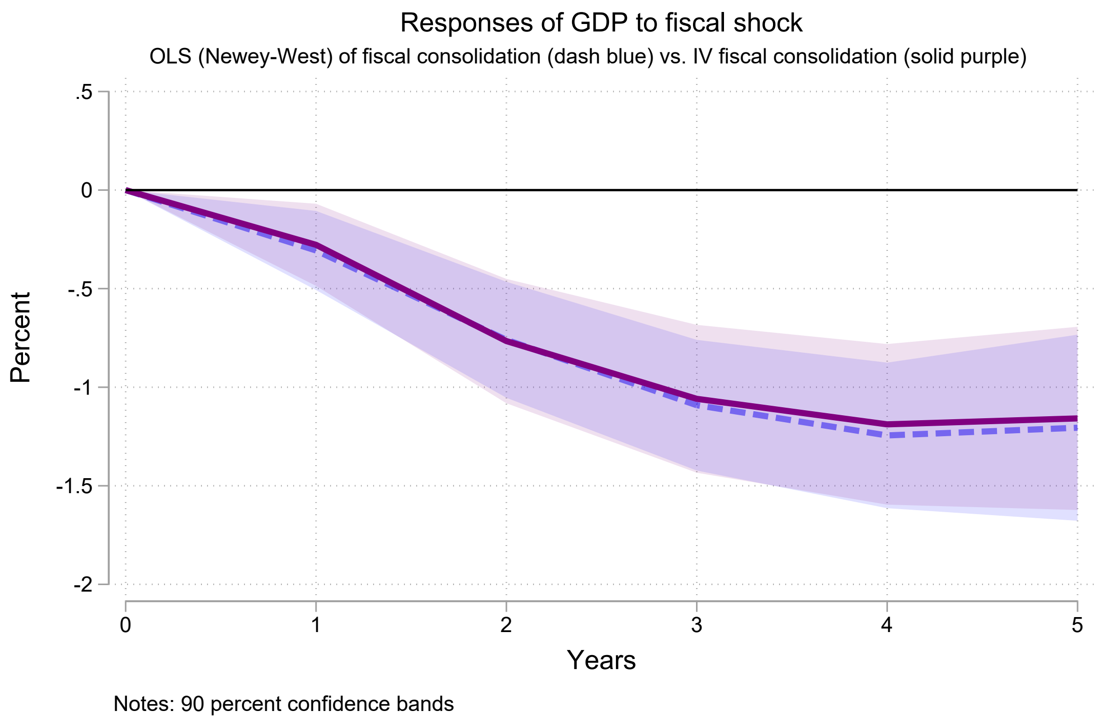


Table 4: Orthogonality to output.

Estimated regression: $\Delta FGDP_{i,t} = \alpha_i + \delta_t + \beta \text{ Fiscal }_{i,t} + \varepsilon_{i,t}$			
Dependent variable: GDP forecast error in t-1			
Measure of fiscal shock	β	Standard error	Obs.
Change in CAPB (Alesina and Ardagna, 2010)	0.3900434***	0.0665131	338
Change in CAPB (World Economic Outlook, 2018)	0.1028633*	0.0550533	442
Change in CAPB (World Economic Outlook, 2022)	0.1983224***	0.0711315	396
Narrative shocks	-0.0463514	0.156738	440

Notes: All specifications contain time and country fixed effects. Standard errors estimates are heteroskedasticity-robust. *** means significant at 1%; ** means significant at 5% and * means significant at 10%.

Figure 40: Relation between narrative and CAPB.

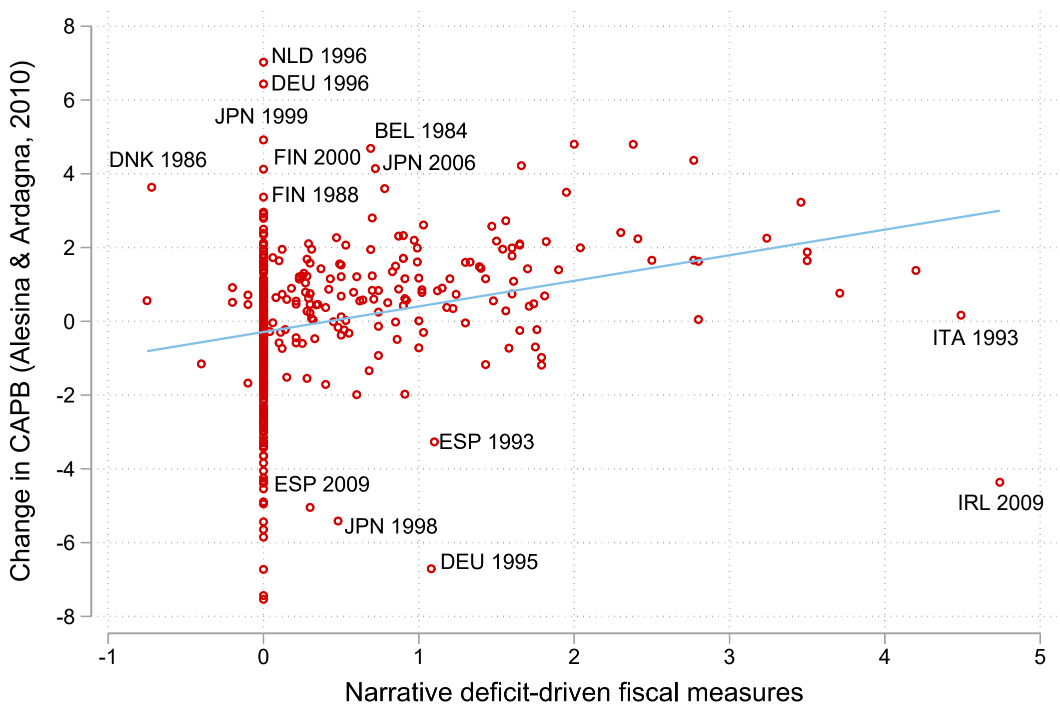
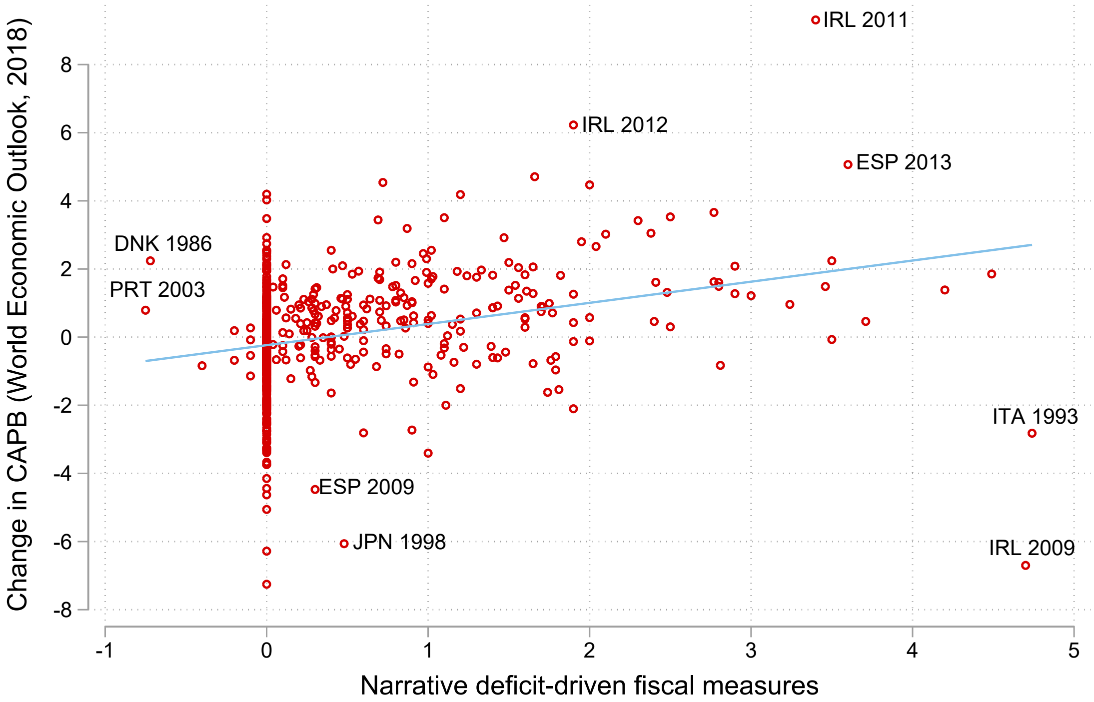
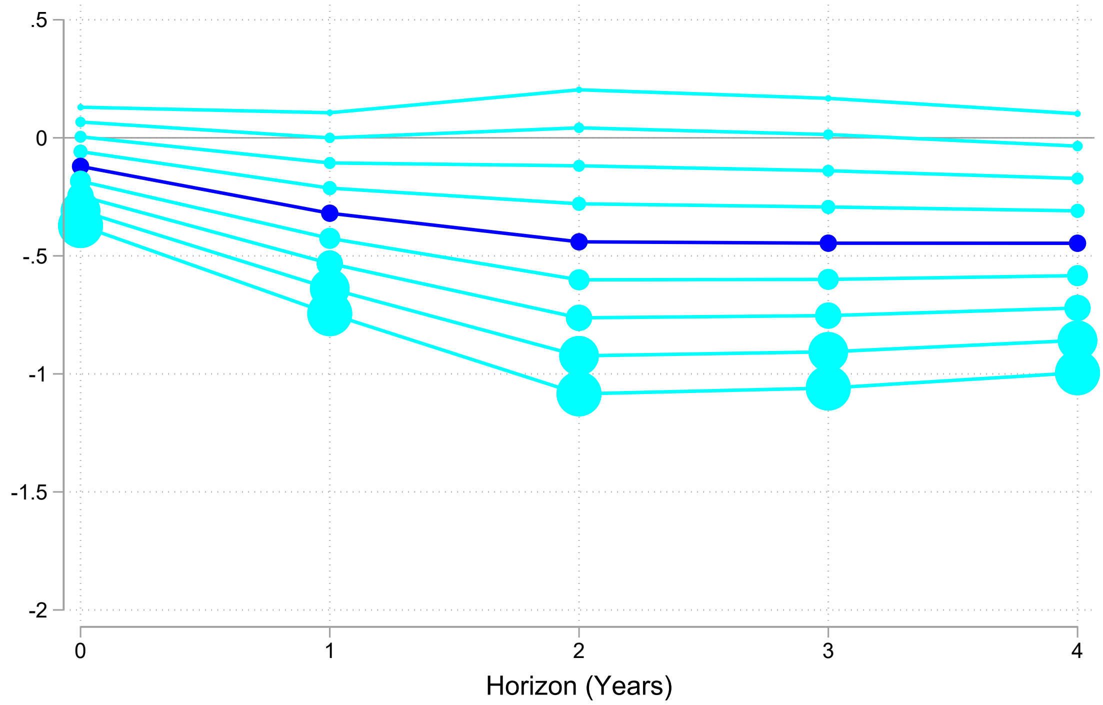


Figure 41: Relation between narrative and WEO CAPB.



Appendix F Response of long-term interest rate.

Figure 42: Response of long-term interest rate by monetary responsiveness.



Appendix G Cumulative fiscal multiplier by monetary responsiveness. 3D graph

Figure 43: Cumulative fiscal multiplier by monetary responsiveness. 3D graph.