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FISCAL POLICY UNCERTAINTY AND THE BUSINESS CYCLE: TIME SERIES EVIDENCE FROM ITALY

by Alessio Anzuini*, Luca Rossi* and Pietro Tommasino*

Abstract

Economic uncertainty is an important factor behind macroeconomic fluctuations: in an uncertain environment, firms reduce hiring and investment, financial intermediaries are more reluctant to lend and households increase their propensity to save. In the present paper, we study the effects of the uncertainty which arises from fiscal policy decisions. We propose a new measure of fiscal policy uncertainty (FPU). In particular, we estimate a fiscal reaction function, allowing the volatility of the shocks to be time-varying. The time series of this volatility is our proxy for FPU. Looking at Italian data over the period 1981-2014, we find that an unexpected increase in our FPU measure has a negative impact on the economy. One implication of this result is that the same change in the government budget can have different effects depending on whether it is associated with a reduction or an increase in FPU. Therefore, the neglect of FPU may partly explain why the size (and sign) of fiscal multipliers differs so much across existing empirical studies.

JEL Classification: C2, E3, O41.
Keywords: vector autoregression; fiscal policy; uncertainty.

Contents

* Bank of Italy – Directorate General for Economics, Statistics and Research.

1 Introduction[1]

After several years of recession or subpar growth in many countries, several economists and policy-makers have become convinced that widespread uncertainty might have concurred to the unsatisfactory pace of the recovery (see e.g. IMF, 2012).

More generally, economic theory suggests that, under certain conditions, uncertainty shocks may be important in explaining economic fluctuations: firms may react to an increasingly uncertain environment by reducing hiring and investment; financial intermediaries may become more reluctant to lend; households may increase their propensity to save, as supported by the evidence in the empirical literature (Bloom, 2014).

Economic uncertainty can take many forms, and may originate from several sources. In the current paper we focus on fiscal policy uncertainty (FPU). Fiscal policy may represent a source of uncertainty for economic agents for several reasons. In countries with unsustainable public finances, households and firms may expect changes in future tax rates and/or expenditure programs (and therefore on crucial variables such as net profits, disposable income, etc.), but they may be unsure of the timing as well as of the magnitude of these changes.[2] Even in countries where public finances are sustainable, FPU may be high if the political process is polarized and fiscal frameworks are weak (Kontopoulos and Perotti, 2002, Roubini and Sachs, 1989). In those countries, political uncertainty translates into FPU, because changes of government and switches in government coalitions can lead to unpredictable or erratic changes in fiscal policy.

In the present paper we propose a new measure of FPU, and study its effects on the macroeconomic situation. Indeed, for most of its recent history Italy has been characterised by fragile public finances and by a highly partisan and often fragmented political landscape. It is therefore an extremely appropriate laboratory to study FPU and its consequences.

In particular, first we estimate a fiscal reaction function in order to capture how the fiscal stance reacts to economic developments. The key difference with respect to previous empirical exercises (for a review, see Golinelli and Momigliano, 2009) is that the fiscal rule incorporates an innovation not only to the level, but also to the volatility of the fiscal stance (technically, we adopt a stochastic volatility model).

[1]The authors would like to thank Francesco Caprioli, Davide Delle Monache, Fabio Fornari, Maura Francese, Marco Lombardi, Luca Metelli, Stefano Neri, Massimo Sbracia and Pietro Rizza. The opinions expressed herein are of the authors and do not necessarily reflect those of Banca d'Italia. The usual disclaimers apply.

[2]A theoretical discussion of the adverse effects of government's procrastination can be found in Gomes et al. (2012).

As a second step, we feed a VAR model with the two series of innovations - i.e. innovations to the *level* and to the *volatility* of the fiscal variables of interest - and analyze how they impact the macro-economy.

We find that the effects of a level fiscal shock are quite standard and in line with the previous VAR literature - i.e. we find positive multipliers. More interestingly, we also find that an increase in FPU has a negative impact on the economy.

Our paper contributes to two different streams of the macroeconomic literature.

First, the recent empirical research on the macroeconomics of uncertainty. As we already mentioned, uncertainty stems from several sources. Some papers have focused on stock-market induced uncertainty, such as Bloom (2009), which uses peaks in stock market volatility (captured by a dummy variable equal to one in selected dates) as a measure of uncertainty (see also the early paper by Romer 1990). Policy may be clearly another relevant source of macroeconomic uncertainty.[3] Baker et al. (2016) propose a broad policy uncertainty index based on the frequency of references to economic policy uncertainty in the news. More specific indicators are those related to trade policy and monetary policy, developed respectively by Handley (2014) and Creal and Wu (2016).[4]

The only two papers that look at fiscal uncertainty shocks (both for the U.S.) are Born and Pfeifer (2014) and Fernández-Villaverde et al. (2015). We follow their econometric methodology, and proxy FPU with the time-varying volatility of the innovation of a fiscal reaction function.[5] However, differently from Born and Pfeifer (2014) and Fernández-Villaverde et al. (2015), we look at the overall (cyclically-adjusted) primary deficit (CAPB) and not just to some of its components. This more encompassing variable is the most used indicator of the government's fiscal stance (incidentally, the CAPB also plays a relevant role in the context of the fiscal framework of the European Union).

Given our focus on the CAPB, our paper is directly relevant for a second stream of literature, namely that concerned with the macroeconomic effects of discretionary fiscal policy.[6] A review of that field is clearly outside the

[3]Policy uncertainty (i.e. not knowing which policy will be implemented) may be in turn due to political uncertainty (i.e. not knowing who will be in power). The economic effects of this latter variable have been studied, for example, by Julio and Yook (2012) and Canes-Wrone and Park (2014).

[4]A related stream of literature neglects the real effects of policy uncertainty, focusing instead on its financial consequences. See e.g. Kelly et al. (2016) and Brogaard and Detzel (2015). Other papers, e.g. Gulen and Ion (2016), look at the microeconomic (firm-level) effects of changes in policy uncertainty. Incidentally, both Brogaard and Detzel (2015) and Gulen and Ion (2016) use the Beker et al. (2016) index.

[5]A similar methodology is adopted by Scotti (2013) and Jurado et al. (2015). Both papers aim at modeling macroeconomic volatility at large, not FPU.

[6]On the contrary, it is not easy to compare the results of Born and Pfeifer (2014) and

scope of this introduction, but it is well-known that there is no consensus about the size - and even the sign - of fiscal multipliers. On one side, studies like Blanchard and Perotti (2002) and Romer and Romer (2010) find standard demand-driven Keynesian effects; on the other side, starting from Giavazzi and Pagano (1990), other authors have argued that the effects of a fiscal change can be non-Keynesian, with the possibility of expansionary fiscal consolidations and contractionary fiscal expansions (a recent example is Alesina and Ardagna, 2013). Our main contribution to this debate is to show that fiscal policy-makers can influence the economy not only by changing the level of the budget deficit, but also by affecting its volatility. As a consequence, the same change in the government budget (say a budgetary expansion) can have different effects depending on whether it is associated with a reduction or an increase in the FPU. From an econometric viewpoint, this implies that a proper assessment of the impact of changes in the fiscal policy stance should correctly identify both the level and the uncertainty shock. From a policy perspective, our findings highlight the importance for policy-makers of being credible, and avoid policies that are unsustainable in the long run.

The remainder of the paper is organised as follows. Section 2 describes how we measure FPU: we outline our methodology, our data, and present the results; in Section 3 we present a battery of VAR estimates to show the effects of the fiscal shocks on macroeconomic variables. Section 4 concludes.

2 Estimating fiscal policy uncertainty

2.1 The empirical model: a fiscal rule with time-varying volatility

We estimate the following two-equation state space model:

$$def_t = \beta_1 debt_{t-1} + \beta_2 gap_{t-1} + \beta_3 def_{t-1} + e^{h_t} u_t \quad \text{where } u_t \sim N(0,1) \quad (1)$$

$$h_t = \alpha_0 + \rho h_{t-1} + \gamma \varepsilon_t \quad \text{where } \varepsilon_t \sim N(0,1) \quad (2)$$

where def_t is the cyclically-adjusted ratio between the general government primary borrowing requirement and GDP at time t, $debt_{t-1}$ is the debt ratio, gap_{t-1} is the output gap, and h_t is the log-volatility of the error term. Concerning the parameters, the βs have obvious interpretations, ρ is the persistence of the log-volatility and γ is the volatility of the shocks to the log-volatility.

Fernández-Villaverde et al. (2015), which look at specific budgetary items, with those of papers which focus on more aggregated fiscal variables. The latter openly acknowledge this limitation (see Fernández-Villaverde et al. (2015), Appendix A).

Equation (1) is a very standard fiscal reaction function (see e.g. Gali and Perotti, 2003 or the survey by Golinelli and Momigliano, 2009).

Equation (2), instead, gives the law of motion for the volatility of the deficit, which in our model is not conditionally deterministic (as, for example, in a GARCH model) but includes a stochastic component.[7] Equation (2) captures our main idea: fiscal policy can in principle be affected by *two* kinds of innovations: level shocks (u_t) and FPU shocks (ε_t).

The inclusion of a stochastic volatility element is important from an economic viewpoint to fully capture the nature of fiscal policy-making, but comes with some non-negligible computational costs. Indeed, it makes our model non-linear, precluding the use of standard econometric techniques, such as the Kalman filter, which requires instead linearity and Gaussianity. To estimate equations (1) and (2) we resort to particle-filter estimation. This technique is similar in spirit to the Kalman filter: in both methods, non-data information (prior) and data information (likelihood) are combined to obtain an estimate of the variables of interest. Furthermore, as in the Kalman filter, the process h_t is unobservable and has to be estimated along with other parameters of the specification: α_0, ρ, β_1, β_2, β_3, γ.

However, differently from the Kalman filter, we do not have closed-form (analytical) solutions for the posterior distributions. The integrals involved in the computations of the posterior are approximated by using the discrete random samples obtained by drawing from the posterior.[8]

We use the Liu and West (2001) version of the of the particle filter, which allows joint estimation of state and parameter vectors, and introduce the following re-parametrization of our model:

$$\begin{aligned} \alpha_0 &\equiv (1-\rho)\omega \\ \rho &\equiv \frac{\exp(\bar{\rho})}{\exp(\bar{\rho})+1} \\ \gamma &\equiv (1-\rho^2)^{\frac{1}{2}} e^{\bar{\gamma}} \end{aligned}$$

and we estimate ω, $\bar{\rho}$, and $\bar{\gamma}$ instead of α_0, ρ, and γ. Incidentally, the reparametrization allows a relatively easy interpretation of the parameters we need to estimate.[9] Indeed, $E(h_t) = \omega$, so that ω is the log-modal volatility, and $var(h_t) = e^{2\bar{\gamma}}$, so that $sd(h_t) = e^{\bar{\gamma}}$.

[7] The advantages of a stochastic volatility model with respect to a GARCH are highlighted in Fernández-Villaverde and Rubio-Ramirez (2013).

[8] The algorithm for the basic version of the particle filter has been developed by Gordon et al. (1993). Other important contributions are included in Doucet et al. (2001).

[9] Without these transformation we could have had problems with estimating variances (which must be positive) and autoregressive parameters (which must be inside the unit circle); instead, ω, $\bar{\rho}$, $\bar{\gamma}$ can assume any real value, as the logistic transform is constrained in the [0,1] interval, and the log transform ensures a positive parameter.

2.2 The data

We consider the period from January 1981 to March 2014. Monthly data for the general government borrowing requirement and the debt are taken from the official series published by the Bank of Italy (*Supplement to the Statistical Bullettin - The public finances, borrowing requirements and debt*). The borrowing requirement is computed on a cash basis, using changes in the stock of debt instruments, on which precise and almost complete information is available. It is controversial whether cash-basis or accrual-basis data (as in the national accounts) are the most appropriate when studying the impact of government operations on the economy (for a discussion of this issue see, among others, Levin, 1993). In our case, cash data are preferable: i) they are sufficiently long; ii) they allow deficit and debt to be built with the same methodology and criteria (the latter are indeed available only on a cash basis); iii) contrary to accrual data, they are not subject to ex-post revisions. This is important as a growing literature[10] underlines that fiscal rules should be consistent with the information set available to the policy maker at the time in which the fiscal action is made.

As it is customary in the literature (see e.g. Giordano et al., 2007), we exclude from the borrowing requirement debt settlements and privatization receipts, because the first refers to expenditures undertaken in past periods, while the latter cannot be considered as resources compulsorily subtracted from the private sector.

Since the GDP series has quarterly frequency, the fiscal reaction function is estimated on a quarterly basis.[11] We could have tried to retrieve a monthly measure for GDP within a mixed frequency approach, therefore being able to estimate a monthly fiscal rule. However, in order to contain estimation errors we preferred to avoid estimating a further state variable (i.e. monthly GDP), so that we opted for aggregating the figures for borrowing requirements and working at a lower frequency.[12] More importantly, it is not plausible that fiscal authorities decide their fiscal stance on a monthly basis.

The quarterly time series of the cyclically-adjusted primary balance, the debt and the HP-filtered log-GDP are plotted respectively in Figure 1, 2 and 3.

[10] See Cimadomo (2016) for an up-to-date survey; the importance of using real time data when estimating policy rules has been first emphasized by Orphanides (2001) in the context of monetary policy.

[11] As public finances data are monthly, deficit figures are aggregated by sum, while for debt, we use the start-of-quarter figure. The output gap is obtained by HP-filtering the series for the log real GDP ($\lambda = 1600$). All the series are seasonally and calendar adjusted using X-ARIMA-12 RSA4c filtering.

[12] Nonetheless, a formal comparison of fiscal rules estimated at different frequencies (e.g. monthly versus quarterly) would alone deserve to be performed in future research. Note that although debt figures are available at a monthly frequency, they do not require temporal aggregation because they are stock variables.

2.3 Choosing the priors

Economic theory does not offer any hint about the values of the parameters for debt and GDP in the fiscal reaction function, i.e. β_1 and β_2 in Equation (1), so we choose zero-mean uniform priors on a very wide support in both cases.

Regarding the autoregressive parameter β_3, one can reasonably expect it to be between 0 and 1, since the series appears stationary and does not present negative autocorrelation. Therefore, we use a uniform prior on this support.

We do not know much about $\bar{\rho}$ either (the logit of the persistence of the log-volatility), therefore we use a normal $N(0, 1.5)$ prior for this parameter, which implies that ρ has an almost uniform density on the support [0,1] (so the log-volatility is neither a negatively autocorrelated nor an explosive process).

The parameter ω is the modal log-volatility of the fiscal shock. We expect e^{ω} to be lower than the unconditional (sample) volatility of def (Figure 4, lower left panel). In particular we choose $pr(\omega) \sim N(-3.94, 0.2)$.

Choosing a prior for $\bar{\gamma}$ is particularly difficult so we choose it based on what are the likely effects on the standard deviation of the level shock once a one-standard deviation volatility shock occurs (see Figure 5).[13]

Recall that $E(h_t) = \omega$, and $sd(h_t) = e^{\bar{\gamma}}$. Therefore, our prior for the log-volatility is $\sim N(pr(\omega), e^{pr(\bar{\gamma})})$, where $pr(\omega)$ is the mean of our prior for ω, whilst $pr(\bar{\gamma})$ is the mean of our prior for $\bar{\gamma}$. Figure 6 plots the histogram of the realized initial values we used in the analysis.

2.4 Estimates of fiscal policy uncertainty

Figure 7 plots the estimated series for the time-varying volatility recovered with the particle filter ($e^{\hat{h}_t}$)[14]. Two of the three relative peaks of the index during the eighties (the one at the beginning of 1983 and the one in 1985) correspond to two well-known episodes of macroeconomic turbulence related to public finances. At the end of 1982 the Bank of Italy refused to buy government securities unsold on the primary market, creating uncertainty on sovereign bond markets and obliging the Parliament to pass a one-off one-year advance form the Central Bank. In 1985, the repayment of a dollar-denominated loan of a large public enterprise was associated with severe

[13] In the figure we show the effects on the standard deviation of the level shock when two distinct one-standard-deviation volatility shocks occur. The first is a negative shock (left density), whereas the second is a positive one (right density). The red line in the middle is the median of the prior for the standard deviation of the level shock.

[14] We run the particle filter using $M = 100,000$ and $R = 150,000$, where M is the number of particles that jointly approximate the posterior, and R is the number of draws in the auxiliary variable sampling step.

foreign exchange turbulences.

It is important to note that the two major peaks in the volatility series are in the nineties and coincide with critical moments in the recent history of Italian public finances. The first is in the second half of 1992, when a balance-of-payments crisis questioned the viability of the fixed-exchange regime and the sustainability of Italian public finances. In this circumstance, the Government tightened budgetary policy (with emergency measures decided in July 1992), but ultimately (September 1992) the country was forced to abandon the European Exchange Rate Mechanism. The second peak is in the first half of 1999, i.e. the first months of the European Monetary Union. Starting from January 1st, 1999, the Euro area countries were subject to a single fiscal framework, the so-called Stability and Growth Pact. Doubts about the implementation of the new rules can easily rationalize this spike in our measure of uncertainty. A further element of fiscal uncertainty was determined by the promise by the Government to give partly back to taxpayers –but only in case of EMU admission! –a one-off tax which was levied in 1996. The fraction of the restitution was not specified ex ante (it was decided only at the end of 1999 and turned out to be 60%). Also relevant might have been, in the same period, the introduction of two brand new taxes (the municipal and regional additions to the personal income tax) also meant to increase the degree of fiscal autonomy of local governments (which might in itself be considered something which increases fiscal uncertainty).

Finally, the local peak in 2001 can be rationalized as the effect of a significant turning-point in fiscal policy, as the Parliament approved the first expansionary budget in years. With the benefit of the hindsight, fiscal outturns also benefitted by the windfall gains due to buoyant financial markets (which is reflected in the fiscal stance).

Notice that our level shock series, although recovered in a completely different framework, correlates significantly with those recovered by Giordano et al (2007). In particular, and as expected, it correlates positively with their tax shock series and negatively with their expenditure shocks series.

3 Fiscal Policy Uncertainty and the macroeconomy: a VAR approach

3.1 Baseline results

Having recovered the two series of the fiscal level shock and fiscal volatility shock we are now ready to analyse their impact on macroeconomic variables. In particular, we estimate a recursive autoregressive model with conditioning exogenous variable corresponding to our measure of fiscal level shock and fiscal volatility shock (FPU). In the econometric literature this model is usually referred as a VARX model or as a rational distributed lag model (see Lütkepohl, 2005, chapter 10). Our system of equations is:

$$Y_t = \delta_0 + \delta_1 t + \delta_2 t^2 + A(L)Y_{t-1} + b(L)\chi_t + c(L)\mu_t + \upsilon_t \quad (3)$$

where the vector Y_t contains the log of real private GDP, the log of the private GDP deflator, log private employment and the 10 years Government bond yields. The variables χ_t and μ_t are respectively the fiscal level shock and the FPU determined outside the system of the equations. δ_0, δ_1 and δ_2 are vectors of coefficients, while $A(L)$ is a polynomial matrix in the lag operator and $B(L)$ and $C(L)$ are finite-order polynomials in the lag operator L.[15] Finally, t is a time trend, and υ_t a vector of white noise and mean-zero i.i.d. error terms.

Our system is estimated using standard Bayesian techniques. In particular, we use a non-informative prior (Jeffrey's prior) distribution on parameter space and an inverse Wishart distribution as the conjugate prior for the covariance matrix. Antithetic acceleration is then used to improve convergence of the Monte Carlo draws.

We feed the estimated model with a one-standard-deviation shock on the unexpected variations in the cyclically adjusted primary balance (as a fraction of GDP) or, alternatively, a two-standard-deviation increase in unexpected FPU (i.e. the shocks to the log-volatility of the innovations to the budget balance)[16].

The effects of the two shocks are quite different, so that not properly disentangling the two sources of the fiscal shocks and mixing them in a single shock would blur the effects of fiscal policy.

Figure 8 shows the conditional movements of the Italian macro variables after an unexpected expansionary shock to the deficit-to-GDP ratio: standard Keynesian effects tend to dominate. GDP rises significantly and so does employment: the peak response in GDP is reached after one quarter and, although positive, is rather weak (0.23%); the response in employment is strong and persistent reaching a peak (0.2%) after two quarters and remaining significantly positive for three years. The 10-year government bond yield tend to rise although not significantly. The peak GDP response to a one percentage point increase in the fiscal level shock in our VAR is not statistically different (although close to their upper bound) to what Giordano et al. (2007) find as a GDP response to a one percentage point government purchases shock. They found a median peak response of 0.6% but their 95% confidence band includes our median peak response of 1.1%.[17]

When we feed the model with an unexpected shock to FPU, results are reversed. The private GDP persistently and significantly decreases reaching

[15] Both AIC and BIC select 1 lag as preferred specification.

[16] In using two-standard deviations, we follow Fernandez -Villaverde et al. (2015).

[17] Notice though that our VAR is different from the VAR estimated by Giordano et al. (2007) as theirs includes more than one fiscal variable. Government purchases is the budgetary component which in their estimates has the largest impact on economic activity.

a negative trough after six quarters and employment persistently decreases reaching its lowest (-0.16%) level after 10 quarters (results are shown in figure 9).

To sum up, the two fiscal shocks have an opposite impact on economic activity: GDP increases after a level shock (fiscal expansion) and decreases after a volatility shock (FPU increase). As we argued in the introduction, ignoring the existence of the two dimensions of fiscal shock might be the underlying reason of the different effects recovered in the literature on fiscal multipliers.

Our results suggest that both the Keynesian and the non-Keynesian view of the effects of fiscal policy may be reconciled: a policy which increases the budget deficit tends to sustain growth if the way in which it is implemented decreases - or at least does not increase - FPU, but it can be contractionary otherwise. To illustrate this point, we show in figure 10 the joint effect on the dynamic system of a one-standard-deviation expansionary fiscal shock and a two–standard-deviations FPU shocks happening simultaneously.[18] In this case, the response of private GDP and private employment becomes largely insignificant. The fiscal expansion ends up being worthless as it induces a recessionary increase in FPU. The example corroborates our argument that governments should take into account,when assessing the effectiveness of a planned fiscal measure, the possible effects on uncertainty.

3.2 Robustness checks

In the current section, we present several robustness checks which all in all suggest that our fiscal shocks can be considered as exogenous.

Inclusion of the structural shocks among the endogenous variables. - We perform these estimates as a robustness check even though we checked that, in our VAR, the fiscal structural shocks are statistically unrelated to the other endogenous variables, i.e. no variable Granger causes our fiscal shocks. In particular the variables included in Y_t do not Granger Cause the structural shock ε_t. When u_t is considered however results are less clear-cut and it might well be possible that there exist a particular lag structure configuration for which a single variable in the vector Y_t might Granger cause u_t. In order to show that this possibility does not bias our results, we report also the estimates *à la* Romer and Romer (2010) including ε_t and u_t in the vector of endogenous Y_t. Results, virtually unchanged, are reported in figure 11 and 12.

Ordering of the variables. - We checked that changing the order of the variables in the VAR does not change the results.

Subsample stability. - We run the same empirical model excluding the pre-EMU period (the eighties and the nineties). Empirical results are

[18]In selecting a larger volatility shock, we follow Fernàndez-Villaverde et al. (2015).

virtually unchanged although the statistical significance is reduced due to the loss of degrees of freedom.

Different measures of fiscal balance. - We estimated the fiscal rule with different measures of budget deficit (a similar "eclectic" approach can be found in Fatàs and Mihov, 2012). In particular, volatility estimates are robust to using the following dependent variables instead of the primary borrowing requirement: total borrowing requirement (i.e. including interest outlays), change in the total borrowing requirement, change in the CAPB, cyclically-*un*adjusted primary borrowing requirement, change in the cyclically-*un*adjusted borrowing requirement.

Indeed, running the particle filter with all the above measures yields similar filtered estimates for volatility. This is encouraging because this means that our estimates do not depend on the measures of budget balance we use in the fiscal rule, which instead is a hotly debated issue (see, e.g., Golinelli and Momigliano, 2009).

Different specifications of the fiscal reaction function. - We augmented our fiscal rule including a dummy series for regular and one for snap election and found that none of the two is significant. Our fiscal volatility measure was not affected either.

An alternative uncertainty index. - Our result that an increase in uncertainty is contractionary is in line with Baker et al. (2016), which develop an index based on newspaper coverage frequencies of words associated to economic policy uncertainty. In our case, though, the shock has a much cleaner interpretation. The uncertainty shock we identify is indeed a pure FPU shock, while the one recovered in Baker et al. (2016) mixes uncertainty stemming from fiscal policy with a generic economic policy uncertainty stemming from several other sources. In figure 13 we plot our index together with Baker et al. (2016) index; the correlation between the two is equal to about 27%. The main differences between the two indices, as it is apparent from figure 13, are related with two episodes: between 2011 and 2013 (i.e. during the most acute phase of the Euro area sovereign debt crisis), the Baker et al. (2016) index records a larger increase in uncertainty than our FPU index; on the contrary, in 1999, corresponding to the launch of the Euro, the increase in FPU is more pronounced.

EGARCH approach. - Recovering the correct volatility series is crucial to our analysis. As the particle filter estimation relies on a priori information, we wanted to check if a different approach delivers completely different results. It turns out that this is not the case. The time profile of the two volatility series is quite similar, although the one implied by the EGARCH model is higher. This should stem from the fact that the EGARCH approach is not able to disentangle the shock to the level from the shock to the volatility.[19]

[19]The Exponential GARCH (EGARCH) model assumes a specific parametric form for

4 Concluding remarks

The fact that economic uncertainty plays a role in shaping the business cycle should be by now relatively uncontroversial. As John Cochrane puts it, "*the question is: how much uncertainty is there? To what extent and by what mechanism does uncertainty influences GDP, investment and stockprices? The answer is certainly more than zero and less than infinity. As economists we need to look quantitatively at different causes of stagnation*".[20]

In this paper we go in this direction by isolating the uncertainty stemming from a specific source - namely governments decisions about the overall fiscal policy stance - and measuring its effects on the macroeconomy.

We find that when FPU - captured by a volatility shock in the government fiscal reaction function - unexpectedly increases, both GDP and its components decrease. This result highlights that fiscal policy is not just about choosing a deficit level, but it is also about anchoring fiscal expectations. The same change in the public deficit may have very different macroeconomic consequences, depending on whether the choice of the government increases or decreases the uncertainty surrounding fiscal policy.

This should be taken into account by econometricians trying to measure the impact of budgetary consolidations and expansions and by fiscal authorities, which should rely on credible and well-communicated medium-term budgetary frameworks in order to avoid large and sudden policy adjustments.

the conditional heteroskedasticity. More specifically, we say that $\varepsilon_t \sim EGARCH$ if we can write $\varepsilon_t = \sigma_t z_t$, where z_t is standard Gaussian and: $ln(\sigma_t^2) = \omega + \alpha(|z_t - 1| - E[|z_t - 1|]) + \gamma z_t - 1 + \beta \ln(\sigma_{t-1}^2)$.

[20] Quoted in Mordfin (2014).

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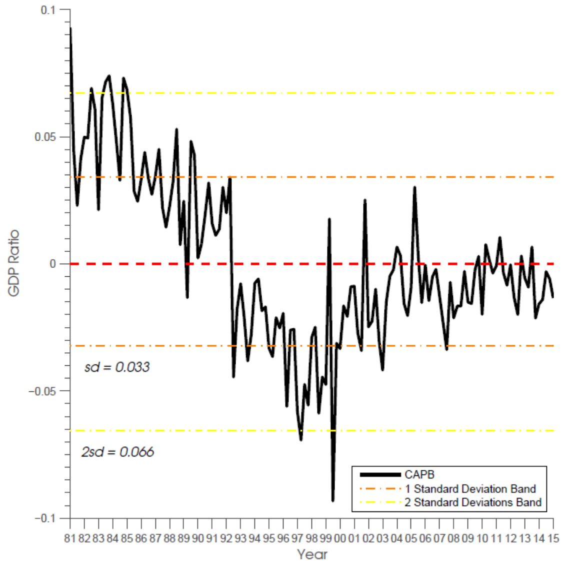


Figure 2: Public Debt

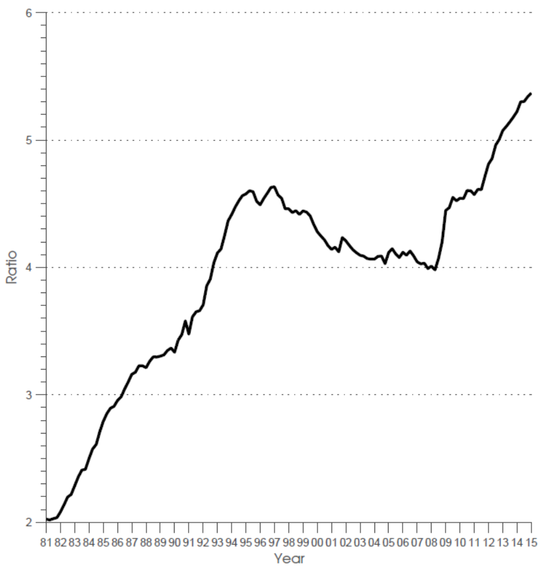


Figure 3: Filtered GDP

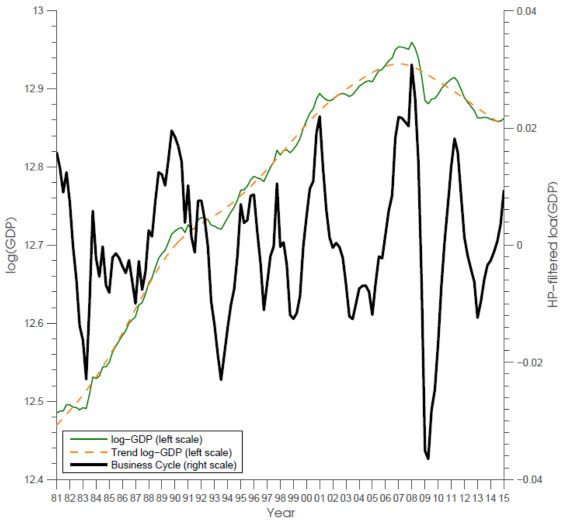


Figure 4: Priors for transformed parameters

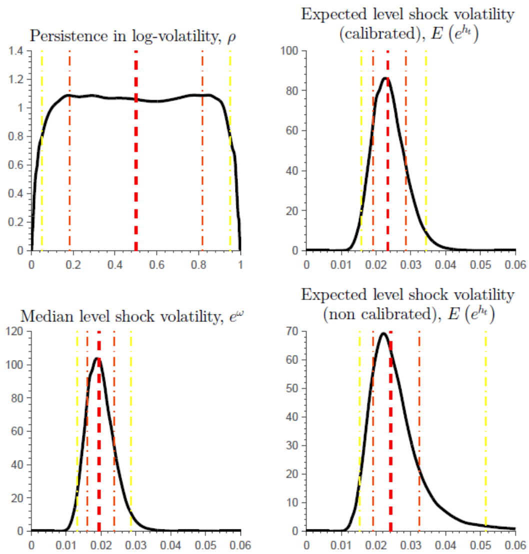


Figure 5: Prior for volatility of volatility

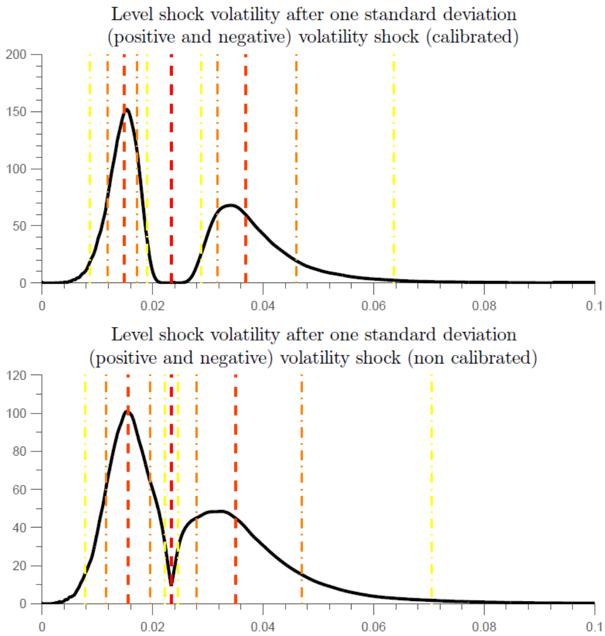


Figure 6: Volatility Prior distribution for level shock volatility

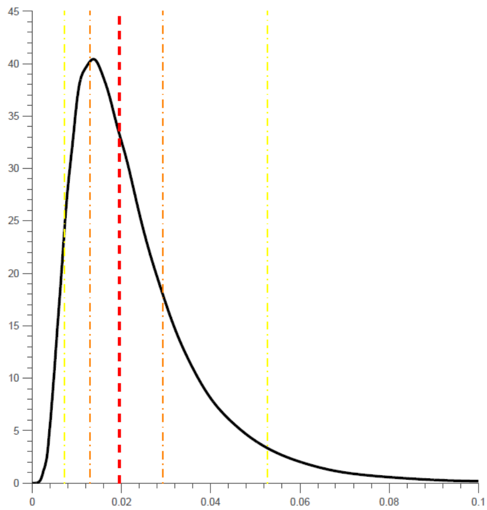


Figure 7: Fiscal Policy Uncertainty index

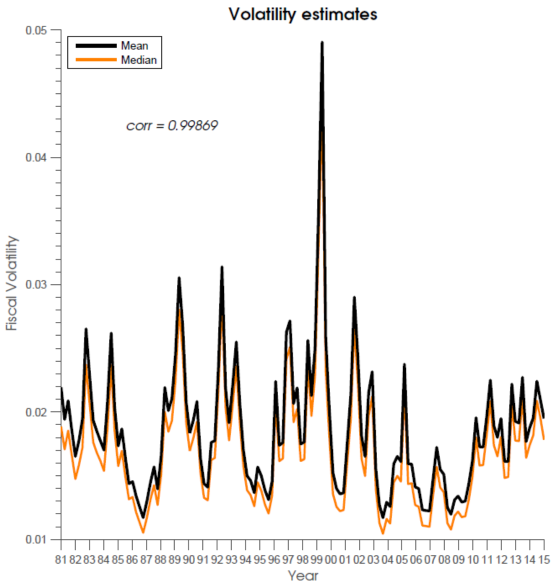


Figure 8: Impulse response functions - CAPB level shock

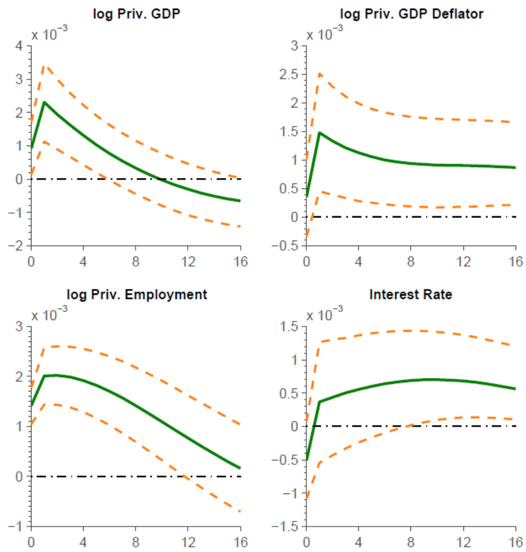


Figure 9: Impulse response functions - FPU shock

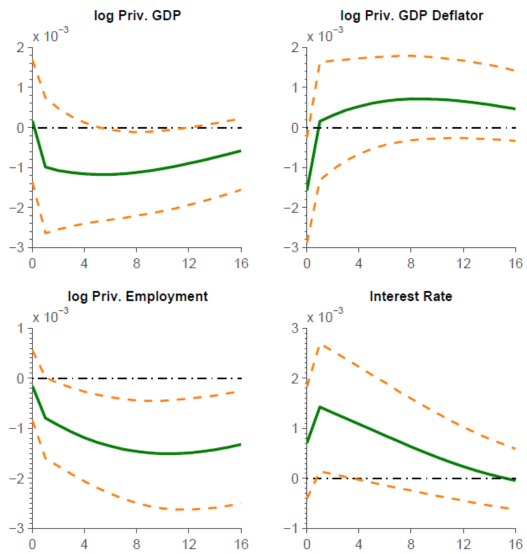


Figure 10: Impulse response functions - joint shocks to CAPB and FPU

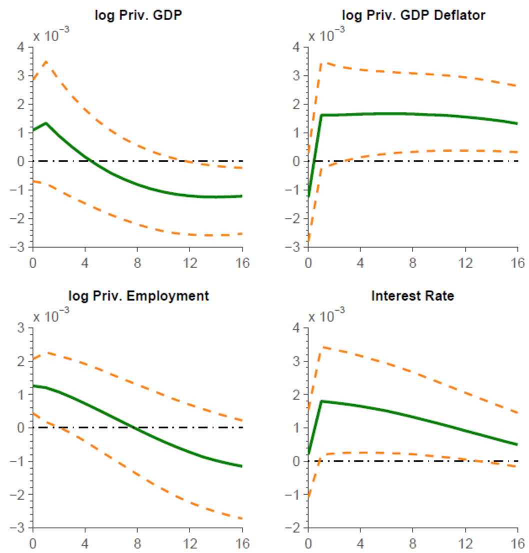


Figure 11: Impulse response functions - CAPB level shock endogenous

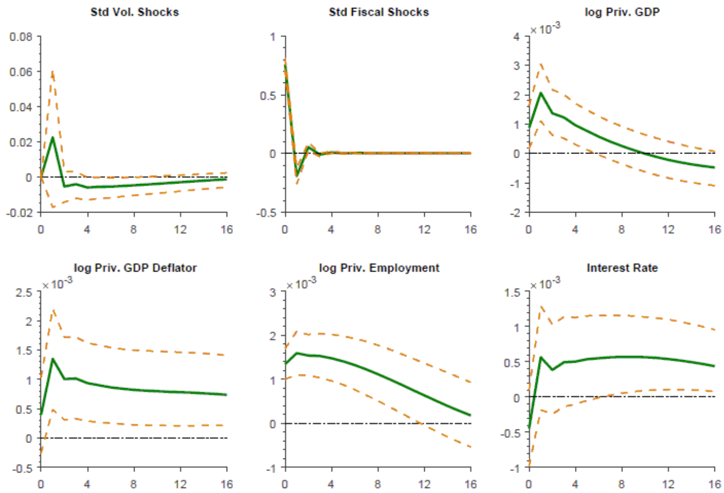


Figure 12: Impulse response functions - FPU shock endogenous

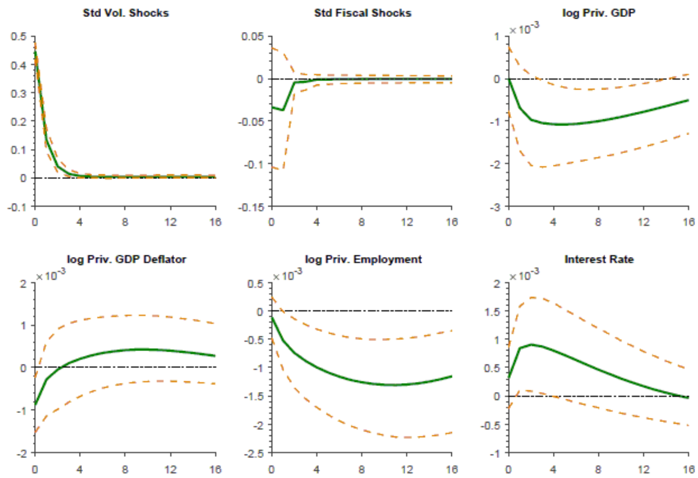
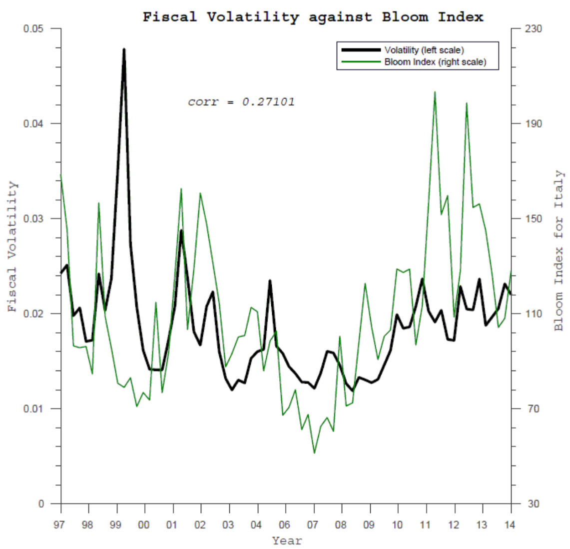


Figure 13: Fiscal volatility index (FPU) against the Baker et al. (2016) index



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