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The Euro Area Periphery Sovereigns' Fiscal Positions and Unconventional Monetary Policy

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The Euro Area Periphery Sovereigns' Fiscal Positions and Unconventional Monetary Policy

Abstract

We explore the reaction of the euro area periphery sovereigns' fiscal positions to an unconventional monetary policy shock. We estimate panel vector autoregressive (VAR) models over the period 2010-2018, and identify the shock by imposing sign restrictions. Our results suggest that the sovereigns' fiscal positions improve in response to the economic expansion induced by an expansionary non-standard monetary policy innovation which lowers sovereign CDS spreads. Moreover, we observe that fiscal discipline is maintained rather than undermined.

JEL-Codes: E520, E620, H620, H630.

Keywords: euro area periphery sovereigns, fiscal position, unconventional monetary policy, panel vector autoregressive model.

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1 Introduction

Euro area periphery sovereigns' fiscal positions deteriorated in the aftermath of the global financial crisis, which unfolded into the European sovereign debt crisis. Public debt increased sharply due to the economic slack, the materialization of contingent liabilities including the rescue of the national banking sector and losses incurred by state owned enterprises (Eyraud et al., 2017), and the increase of interest expenditures as sovereign bond rates soared (Bernoth and Erdogan, 2012; D'Agostino and Ehrmann, 2014; Afonso et al., 2018).

The European Central Bank (ECB) responded to the crisis by implementing a number of unconventional monetary policy measures in addition to lowering the policy rate. Many of these measures were aimed at preserving price stability by removing tensions in the sovereign debt market, which were viewed as the main driver of financial fragmentation (ECB, 2013; Cour-Thimann and Winkler, 2013). For instance, the *Securities Market Programme* (SMP) involved sovereign bond purchases between 2010 and 2012. The announcement of the *Outright Monetary Transactions* (OMT) in 2012 underlined the commitment to intervene in the sovereign debt market (Altavilla et al., 2016). The launch of the *Extended Asset Purchase Programme* (APP) in 2015 provided a further stimulus (Eser et al., 2019). Especially, the *Public Sector Purchase Programme* (PSPP) under the APP involved large-scale government bond purchases until 2018. Moreover, the asset purchases were accompanied by a number of longer-term refinancing operations (LTROs) with full allotment and extended maturities and targeted longer-term refinancing operations (TLTROs) that provided long-term funding at attractive conditions. Empirical evidence suggests that the sovereign debt market was stabilized by unconventional monetary policy, which contributed to lowering government bond rates by reducing sovereign risk premiums.¹

In this paper, we analyze the effect of the ECB's unconventional monetary policy on euro area periphery sovereigns' fiscal positions. Our sample includes Italy, Portugal and Spain.² We estimate panel vectorautoregressive (VAR) models with Bayesian methods over the period 2010-2018 to generate impulse responses of important fiscal variables, such as the government debt-GDP ratio, to an expansionary shock to non-standard monetary policy. The analysis contributes to assessing the negative consequences of unconventional monetary policy by undermining fiscal dis-

¹Eser and Schwaab (2016) document that the SMP induced a significant fall in bond yields. Altavilla et al. (2016) and Afonso et al. (2018) observe that the OMT announcement had a similar effect. Moreover, Eser et al. (2019) show that the asset purchases conducted under the APP contributed to lower term premiums and flattened the yield curve.

²Note that we exclude Ireland from our benchmark analysis due to a massive structural break in the Irish GDP series in 2015. However, we also estimate models that include Ireland to assess the robustness of our results. Moreover, we exclude Greece since the country had essentially no access to global financial markets between 2010 and 2018.

cipline due to lower interest rates. We use sign restrictions to identify the shock (Canova and de Nicrolo, 2002; Peersman, 2005; Uhlig, 2005; Rubio-Ramirez et al., 2010; Arias et al., 2014).

Our work is related to several recent studies that examine the macroeconomic effects of unconventional monetary policy. Kapetanios et al. (2012), Baumeister and Benati (2013), Gambacorta et al. (2014), Weale and Wieladek (2016), Meinusich and Tillmann (2016) and Dell’Ariccia et al. (2018), among others, document an increase in real output across developed countries in response to expansionary non-standard monetary policy, which is accompanied by a rise in prices. Moreover, unconventional monetary policy seems to be effective in preventing financial distress, restoring the functioning of financial markets and compressing long-term interest rates (Boeckx et al., 2017; Dell’Ariccia et al., 2018). Hesse et al. (2018) observe that the effectiveness of unconventional monetary policy changed over time, i.e. early asset purchase programs generated a stronger effect on output than subsequent programs (see also Feldkircher and Huber, 2018). Burriel and Galesi (2018) report that countries with fragile banking systems benefit the least from unconventional monetary policy measures, particularly in terms of output gains. Hristov et al. (2019) find that the potential of non-standard monetary policy to bring down bank lending rates by reducing sovereign bond yields is limited. While all of these studies address important issues related to the effects of unconventional monetary policy, to the best of our knowledge, none of them explores the reaction of fiscal variables to such monetary policy measures.

Our results suggest that the euro area periphery sovereigns’ fiscal position improves in response to an unconventional monetary policy shock. In particular, we find that government consumption increases along with real output, which is accompanied by a rise in government revenue. Simultaneously, interest expenditures decline due to the fall in the cost of borrowing arising from lower sovereign bond rates. Overall, the government debt-GDP ratio decreases. Moreover, government new debt declines. A counterfactual experiment shows that the improvement of the fiscal position appears mainly due to those non-standard monetary policy measures that induce a decline in sovereign bond yields by compressing CDS spreads, such as government bond purchases.

At first sight the improvement of the euro area periphery sovereigns’ fiscal position in response to the unconventional monetary policy shock is not surprising. The fiscal position is strengthened by the economic boom induced by non-standard monetary policy measures. However, our results suggest that fiscal discipline is not waning after an expansionary non-standard monetary policy innovation, which is at odds with the results of De Haan and Sturm (2000), Theofilakou and Stournaras (2012), de Groot et al. (2015), and Debrun and Kinda (2016), among others, who document that fiscal policy is disciplined by market pressure, i.e. fiscal discipline is

strengthened in times of high sovereign bond yields that give rise to the consolidation of government debt. Furthermore, in contrast to [Tkačevs and Vilerts \(2019\)](#), we observe that the primary balance improves although borrowing cost decline. The different results might be explained by our focus on the effect of unconventional monetary policy on the fiscal positions during the economic slack following the sovereign debt crisis. [Dell’ Erba et al. \(2015\)](#) find that fiscal consolidations occur under market pressure, however, especially those aimed at reducing budget deficits also occur with initially weak macro-fiscal fundamentals, such as poor economic growth, high debt and adverse debt dynamics. In addition, our results may also be a consequence of strong political pressure arising, for instance, from the wish to avoid the usage of rescue packages that are conditional on austerity measures. Thus, although unconventional monetary policy eased market pressure, and hence, should have weakened fiscal discipline, these measures were implemented at a time when other policies were put in place that replaced market pressure with political pressure.

The remainder of the paper is organized as follows. Section 2 discusses our benchmark panel VAR model set-up. We outline the model framework, introduce the data and discuss extensions of the framework as well as the strategy to identify an unconventional monetary policy shock. In Section 3, we summarize our results that are derived from impulse responses analyses and forecast error variance decompositions. Moreover, we conduct a number of robustness checks and compute counterfactual impulse responses. Section 4 provides concluding remarks.

2 Panel VAR model with sign restrictions

2.1 Benchmark specification

We use a panel VAR model in reduced form:

$$y_{k,t} = \sum_{j=1}^p B_j y_{k,t-j} + \tilde{c}_k + \varepsilon_{k,t}, \quad (2.1)$$

where $y_{k,t}$ is a vector of endogenous variables for country k , B_j is a matrix of autoregressive coefficients for lag j , p is the number of lags, \tilde{c}_k is a vector of country specific intercepts, which account for possible heterogeneity across the units. Furthermore, $\varepsilon_{k,t}$ is a vector of reduced form residuals. In our benchmark specification, the vector $y_{k,t}$ consists of real GDP, the price level measured by the GDP deflator, the shadow rate of monetary policy, the sovereign CDS spread and the government bond rate. The shadow rate is identical for all countries, while the remaining variables are country-specific. Real output and the price level are in logs, the shadow rate and the government bond yield are in percent, and the sovereign CDS spreads

are calculated by means of log differences. Moreover, each variable is demeaned at the country level over the sample period. For each element of $y_{k,t}$ we use a pooled set of $M \cdot T$ observations, where M denotes the number of countries and T denotes the number of observations corrected for the number of lags p . The reduced form residuals $\varepsilon_{k,t}$ are stacked into a vector $\varepsilon_t = [\varepsilon'_{1,t} \dots \varepsilon'_{M,t}]'$, which is normally distributed with mean zero and variance-covariance matrix Σ .

Since our sample is short we follow [Ciccarelli et al. \(2015\)](#) by using a panel of euro area periphery countries that comprises Spain (ES), Portugal (PT) and Italy (IT). The panel approach allows us to pool the diverse information from the countries, while controlling for heterogeneity in the constant term. A main advantage of the approach is that it increases the efficiency of the statistical inference. However, this comes at the cost of disregarding cross-country differences by imposing the same underlying structure for each cross-section unit. Since we consider the euro area periphery countries only, we seek to address this shortcoming by focusing on a relative homogenous set of entities.

Note, that we exclude Ireland from our panel of countries although the country belongs to the group of euro area periphery economies. The reason is that Irish GDP grew in 2015 by up to 26%. The strong growth resulted from the fact that Ireland attracted a number of large multinational cooperations to relocate their economic activity to the country by low corporation tax rates. As a result, GDP growth was correspondingly large. Hence, our estimations might be distorted by the structural break in the Irish data. However, we also estimate models with a panel of countries including Ireland as a robustness check. Moreover, we exclude Greece, because it obtained external finance merely through financial aid programs of the euro area member countries from May 2010 onwards. External financing through capital markets did not take place, while at the same time sovereign bond rates increased tremendously. In addition, Greek government bonds were ineligible for the PSPP over the entire net asset purchase phase.

2.2 Data

The data is taken from Eurostat, the ECB and Thomson Reuters Datastream and collected on a quarterly basis covering the period from 2010Q1 to 2018Q4.³ The beginning of the sample period is determined by the ECB's launch of the Securities Market Programme (SMP) that started with a first wave of sovereign bond purchases in May 2010. Before the SMP a number of unconventional monetary policy measures were already conducted, which were also maintained thereafter. In particular, the central bank switched to main refinancing operations with fixed rates and full allotment, and implemented longer-term refinancing operations (LTROs)

³See the Appendix for a description of the data.

with an extended maturity, which were also offered at fixed rates with full allotment. At the same time government guaranteed own-use bonds were accepted as collateral and the collateral rating for central bank refinancing was reduced. The SMP was launched in response to the European sovereign debt crisis. The program included the purchases of Italian, Spanish, Irish, Greek and Portuguese sovereign bonds, which, however, were sterilized. The announcement of the OMT in September 2012 contributed to a lowering of sovereign bond yields, although the program itself was never activated (Altavilla et al., 2016).⁴ Meanwhile, LTROs were offered with a maturity of up to 36 months, which were followed by a series of Targeted Long-term Refinancing Operations (TLTROs) with a maturity of 45 and 48 months, respectively. Additionally, the interest rate on the deposit facility was cut to become negative. The ECB's APP was launched in January 2015, and comprised large scale sovereign bond purchases (Breckenfelder et al., 2016). The initial amount of securities purchases was €60 billion per month, which was expanded to a monthly amount of €80 billion in March 2016, while in April 2017 the pace of monthly purchases was reduced back to €60 billion. Later the amount of securities purchases was set to €30 billion per month and €15 billion thereafter, respectively. The APP expired at the end of 2018. Overall, the ECB's accumulated purchases of sovereign securities conducted under the APP amounted to €2,102,048 billion. The APP was additionally accompanied by the conduct of a number of TLTROs. The ending of the APP marks the end of our sample period.

The selection of the variables in the benchmark model is standard (Weale and Wieladek, 2016; Gambacorta et al., 2014; Boeckx et al., 2017). Real output and the dynamic of prices reflect the macroeconomic development. The ECB's monetary policy is measured by the shadow rate, which attempts to proxy the true stance of monetary policy in times when conventional monetary policy is constrained by approaching the zero lower bound and non-standard measures are adopted.⁵ In particular, we resort to the shadow rate constructed by Krippner (2013). Figure 1 displays the shadow rate for the euro area together with the policy rate.

The shadow rate remained close to the policy rate before the onset of the financial crisis. Deviations emerged after the ECB conducted its first non-standard measures in 2007, and intensified thereafter when the policy rate moved towards the zero lower bound. In contrast to Gambacorta et al. (2014) and Boeckx et al. (2017), we refrain from using the ECB's total assets as a measure to identify unconventional monetary policy. The reasons are twofold. First, our analysis includes the APP, which was announced and every decision associated with changes of the program were communicated in advance. Thus, the expansion of total assets stemming from

⁴See also Dell'Ariccia et al. (2018) or Hristov et al. (2019), among others, for a discussion.

⁵Neuenkirch and Nöckel (2018) and Mandler and Scharnagl (2019), for example, use the shadow rate to identify unconventional monetary policy measures.

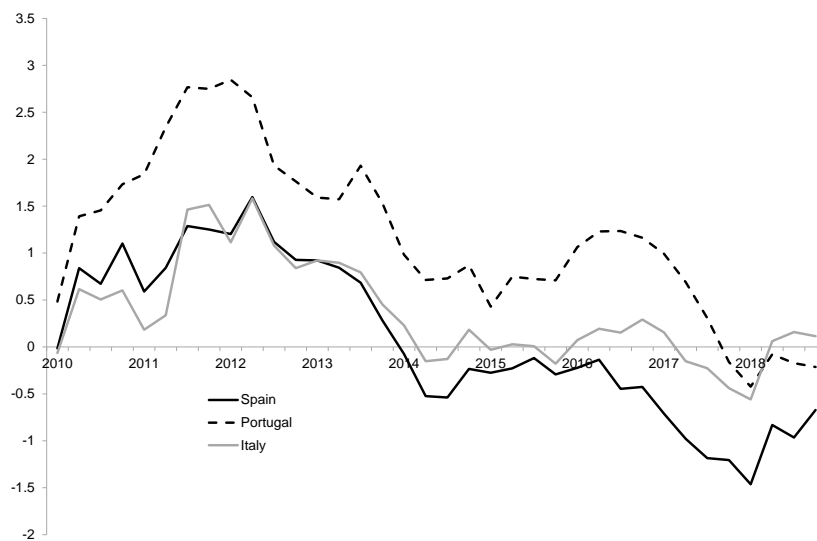
Figure 1: Euro area shadow rate



Notes: Data taken from the ECB and [Krippner \(2013\)](#).

the asset purchases conducted under the APP are difficult to interpret as shocks. Second, we also consider the OMT program, which, however, was never activated. Thus, the effect arising from the announcement of the program had an impact on bond yields without a change in total assets. The governments' borrowing conditions are summarized by the sovereign bond yield. Finally, the sovereign CDS spread is a measure of credit risk that reflects tensions in the sovereign debt market, which occurred in the aftermath of the global financial crisis. Figure 2 shows the evolution of the euro area periphery sovereign CDS spreads.

Figure 2: Sovereign CDS spreads



Notes: Data taken from Thomson Reuters Datastream. Sovereign CDS spreads are calculated on the basis of five years sovereign credit default swaps. The base for computing the spreads is 2009Q2.

The spreads increased considerably between 2010 and 2012 and, although they declined afterwards, they still remained at an elevated level until 2014. In Portugal, the sovereign CDS spread even remained on an elevated level until mid-2017.

Since our focus is on the reaction of the sovereigns' fiscal position to unconventional monetary policy shocks, we subsequently modify the benchmark model by including fiscal variables. In particular, we focus on two categories of variables: real fiscal variables, i.e. nominal variables deflated by the GDP deflator, and nominal fiscal variables relative to GDP, i.e. GDP ratios. Table 1 overviews our set variables.

Table 1: Fiscal variables

<i>Real fiscal variables</i>	<i>Nominal fiscal variables relative to GDP</i>
Government consumption	Government consumption
Interest expenditures	Interest expenditures
Government revenue	Government revenue
Total government debt	Total government debt
	New debt
	Primary balance

The real fiscal variables are in logs, while the ratios are expressed in percent.⁶ All fiscal variables are demeaned at the country level over the sample period.

2.3 Identification of shocks

We estimate the VAR model (2.1) with Bayesian methods using a Normal Wishart prior, 10,000 draws, and, according to the Bayes information criterion (BIC) a lag order of $p = 1$, which is the preferable lag order.⁷ As a robustness check, we also perform the estimation with a lag order of two. Based on the estimated model, we generate impulse responses of the endogenous variables to the structural shocks η_t . We resort to the algorithm of [Rubio-Ramirez et al. \(2010\)](#) to identify the structural shocks through sign restrictions.

The structural representation of the VAR model (2.1) can be expressed as:

$$A_0 y_{k,t} = \sum_{j=1}^p A_j y_{k,t-j} + c_k + \eta_{k,t}, \quad (2.2)$$

⁶Note that using the primary balance relative to total government expenditures or to total government debt, respectively, instead of considering the primary balance to GDP ratio has no effect on our results.

⁷The BIC information criterion for lag selection is -25.81 for $p = 1$, -25.17 for $p = 2$, -24.19 for $p = 3$, and -23.03 for $p = 4$.

with $\eta_{k,t} \sim N(0, I)$, where I is the identity matrix. The reduced form representation of the SVAR is derived by multiplying both sides of (2.2) with A_0^{-1} . The structural shocks $\eta_{k,t}$ relate to the reduced form residuals $\epsilon_{k,t}$ according to $\epsilon_{k,t} = A_0^{-1}\eta_{k,t}$, where $\epsilon_{k,t} \sim N(0, \Sigma)$. The identification of the structural parameters of the model is equivalent to finding the appropriate matrix $\tilde{A} = A_0^{-1}$, which is done by means of sign restrictions. The algorithm of [Rubio-Ramirez et al. \(2010\)](#) uses the fact that the Cholesky decomposition of the covariance matrix of the reduced form residuals $\Sigma = PP'$, where P' is lower triangular, can be extended by any orthogonal matrix Q as follows: $\Sigma = PP' = P'Q'QP$ where $QQ' = I$. As the algorithm further requires that Q has a uniform distribution with respect to the Haar measure, Q can be generated by means of a QR-factorization of a random matrix W of proper dimensions, where each element of W follows an independent standard normal distribution. A particular Q is considered a solution to the identification problem if the impulse responses implied by $\tilde{A} = P'Q'$ satisfy a set of sign restrictions. We follow the steps suggested by [Rubio-Ramirez et al. \(2010\)](#) to estimate the posterior of the structural model: (i) we draw from the posterior of the reduced form model, (ii) then we draw an orthogonal matrix Q , (iii) we keep the draw if the combination of reduced form parameters and Q satisfies the sign restrictions and discard it otherwise, (iv) we return to (i) until the required number of draws satisfying the restrictions is obtained. Our results are based on 10,000 draws consistent with the imposed sign restrictions, which are discussed in the following.⁸

2.4 Sign restrictions

Table 2 summarizes the sign restrictions that we impose in our baseline identification scheme. Although we are primarily interested in the unconventional monetary policy shock, we also identify an aggregate supply and an aggregate demand shock to improve the identification.

Table 2: Sign Restrictions

	Aggregate supply	Aggregate demand	Monetary policy
Output	≥ 0	≤ 0	•
Price level	≤ 0	≤ 0	•
Shadow rate	•	≤ 0	≤ 0
Sovereign CDS spread	•	•	≤ 0
Government bond rate	•	•	•

Notes: Sign restrictions are binding over a period of one quarter. Unrestricted responses are denoted by •.

⁸It has to be noted that sign restrictions relying on the Haar measure regarding the rotation matrix Q could lead to implicit priors on the impact impulse responses ([Baumeister and Hamilton, 2015, 2018](#)).

We assume that real output and prices move in opposite direction in response to an aggregate supply shock, and in the same direction following an aggregate demand shock (Peersman, 2005; Canova and Paustian, 2011). While we leave the response of the shadow rate to an aggregate supply shock unrestricted, the shadow rate is supposed to decrease in response to an adverse aggregate demand shock.⁹ The monetary policy shock is assumed to lead to a decline in the shadow rate that is accompanied by a lowering of the sovereign CDS spread. Following Weale and Wieladek (2016), Gambacorta et al. (2014) and Boeckx et al. (2017) we leave the responses of real output and prices to the unconventional monetary policy shock unrestricted. Finally, the response of the government bond rate to all shocks is left unrestricted. The sign restrictions are imposed as \leq or \geq and are binding over a period of one quarter.

3 Results

3.1 Benchmark model impulse responses

Figure 3 shows the responses of the macroeconomic variables to an expansionary unconventional monetary policy shock. The dotted lines are the median impulse responses and the shaded areas correspond to the 68% posterior credibility bounds.¹⁰

We see that the euro area periphery economies are stimulated by a sudden monetary policy loosening. Real output rises in response to the unconventional monetary policy shock, which is accompanied by an increase in prices. The responses of both variables peak around ten quarters after the shock. The findings suggest that the ECB’s monetary policy conducted between 2010 and 2018 was effective in supporting the euro area periphery countries by generating an economic expansion. The sovereign CDS spread declines over a period of around eight quarters, which contributes to the fall in the government bond yield due to lower risk premiums.

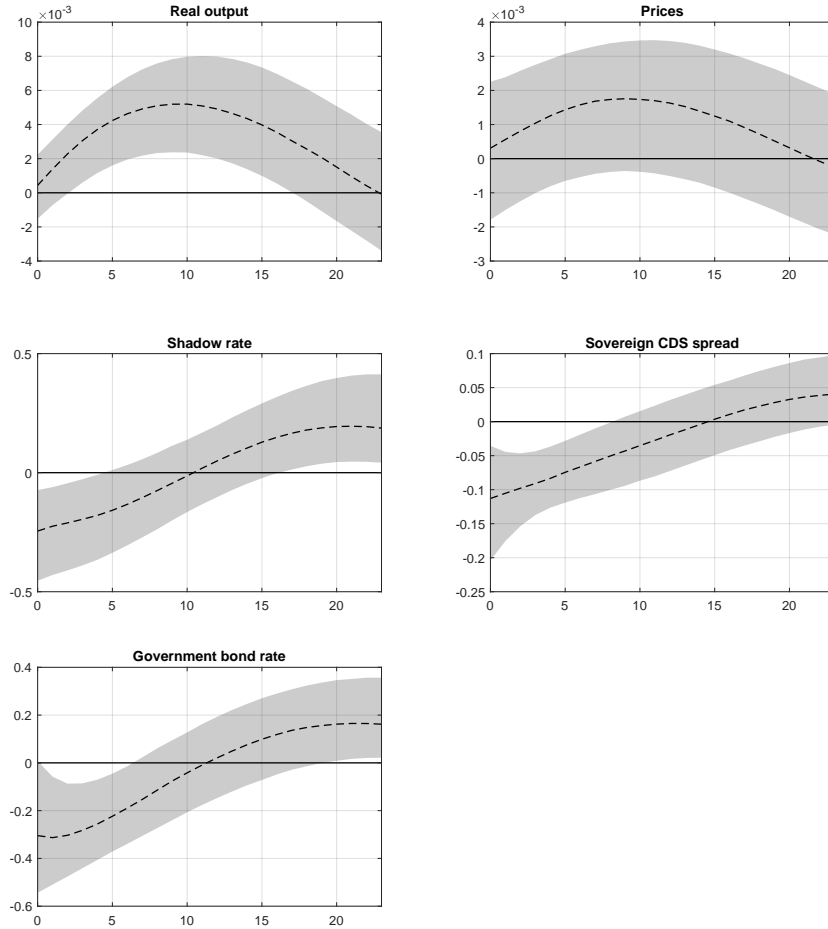
3.2 Euro area periphery sovereigns’ fiscal position

Next, we analyze the reaction of sovereigns’ fiscal position to an innovation to unconventional monetary policy. To this end, we modify the vector of endogenous

⁹We also estimate models where the aggregate supply shock is identified by imposing the additional restriction that the shadow rate falls on impact of the shock. The results are virtually similar.

¹⁰The impulse responses to the other identified shocks, i.e. the aggregate supply and aggregate demand shock, are not reported here, but are available upon request.

Figure 3: Benchmark model impulse responses to a UMP shock

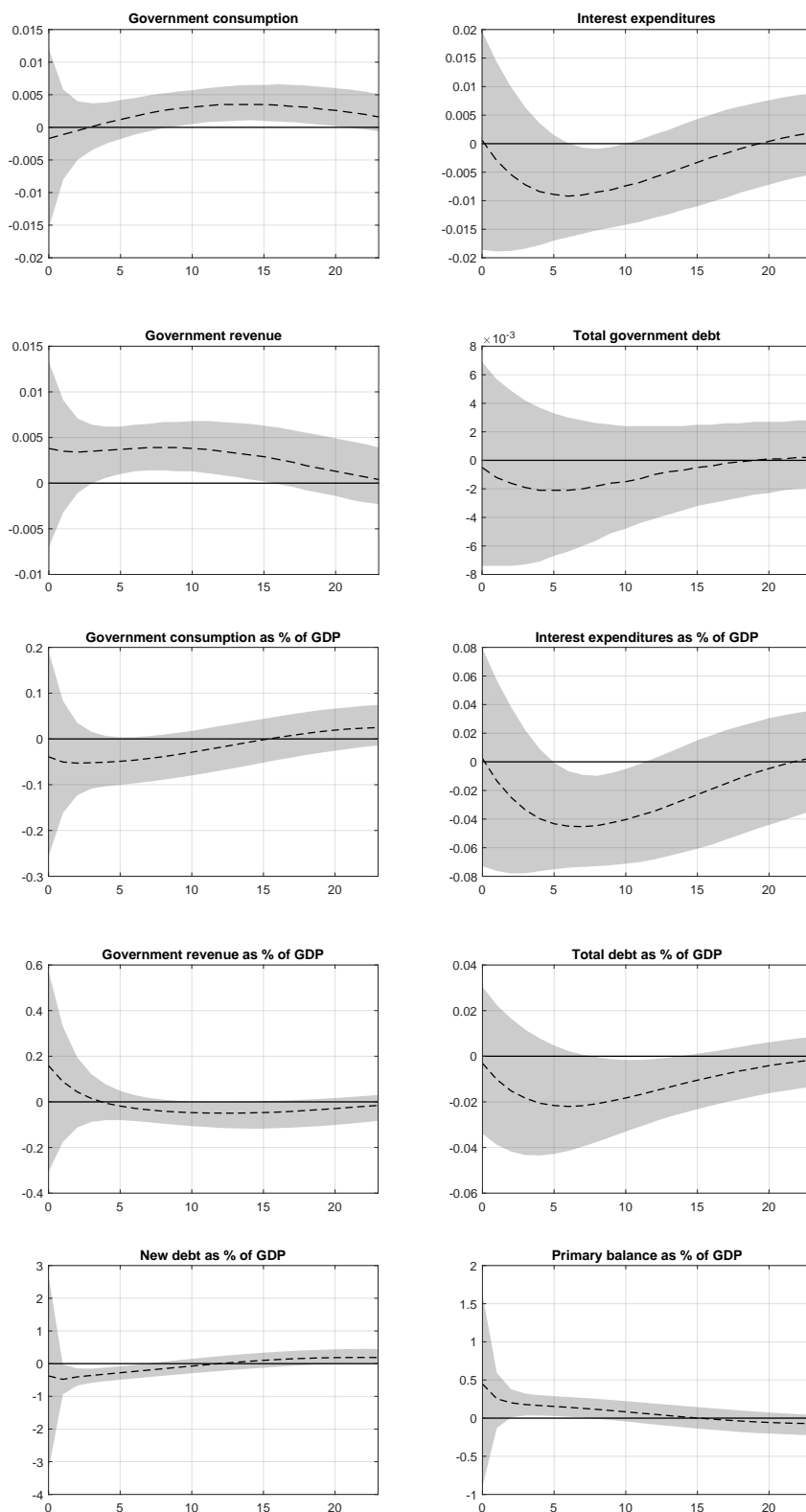


Notes: UMP shock denotes an unconventional monetary policy shock. Real output and prices are in logs, while the shadow rate of monetary policy, the government bond rate and the sovereign CDS spread are in percent. The dotted black lines are the median impulse responses. The shaded areas reflect the 68% credible set. The shock is identified by imposing sign restrictions that hold on impact of the shock.

variables in the benchmark model (2.1) by including each time a fiscal variable that replaces the government bond rate. All models are estimated with a lag order of one. The reaction of the fiscal variables to the respective shocks are left unrestricted. Figure 4 summarizes the impulse responses.

The rise in euro area periphery countries' real output induced by the unconventional monetary policy shock is followed by an increase in real government consumption, which, however, occurs with some delay. Moreover, real government revenue increases. Real interest expenditures decline due to the lowering of the government bond yield, which decrease along with the fall in the CDS spread. The reaction of real total government debt to an expansionary non-standard monetary policy innovation turns out to be insignificant. In addition, we see that the increase in government consumption is lower compared to that of output, i.e. government consumption as % of GDP falls. For the government revenue the same holds true.

Figure 4: Responses of fiscal variables to a UMP shock



Notes: UMP shock denotes an unconventional monetary policy shock. The dotted lines are the median impulse responses. The shaded areas reflect the 68% credible set. The monetary policy shock is identified by imposing sign restrictions that hold on impact of the shock.

Interest expenditures also decline relative to output along with government new debt. Overall, the government debt-GDP ratio, i.e. total government debt as % of GDP, decreases in response to the shock related to non-standard monetary policy. Simultaneously, the primary balance improves. Thus, fiscal soundness seems to benefit from sudden non-standard monetary policy measures which induce a decline in the sovereign CDS spread.

3.3 Forecast error variance decompositions

We compute forecast error variance decompositions (FEVD) to shed some light on the quantitative importance of the unconventional monetary policy shock. In contrast to the impulse response analysis, the FEVDs take into account the estimated magnitude of the innovation. Table 3 reports the FEVD of each fiscal variable at different forecast horizons.

Table 3: Forecast error variance decompositions of the fiscal variables

<i>Real fiscal policy variables</i>				
Quarters	Government consumption	Interest expenditures	Government revenue	Total debt
1	12.12	11.92	12.63	11.97
2	12.10	12.20	12.76	11.80
3	12.12	12.59	12.91	11.63
4	11.95	12.89	13.17	11.65
8	13.39	15.86	15.59	11.72
12	15.40	18.39	17.63	11.84
16	17.25	19.27	18.67	12.04

<i>Fiscal policy variables relative to GDP</i>						
Quarters	Government consumption	Interest expenditures	Government revenue	Total debt	New debt	Primary balance
1	12.88	12.27	12.56	12.29	12.20	12.65
2	12.81	12.84	12.58	12.35	12.26	12.79
3	12.96	13.29	12.67	12.57	12.70	13.14
4	13.36	13.99	12.70	12.72	12.97	13.28
8	14.51	18.28	13.03	13.23	14.79	13.73
12	15.12	22.00	13.69	13.57	16.27	14.13
16	15.47	23.42	14.62	13.79	17.35	14.63

Notes: Quantitative importance of an unconventional monetary policy shock measured in percent.

The results suggest that the variations of the fiscal variables triggered by a disturbance to non-standard monetary policy are quite sizable. The contributions to the fluctuations of real government consumption, real government revenue and real interest expenditures induced by the shock amount to 13%-17% on average. In

turn, the fluctuation of real government debt attributed to the shock is lower, i.e. on average the innovation explains around 12%. Regarding the variations of the fiscal variables as % of GDP we find that the contribution associated with a disturbance stemming from non-standard monetary policy is of similar size. Finally, much of the fluctuation in the primary balance as a ratio to GDP can also be attributed to the shock. The contribution is on average around 14%.

3.4 Robustness

3.4.1 Different model specifications

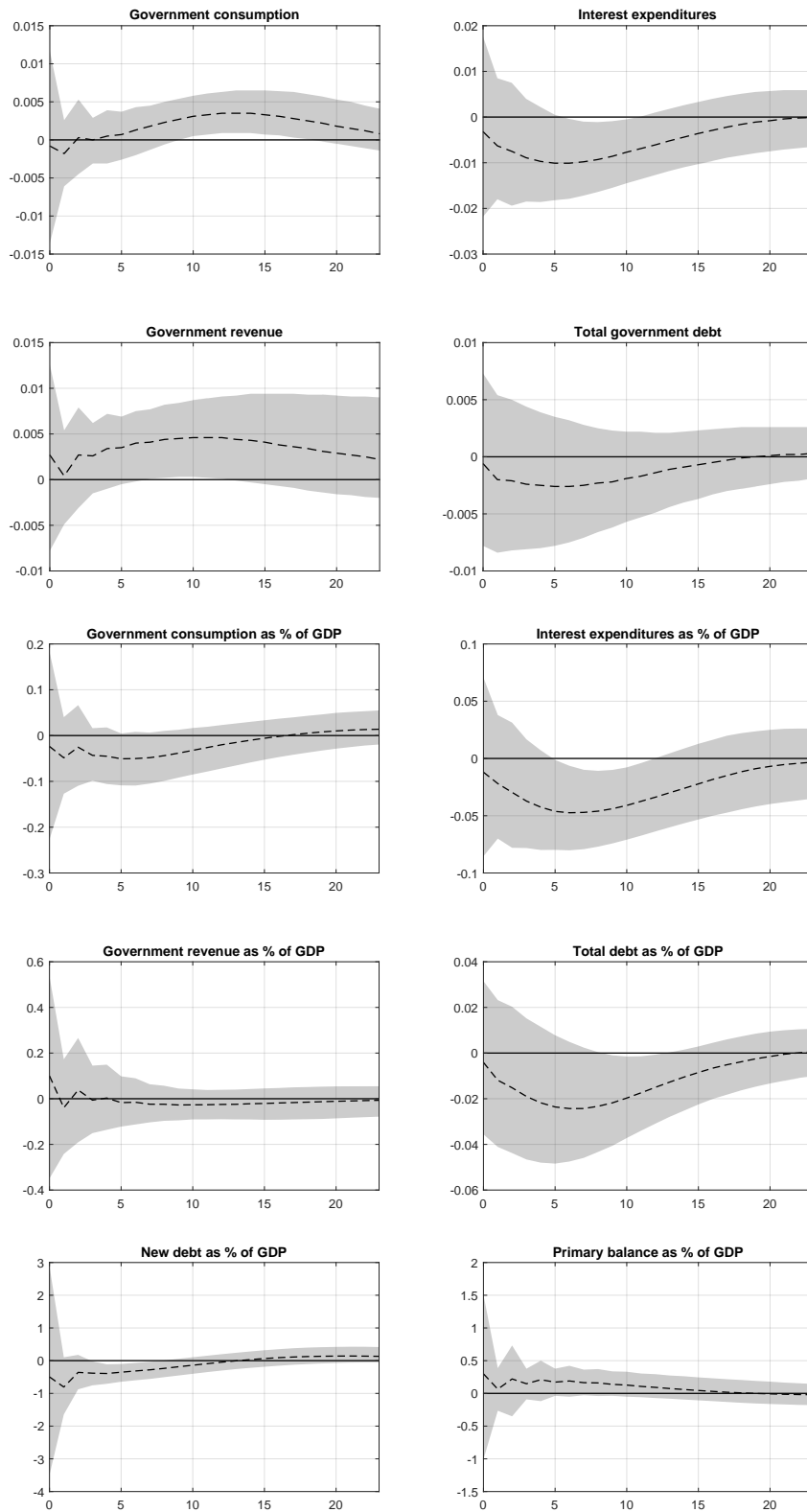
We assess the robustness of our results by estimating a number of different models. First, we estimate each model (2.1) extended by an additional fiscal variable with a lag order of two. Figure 5 summarizes the impulse responses of the fiscal variables to a non-standard monetary policy shock.

The findings indicate that the reaction of the fiscal variables to an innovation to unconventional monetary policy is qualitatively similar. However, in some cases the responses of the variables are less significant. The reaction of the primary balance to the non-standard monetary policy shock turns out to be insignificant, which suggests that fiscal soundness is at least not deteriorating in response to a non-standard monetary policy shock.

Second, we estimate a number of models specified like the benchmark model (2.1), however, in which we replace the sovereign CDS spread by alternative measures that reflect the sovereign bond market conditions. In particular, we resort to the spread of the government bond rate to the German government bond yield and the country-level index of financial stress (CLIFS). All models are estimated over the period 2010Q1-2018Q4 and are set up with a lag order of one. We find that the impulse responses of the fiscal variables derived from these models exhibit a qualitative similar reaction to an innovation to unconventional monetary policy.¹¹ Finally, we estimate models with the sovereign CDS spread as in (2.1) in which we, however, replace the shadow rate of [Krippner \(2013\)](#) with that calculated by [Wu and Xia \(2016\)](#) that is derived on the basis of a factor augmented vector autoregression (FAVAR) model. The models are estimated over the period 2010Q1-2007Q4 because Wu and Xia's shadow rate is only available until February 2018. Moreover, the models are estimated with a lag order of two, because specifications with a lag order of one exhibited that some roots were outside the unit circle. The impulse responses are similar to those obtained from the models with two lags (see Figure 5), however,

¹¹The results are not reported here, but are available upon request.

Figure 5: Responses of fiscal variables to a UMP shock



Notes: UMP shock denotes an unconventional monetary policy shock. Impulse responses are calculated on the basis of the benchmark model (2.1) that is modified each time by including a fiscal variable instead of the government bond rate. All models are estimated with a lag order of two. The dotted lines are the median impulse responses. The shaded areas reflect the 68% credible set. The monetary policy shock is identified by imposing sign restrictions that hold on impact of the shock.

with the difference that the median of the responses of the debt-GDP ratio is below zero, but the reaction turns out to be insignificant.¹²

3.4.2 Including Ireland

In the following, we extend our panel of countries by additionally including Ireland, despite the potential structural break in the Irish GDP data that emerged in 2015. All models are estimated using the same set-up as before, i.e. we adopt a lag order of one and include in each model an additional fiscal variable. The results are shown in Figure 6, which summarizes the impulse responses.

Once more, the reaction of the fiscal variables to an innovation to non-standard monetary policy is quantitatively similar. Nevertheless, some differences are observable. The responses of real government consumption and real government revenue are more delayed but also more persistent. Moreover, the decline in real total government debt is more pronounced. Overall, an unconventional monetary policy innovation appears to be followed by a strengthening of the fiscal position.

3.5 Counterfactual experiment

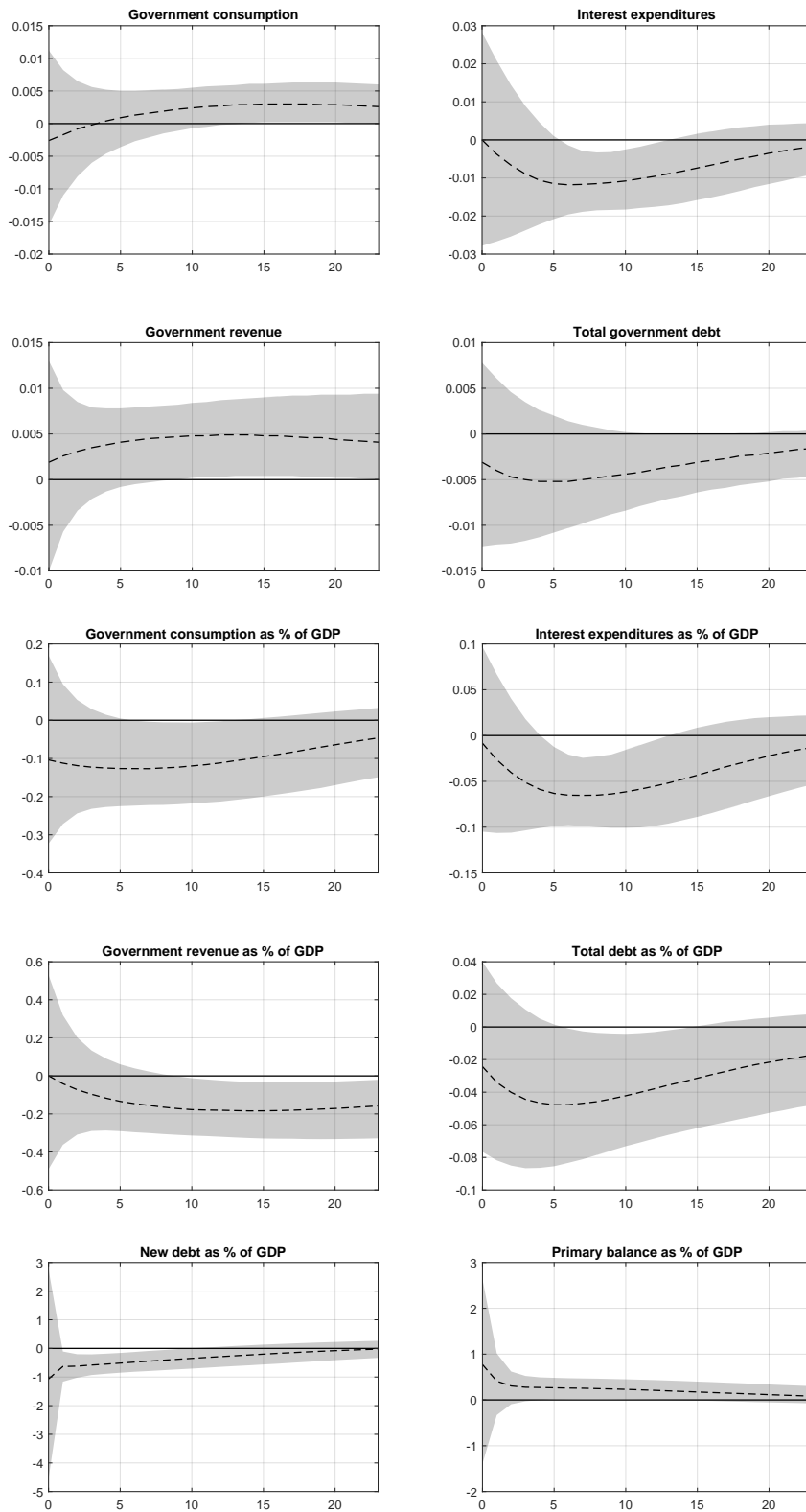
Finally, we conduct a counterfactual experiment to gain more insights into the improvement of the euro area periphery countries' fiscal position induced by a shock to unconventional monetary policy. To this end, we compute counterfactual impulse responses calculated conditional on the assumption that the sovereign CDS spread is *not* reacting to the monetary policy shock. In doing so, we intend to evaluate the effect of those non-standard monetary policy measures that are primarily aimed at removing sovereign market tensions by lowering CDS spreads.

Following [Hristov and Roth \(2019\)](#) we implement the experiment by resorting to the Kalman filter approach described in [Camba-Mendez \(2012\)](#) that extracts the most likely combination of structural shocks consistent with the restriction on one endogenous variables, i.e. in our case the sovereign CDS spread. The responses of the variables in the benchmark model are summarized in Figure 7, in which the actual median responses are marked by the dotted black lines and the counterfactual median responses by "+".

The counterfactual reveals that the increase in euro area periphery countries' output is less pronounced in response to a monetary policy shock, which exerts no influence on the sovereign CDS spread. Moreover, the adjustment of prices is weaker. In turn, the counterfactual reaction of the shadow rate appears, compared

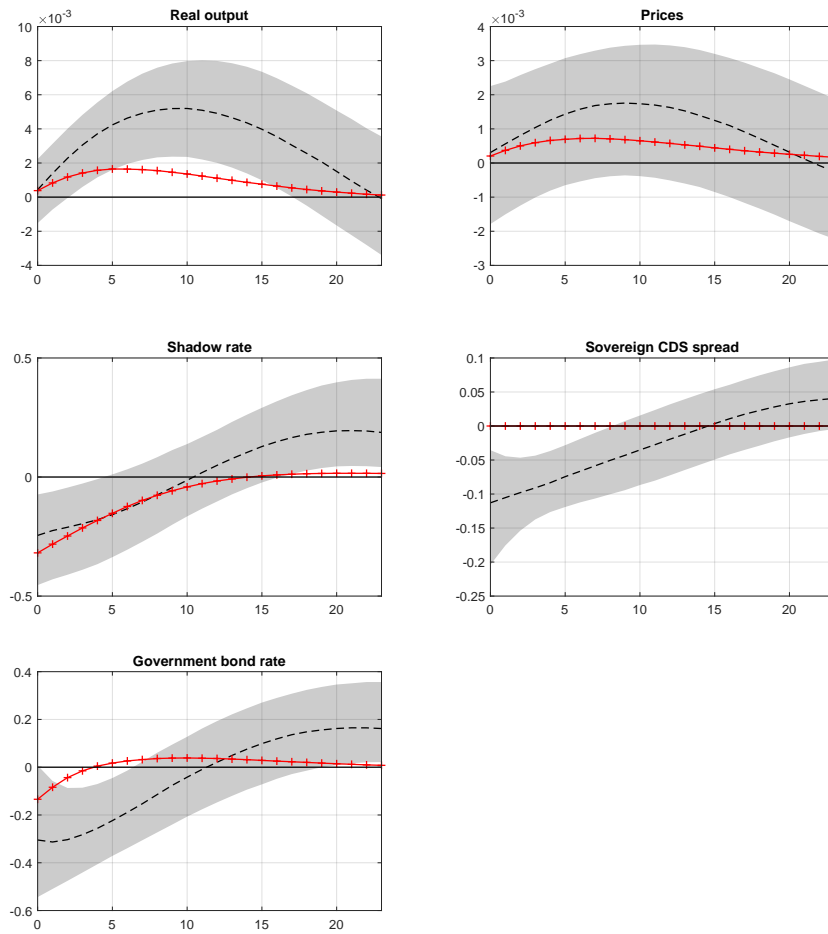
¹²Again the results are not reported here, but are available upon request.

Figure 6: Responses of fiscal variables to a UMP shock



Notes: UMP shock denotes an unconventional monetary policy shock. Ireland is additionally included in the panel of countries. Impulse responses are calculated on the basis of the estimated benchmark model (2.1) that is modified each time by including a fiscal variable instead of the government bond rate. The dotted lines are the median impulse responses. The shaded areas reflect the 68% credible set. The monetary policy shock is identified by imposing sign restrictions that hold on impact of the shock.

Figure 7: Actual and counterfactual impulse responses to a UMP shock



Notes: UMP shock denotes an unconventional monetary policy shock. The dotted black lines are the actual median impulse responses. The counterfactual median impulse responses are marked by "+". The shaded areas reflect the 68% credible set of the actual impulse responses.

to the actual response, more expansionary on impact. The government bond rate declines in response to the shock, however, the counterfactual reaction also exhibits that the decrease is less pronounced.

Figure 8 displays the actual responses of the fiscal variables as well as the counterfactual median responses. We observe that the weaker reaction of the economy to the shock has consequences for the responses of real government consumption, real government revenue and new debt, which all turn out to be close to zero. The decline in real interest expenditures is also weak. Moreover, the primary balance to output ratio is hardly responding. Thus, a notable improvement of the fiscal position cannot be observed, despite the expansionary impulse generated by the decrease in the shadow rate. Therefore, the counterfactual suggests that the effect of monetary policy on fiscal soundness is particularly strengthened by those measures that contribute to reducing risk premiums by lowering the sovereign CDS spreads.¹³

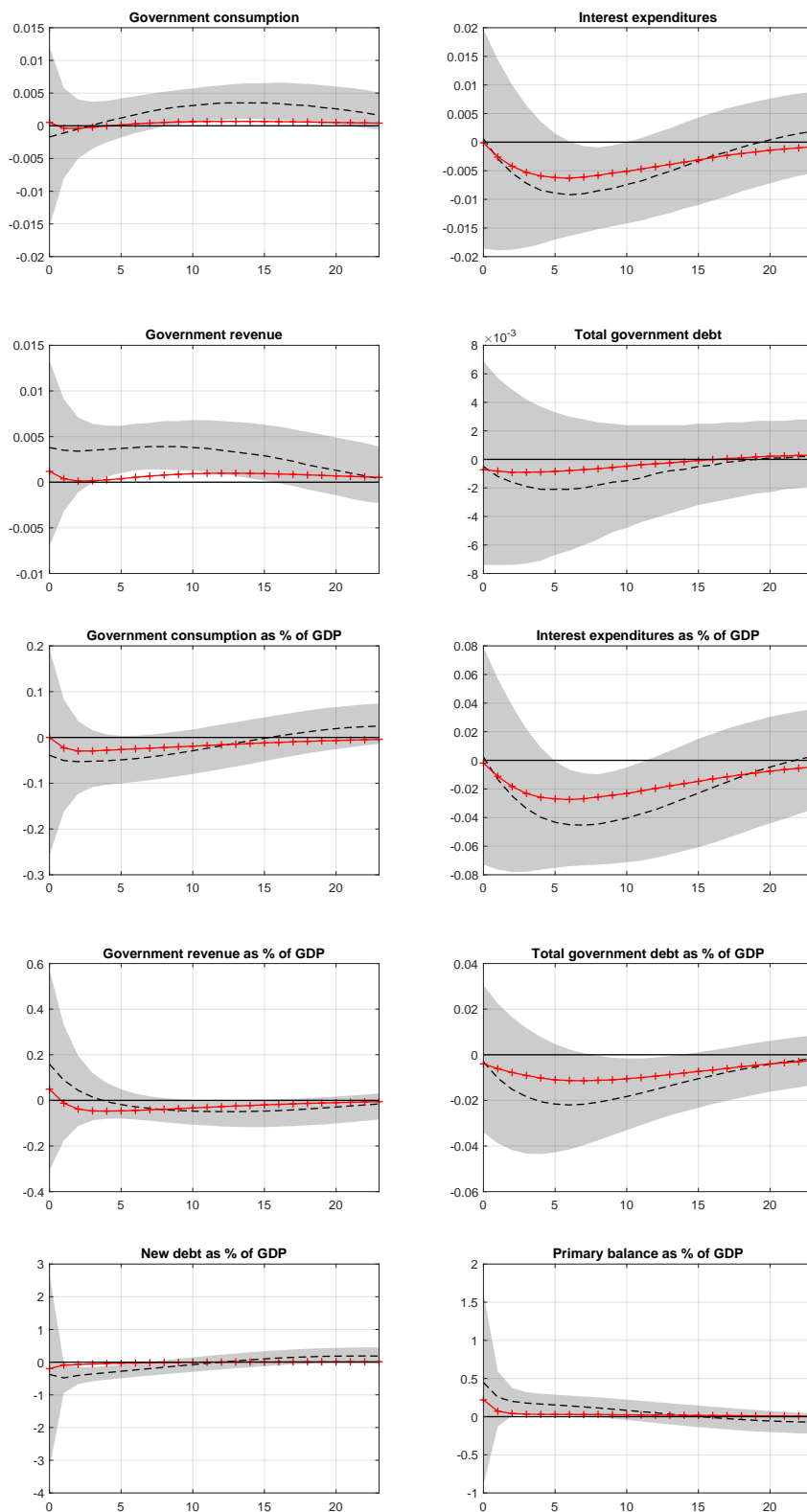
4 Conclusion

We estimate panel VAR models with Bayesian methods to explore the reaction of the euro area periphery sovereigns' fiscal positions to an unconventional monetary policy shock. Our focus is on the period from 2010 to 2018. We identify an innovation to non-standard monetary policy by imposing sign restrictions on impulse responses, and assume that an unconventional monetary policy disturbance is characterized by a fall in the shadow rate and a decline in the sovereign CDS spreads.

Our findings suggest that the euro area periphery countries' economies are stimulated by sudden expansionary measures related to non-standard monetary policy. The increase in real output is associated with a rise in government consumption and revenue. Simultaneously, interest expenditures decline. The fiscal position improves as total government debt relative to output decreases. Moreover, we observe a primary surplus after the shock.

¹³Of course, our counterfactual experiment may be challenged through the lens of the *Lucas critique*. However, as Sims (1998) points out, as long as the counterfactual scenario can be considered element of agents' (subjective) distributional beliefs regarding the relevant economic parameters, the scenario itself does not necessarily represent a structural change. It should rather be viewed as a draw from the *unchanged* parameter distributions underlying the structure of the economy. In such a case, a counterfactual analysis is substantially less prone to the *Lucas critique* (Sims, 1998; Leeper and Zha, 2003). In our case, we assume that monetary policy exerts no influence on the sovereign CDS spreads, which, however, does not rule out that government bond rates may decline in response to an expansionary monetary policy shock. Thus, we believe that the problems giving rise to the *Lucas critique* do not bias our results in a substantial way as we filter out only the effect of those monetary policy measures that have no impact on risk premiums, i.e. the sovereign CDS spreads.

Figure 8: Actual and counterfactual responses of fiscal variables to a UMP shock



Notes: UMP shock denotes an unconventional monetary policy shock. The dotted lines are the actual median impulse responses. The counterfactual median impulse responses are marked by "+". The shaded areas reflect the 68% credible set of the actual impulse responses.

Our analysis contributes to the debate on the disciplining effect on fiscal policy arising from market pressure. According to this view, fiscal discipline should deteriorate in response to falling sovereign bond rates that give rise to an increase in government debt. However, our results seem at odds with this view as we find that fiscal discipline is rather maintained after an unconventional monetary policy shock which induces a decline in government bond yields by lowering sovereign CDS spreads. The different findings may be explained by our focus on the effect of non-standard monetary policy on the fiscal positions during the sovereign debt crisis, which might have put pressure on fiscal consolidation due to weak fundamentals, such as poor economic growth, high debt and adverse debt dynamics. In addition, our results may also be a consequence of strong political pressure arising, for instance, from the wish to avoid accessing rescue packages that are conditional on austerity measures. Therefore, although unconventional monetary policy eased market pressure, and thus, should have weakened fiscal discipline, these measures were implemented at a time when other policies were put in place that replaced market pressure with political pressure.

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Data Appendix

Eurostat:

- Real GDP: chain linked volume index (2010=100), calendar and sessionally adjusted.
- GDP deflator, index (2010=100), calendar and sessionally adjusted.

ECB Statistical data Warehouse:

- Real government consumption
Code: GFS.Q.N.XX.W0.S13.S1.N.D.P3.Z.Z.T.XDC.Z.S.V.N.T
Deflated by GDP deflator. Seasonally adjusted by using Census X12.
- Real government revenue
Code: GFS.Q.N.XX.W0.S13.S1.P.C.OTR.Z.Z.Z.XDC.Z.S.V.N.T.
Deflated by GDP deflator. Seasonally adjusted by using Census X12.
- Real interest expenditure
Code: GFS.Q.N.XX.W0.S13.S1.C.D.D41.Z.Z.T.XDC.Z.S.V.N.T
Deflated by GDP deflator. Seasonally adjusted by using Census X12.
- Real government debt
Code: GFS.Q.N.XX.W0.S13.S1.C.L.LE.GD.T.Z.XDC.T.F.V.N.T
Deflated by GDP deflator. Seasonally adjusted by using Census X12.
- Government consumption as % of GDP
Code: GFS.Q.N.XX.W0.S13.S1.N.D.P3.Z.Z.T.XDCRB1GQ.Z.S.V.N.T
Seasonally adjusted by using Census X12.
- Government revenue as % of GDP
Code: GFS.Q.N.XX.W0.S13.S1.P.C.OTR.Z.Z.Z.XDCRB1GQ.Z.S.V.N.T
Seasonally adjusted by using Census X12.
- Government interest expenditures as % of GDP
Code: GFS.Q.N.XX.W0.S13.S1.C.D.D41.Z.Z.T.XDCRB1GQ.Z.S.V.N.T
Seasonally adjusted by using Census X12.
- Government new debt as % of GDP
Code: GFS.Q.N.XX.W0.S13.S1.C.L.LX.GD.T.Z.XDCRB1GQ.T.F.V.N.T
Seasonally adjusted by using Census X12.

- Government debt as % of GDP
Calculated as government debt relative to nominal GDP, where nominal GDP is taken from Eurostat, own calculations.¹⁴ Seasonally adjusted by using Census X12.
- Government primary balance as % of GDP, deficit (-) surplus (+)
Code: GFS.Q.N.XX.W0.S13.S1.Z.B.B9P.Z.Z.Z.XDCRB1GQ.Z.S.V.N.T,
Seasonally adjusted by using Census X12.
- Government bond rate, average of observations through period
Code: IRS.M.XX.L.L40.CI.0000.EUR.N.Z

In the series' codes XX is a placeholder for the country acronym: Spain (ES), Portugal (PT), Italy (IT) and Ireland (IR), respectively.

Thomson Reuter Datastream:

- Sovereign CDS spreads are calculated on the basis of five years sovereign credit default swaps. The base for computing the spreads is 2009Q2.

Shadow rates:

- Leo Krippner's shadow rate is taken from:

<https://www.rbnz.govt.nz/research-and-publications/research-programme/additional-research/measures-of-the-stance-of-united-states-monetary-policy/comparison-of-international-monetary-policy-measures>.

- Wu and Xia's shadow rate is taken from:

<https://sites.google.com/site/jingcynthiawu/home/wu-xia-shadow-rates>

¹⁴Using government debt relative to the annual moving sum of GDP instead (Code: GFS.Q.N.XX.W0.S13.S1.C.L.LE.GD.T.Z.XDCRB1GQCY.T.F.V.N.T) yields similar results.