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**Fiscal policy and the business cycle: the impact of government expenditures, public debt, and sovereign risk on macroeconomic fluctuations**

Kirchner, M.K.

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# Chapter 1

## Introduction

### 1.1 Macroeconomic background

In the past few years, the world experienced not only the worst financial and economic crisis in decades but also fiscal policy steps of unprecedented scope in response to that crisis. When the financial crisis reached its most critical stage in the autumn of 2008, several governments put in place rescue and support packages for the financial sector. These efforts were strongest in developed countries, which were most affected by the financial turmoil. In 2009, the economic crisis had taken shape and spread across the globe. With monetary policy means exhausted, a large number of governments in developed, developing, and emerging countries introduced fiscal stimulus measures targeting the real economy in an effort to thwart deeper recession.<sup>1</sup>

The numbers that describe the fiscal response to the crisis are significant. According to the ILO, 32 countries including all G-20 nations had announced economic stimulus packages by the first quarter of 2009. At that time, the budgets allocated to those packages amounted to about two trillion U.S. dollars or equivalently 1.4% of global GDP. The packages targeting the financial sector were even larger in size, outweighing the stimulus measures by a factor of five or more (see Khatiwada, 2009). According to

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<sup>1</sup>Detailed timelines of crisis events and the associated international financial sector policies are provided on [http://www.newyorkfed.org/research/global\\_economy/policyresponses.html](http://www.newyorkfed.org/research/global_economy/policyresponses.html). Such policies included in particular increased guarantees for private deposits, guarantees for other bank liabilities, capital injections, funds to purchase mortgage bonds and commercial paper, and options to purchase assets of uncertain value. A study of the ILO summarizes the international fiscal stimulus measures that had been announced by the first quarter of 2009, see Khatiwada (2009), and the IMF has provided several updates since then.

the IMF (2009b), the G-20 stimulus planned as of April 2009 was 2% relative to the group's GDP in 2009 and 1.5% in 2010. Financial sector support, including guarantees, stood at 32% of GDP with upfront financing needs at 3.5%. According to estimates from November 2010, the actual stimulus was 2.1% of GDP in 2009, a planned stimulus of 2% in 2010, and a further stimulus of 1% in 2011 (see IMF, 2010b).

The main goal of the financial sector support measures was to prevent further financial market turmoil or, possibly, a systemic breakdown of the global financial system. Hopes were also raised by several economic advisors that the stimulus measures would be effective in lifting the economy out of recession, particularly in the U.S. where the largest stimulus package was adopted (see, for instance, Romer, 2009, Romer and Bernstein, 2009, Summers, 2008). Such hopes were reinstated by official bodies and policymaking institutions when economic growth started to pick up towards the end of 2009, soon after the implementation of the first stimulus measures. At that time, economic projections indeed indicated that a stimulus-driven recovery was under way. The recovery was expected to be led by the U.S. among the advanced economies and it was forecasted to be even stronger in developing and emerging market economies (see e.g. CBO, 2009; IMF, 2009a, 2010c; OECD, 2009).

However, while the recovery accelerated during 2010 in several emerging market economies, private domestic demand remained weak in the U.S. and in various other advanced economies. In addition, the case for fiscal consolidation became obvious as a sovereign debt crisis erupted in Europe in the spring of 2010 and U.S. public debt was also projected to rise at an accelerated pace (see IMF, 2010e).

This fragile and uneven recovery has continued into 2011, while advanced-country debt sustainability concerns have remained (see IMF, 2011b). At the current and the foreseen fiscal stance, the average public debt-to-GDP ratio in advanced economies is still projected to rise from 73.1 percent in 2007 to 107.3 percent in 2016. Furthermore, despite major policy actions by national governments, EU, ECB, and IMF, the European debt crisis seems far from over as government bond yields and interest rates on credit default swaps are still rising in a number of euro area countries. The dispersion in yields already exceeds pre-EMU levels, including during the European Monetary System crisis of the early 1990s (see IMF, 2011a).

The present thesis studies the relationship between fiscal policy and short-run to medium-term macroeconomic fluctuations (i.e. the business cycle). The events described above have filled the macroeconomic news and the economic and political agenda while I was working on this topic. It has been a turbulent time but, admittedly, also an exciting time to conduct this research.

## 1.2 Macroeconomic research

What does existing research tell us on the linkages between fiscal policy and the business cycle, with a view of the macroeconomic background described above? This section reviews a number of critical issues, focusing on three relevant topics on which the macroeconomic literature seems to provide relatively little guidance.

### 1.2.1 Measuring the effects of fiscal policy

First, there is hardly any consensus across empirical studies—using vector autoregression (VAR) techniques or other empirical methods—on the size of fiscal multipliers on economic output, which are often used to measure the effectiveness of discretionary fiscal policy over the cycle. As a by-product of this lack of consensus, there is also significant uncertainty on the size or even the sign of the effects of discretionary fiscal policy on other macroeconomic variables, in particular output components.<sup>2</sup>

The short-run fiscal multiplier on output is defined as the percentage response of GDP in a given period to an *autonomous change* in a given fiscal item or budgetary instrument of size 1% of GDP which occurs in that period.<sup>3</sup> Thus, if a multiplier is found to be larger (smaller) than one, a fiscal expansion tends to crowd in (crowd out) some component or components of private demand. Opinions differ on the definition

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<sup>2</sup>Large-scale DSGE models have also been used to estimate the size of fiscal multipliers by Bayesian techniques. A relatively broad consensus on the effectiveness of discretionary fiscal policy has emerged from this literature, see in particular Coenen, Erceg, Freedman, Furceri, Kumhof, Lalonde, Laxton, Lindé, Mourougane, Muir, Mursula, de Resende, Roberts, Roeger, Snudden, Trabandt, and in 't Veld (2010). I do not provide a complete review here and refer the reader instead to Leeper, Traum, and Walker (2011) for a discussion of the restrictions on fiscal multipliers implied by the commonly used classes of models and the commonly adopted Bayesian priors.

<sup>3</sup>This definition was originally proposed by Kahn (1931) and it is often used in the literature, see e.g. Blanchard and Perotti (2002), Caldara and Kamps (2008), and Ramey (2011a).

of multipliers at longer horizons; some studies relate the response of GDP at a given horizon to the initial change in the relevant fiscal variable (e.g. Blanchard and Perotti, 2002) whereas others use cumulated changes of GDP relative to cumulated changes in fiscal variables up to some horizon, possibly in present value terms (e.g. Mountford and Uhlig, 2009). Given these definitional differences, the focus of the following discussion is on short-run multipliers but the main conclusion (i.e. lack of consensus) is no different as regards the size of longer-term multipliers.

Estimates of fiscal multipliers are indeed dispersed to a degree that there is no agreement across different empirical studies, even across those that use similar techniques, on whether multipliers are usually smaller or larger than one. In particular, according to a recent survey by Ramey (2011a), estimated short-run multipliers for temporary, deficit-financed increases in government purchases of goods and services in the U.S. usually lie between 0.8 and 1.3. However, the data can also not reject 0.5 and 1.8. Ramey (2011a) further notes that there is significant uncertainty on the size of multipliers for fiscal expansions falling on tax cuts. In addition, from a recent survey by Afonso, Baxa, and Slavík (2011) one can conclude that empirical estimates of fiscal multipliers in Europe, even for identical countries, are also quite dispersed. Moreover, the general uncertainty on the effects of fiscal expansions on output goes along with a lack of agreement on the impact of spending expansions on private consumption and investment (see Perotti, 2008).

What are the reasons for this lack of consensus?

One critical issue is that econometric problems in the measurement of structural fiscal shocks (i.e. *autonomous changes* in fiscal instruments) pose significant challenges to empirical work. An important potential cause is that the presence of news or foresight about future policy changes can create equilibria with non-fundamental or non-invertible moving average representations. This means that structural shocks cannot be recovered by VAR techniques. This issue has been pointed out with reference to fiscal policy by Leeper, Walker, and Yang (2011), Ramey (2011b), and Yang (2005). The issue is especially relevant in the case of fiscal policy due to frequent pre-announcement of fiscal measures and legislative lags or other delays in the implementation of announced measures. The above authors show that non-fundamentalness

due to policy foresight can seriously distort VAR inference of the effects of fiscal measures. If the issue is ignored, estimated multipliers can even have opposite signs than implied by an underlying model that does incorporate policy foresight.

A second difficulty is presented by the fact that the causal effects of fiscal policy are still hard to identify even in the absence of policy foresight, or also in the presence of policy foresight when the above non-fundamentalness issues could be circumvented in some way. The main reason is that both government expenditures and revenues, to some extent, automatically respond to economic fluctuations. Such changes need to be distinguished through appropriate identification approaches from deliberate policy changes. If the latter is not accomplished, such endogenous reactions of fiscal variables to the business cycle can induce reverse causation. This can lead to biased and therefore incorrect estimates of the effects of fiscal policy.<sup>4</sup>

A third problem are instabilities over different time periods, whose existence has been pointed out by several studies, including e.g. Bénassy-Quéré and Cimadomo (2006), Bilbiie, Meier, and Müller (2008), and Blanchard and Perotti (2002). Possible factors of instability include structural changes and breaks that could lead to changes in the effects of fiscal policy over time. For example, increasing trade integration could lead to increasing open-economy leakages of fiscal expansions. For obvious reasons, such types of sub-sample instabilities make it hard to interpret estimation results for overlapping time periods without ambiguity.

Hence, it is hard to measure the effects of fiscal policy on output and other variables, which may explain part of the missing consensus in the empirical literature. The aim of Chapters 2 and 3 is to address some of the issues just discussed.

## 1.2.2 Fiscal policy during financial crises

A second aspect are the effects of fiscal policy in times of financial stress, on which relatively little is known on both the theoretical and empirical side. The lack of theoretical studies has been associated with a neglect of relevant linkages between the real economy and the financial sector in standard macroeconomic models. On the other

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<sup>4</sup>See Caldara and Kamps (2008) for an overview and a comparison of differences in outcomes of existing methods for the identification of fiscal shocks.

hand, some of the lack of empirical studies might be explained by a relative shortage of data on crises in advanced economies.<sup>5</sup> An overall scarcity of data for developing and emerging market economies, where crises have been more frequent, and concerns on the quality of the available data contribute to the lack of relevant studies.

Having said that, the empirical literature on the topic is slowly growing. For example, Afonso, Baxa, and Slavík (2011) apply a threshold VAR approach using quarterly data for the U.S., the UK, Germany, and Italy to investigate whether the effects of fiscal policy on economic activity differ depending on financial market conditions. The authors conclude that there are only small differences in the effects of fiscal shocks in regimes of high financial stress compared to regimes of low financial stress.

Cross-sectional studies include, for instance, Baldacci, Gupta, and Mulas-Granados (2008) who use OLS and ordered logit to estimate the effects of fiscal policy interventions during 118 episodes of banking crises in developed and emerging countries. These authors find that fiscal stimulus accompanied by financial sector policies can shorten such crises, but this result does not hold for countries with limited fiscal space. On the other hand, for a panel of 127 OECD and non-OECD countries, Afonso, Grüner, and Kolerus (2010) cannot reject the hypothesis that the effects of fiscal policy are the same in normal times and during a financial crisis.

Hence, the evidence from recent empirical studies does not yet speak very clearly on the effects of fiscal policy during financial crises. Of course, similar problems as in the measurement of fiscal multipliers also affect those studies. In addition, the available data is often not rich enough to distinguish between different transmission channels (e.g. exceptional financing constraints) or different policy instruments. It therefore seems important to put more theoretical work into analyzing the effects of fiscal policy in the presence of financial frictions. Structural macroeconomic models can be used to conduct this type of analysis, but standard models need to be augmented by adding the relevant macroeconomic relations and frictions.

In the face of the recent crisis, there has been significant progress at this frontier. A relative large literature has developed that studies the interaction of fiscal and mon-

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<sup>5</sup>Noteworthy developed-country financial and economic crisis episodes, according to Spilimbergo, Symansky, Blanchard, and Cottarelli (2009), include the U.S. Savings and Loans crisis in the 1980s, the Nordic countries in the early 1990s, Japan in the 1990s, and Korea in 1997.

etary policy in a crisis scenario, analyzing the effects of fiscal stimulus in structural macroeconomic models when monetary policy allows real interest rates to fall or when nominal interest rates are at the zero lower bound, as occurred during the recent crisis (see e.g. Christiano, Eichenbaum, and Rebelo, 2009; Coenen et al., 2010; Davig and Leeper, 2011; Eggertsson, 2011; Erceg and Lindé, 2010; Woodford, 2011).

When attempting to study potential financial sector feedbacks of such policies, one faces the problem that standard models are not set up for an analysis of this type. However, promising models with frictions in financial intermediation have recently been developed. These models have been used to study the effects of central bank credit intermediation and government policies targeting the financial sector in a financial crisis; see, in particular, Gertler and Karadi (2011), Gertler and Kiyotaki (2010), Gertler, Kiyotaki, and Queralto (2010), and also Christiano and Ikeda (2011).

However, many questions remain open. For instance, what kind of interactions can we expect due to the presence of government securities holdings next to private assets on bank balance sheets? What are the effects of traditional discretionary government policies (such as spending expansions) and policies targeting the financial sector if these are financed by issuing bonds to a troubled banking sector? In particular, can higher government deficits affect bank lending to the non-financial sector? These types of questions have played an important role in recent policy discussions (see e.g. IMF, 2010a), but standard macroeconomic models are not yet able to guide such discussions. The aim of Chapter 4 is to tackle this issue.

### 1.2.3 Sovereign risk and macroeconomic fluctuations

The literature furthermore tends to lack quantitative business cycle models that take into account the possibility that governments can default on their debt. This deficiency became obvious as post-crisis fiscal sustainability concerns have recently come to the forefront of the economic and political agenda in the developed world.

In particular, as argued by Bi and Leeper (2010), policy evaluations in models that do not allow for the possibility of sovereign debt default seem unreliable when applied to economies where financial markets regard government debt as risky. It would therefore be useful to characterize and understand the link between public debt,



sovereign risk, and macroeconomic fluctuations to be able to recommend appropriate fiscal or monetary policies in an environment where debt sustainability is a concern. To address this issue, it would be useful to estimate a business cycle model on a sample of macroeconomic data that includes at least some episode where sovereign default risk has played a significant role. However, the data for advanced economies does not seem very informative in this respect given the lack of applicable episodes over the past few decades. At the same time, the literature on quantitative business cycle models for emerging market economies, where such episodes have again been more frequent than in advanced economies, is still relatively small.

Some studies have however analyzed emerging market business cycles in calibrated or estimated business cycle models. In particular, Aguiar and Gopinath (2007) examine the role of permanent productivity shocks. In addition, Chang and Fernández (2010), García-Cicco, Pancrazi, and Uribe (2010), Neumeyer and Perri (2005), and Uribe and Yue (2006) explore the impact of financial frictions such as debt-elastic interest rates. One broad conclusion that emerges from this literature is that unlike permanent productivity shocks, financial frictions can explain important regularities of emerging market business cycles, in particular the relatively high observed volatility of consumption relative to output and the countercyclicality of interest rates. Given this evidence and the relative frequency of default episodes in emerging countries, it seems promising to continue in this direction by focusing on financial frictions that are explicitly linked to the risk of sovereign debt default.

Theoretical analyses of sovereign default risk include, in particular, Schabert (2010), Schabert and van Wijnbergen (2011), and Uribe (2005). A common conclusion of these studies is that the possibility of sovereign default matters for the implementation of monetary policy.<sup>6</sup> A quantitative analysis of sovereign default risk is provided by Juessen, Linnemann, and Schabert (2009), who develop a real business cycle model that allows for government debt default when fiscal policy does not preclude a Ponzi game. This study shows that default premia can emerge at relatively high debt-to-GDP ratios. In addition, Bi and Leeper (2010) develop a real business cycle model

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<sup>6</sup>Related work studies “fiscal limits” to debt accumulation and the interactions of fiscal and monetary policy in the absence of nominal sovereign debt default; see, in particular, Leeper and Walker (2011), and Davig, Leeper, and Walker (2010).

that allows for debt default when the government reaches the limit of its capacity to raise revenues through distortionary taxation. These authors show that certain types of fiscal reforms can shift this limit to prevent default premia from emerging. Moreover, a recent study by Mendoza and Yue (2011) makes a link between quantitative models on strategic sovereign default based on Eaton and Gersovitz (1981), where default events are driven by exogenous output endowment processes, and quantitative models of emerging market business cycles with debt-elastic interest rates.<sup>7</sup> This study shows that a model that jointly determines the equilibrium dynamics of output and sovereign default does well in explaining key stylized facts of actual defaults.

In spite of this progress, to my knowledge no study has attempted to analyze the implications of sovereign default risk in a quantitative structural model estimated by full information methods. This type of analysis would however allow to describe the joint behavior of different economic time series conditional on a system of structural macroeconomic relations, potentially providing additional understanding of macroeconomic amplification and propagation channels due to sovereign risk. The aim of Chapter 5 is to make progress on this matter.

### 1.3 Overview of the thesis

Overall, despite significant recent progress, the above discussion indicates that the macroeconomic literature

(i) has not yet reached consensus on the size of fiscal multipliers due to, in particular, problems in measuring fiscal shocks and, moreover, sub-sample instability,

(ii) provides only relatively little guidance on appropriate fiscal policies in a situation of financial stress, and

(iii) shows scope for further research on quantitative business cycle models that incorporate sovereign default risk.

The aim of this thesis is to provide a contribution in filling those gaps. Using a combination of empirical macroeconometric techniques and macroeconomic theory, the thesis studies the impact of government expenditure policies, public debt, and

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<sup>7</sup>Recent studies on strategic default include, for instance, Aguiar and Gopinath (2006), Arellano (2008), and Yue (2010).

sovereign default risk on business cycle fluctuations. In the following chapters, the thesis addresses the three issues listed above. Developments in public debt are of course linked to all three issues. However, for reasons that are discussed below, the thesis puts emphasis on expenditure policies whereas measures falling on the revenue side of the government budget (i.e. tax policies) are not analyzed.

Chapter 2, which is based on joint work with Jacopo Cimadomo and Sebastian Hauptmeier, provides an analysis of time variation in the macroeconomic effects of government consumption and investment spending. As mentioned above, empirical studies of the effects of discretionary fiscal policy usually do not take into account the possibility that those effects could change over time. In most studies, the effects of fiscal policy are instead estimated on average over samples spanning around two decades or more. However, presuming that the structure of an economy can change during such a period, it seems cautious not to exclude the possibility that fiscal policy could have different effects at different points of time.

The chapter thus estimates VAR models with time-varying parameters for the euro area. This particular method is chosen as it allows for a flexible description of time variation in the relationship among macroeconomic variables. The chapter then identifies structural shocks to government spending at different points of time and simulates the short-run to medium-term effects of those shocks. The chapter also describes potential sources of the detected time variation using simple regression analysis. The latter is thought to add additional structure to the results and thereby to contribute to the understanding of the fiscal transmission mechanism. The focus on the euro area is motivated by the facts that the empirical literature is especially inconclusive on the effects of fiscal policy in Europe and that sub-sample instability due to structural changes is an obvious possibility at the euro area level. The focus on government spending stems from the advantage that significant endogenous reactions to macroeconomic fluctuations seem less likely in the case of public expenditures than in the case of tax revenues, making it easier to identify autonomous policy changes.

Chapter 3 focuses on the econometric problems that are posed to structural VAR analysis by the presence of news or foresight on fiscal policy, following in particular the analysis of Leeper, Walker, and Yang (2011). As argued above, policy foresight

presents significant challenges to empirical work since it may lead to non-invertibility of the moving average representations of the relevant equilibrium time series into VAR representations. However, Laubach (2008) has already pointed out the possibility of using direct measures of expectations on fiscal variables, such as survey data, in order to address those challenges. Several recent contributions have indeed used information from forward-looking data to tackle the econometric issues due to policy foresight. The chapter seeks to provide a theoretical foundation for such attempts.

The chapter is concerned with the particular problem of quantifying the effects of government spending under policy foresight. Based on a simple theoretical model, the chapter first shows how the associated econometric issues can be addressed by using data that captures the expectations of economic agents (or market participants) on future government spending in VAR models, and how such an approach makes it again possible to identify structural spending shocks by VAR methods. The chapter then estimates the effects of government spending in the U.S., using data from the Survey of Professional Forecasters to measure the relevant expectations. The renewed focus on government spending also in this chapter, in particular the sum of government consumption and government investment in the U.S., is due to the fact that quarterly survey data is only available for this sum. Similar data is however not available for other budgetary items, for the U.S. or other countries.

Chapter 4, which is based on joint work with Sweder van Wijnbergen, takes a step towards an analysis of government policies in an environment of financial stress. This chapter builds on recent work by Gertler and Karadi (2011) who have developed a New Keynesian structural macroeconomic model with financial frictions due to an agency problem in financial intermediation. The particular type of friction proposed by Gertler and Karadi—also used in Gertler and Kiyotaki (2010)—leads to endogenous balance sheet constraints on the operations of financial intermediaries. These constraints imply a financial accelerator mechanism that helps to generate key features of a financial and economic crisis of the type and the magnitude of, not exclusively, the recent crisis. Those features include, in particular, mutual feedbacks between financial sector balance sheets and the real economy. However, the above studies assume that the government does not rely upon intermediary funding. As argued in the chapter, this assumption

does not do justice to the actual practice of fiscal financing.

The chapter therefore extends the above framework by allowing for the presence of government securities in intermediary portfolios. This extension makes it possible to analyze the effects of government policies during a financial crisis when such policies are financed at least to some extent through the relevant financial intermediaries. The chapter then analyzes the effects of deficit-financed stimulus measures and financial sector policies. The particular set of policies that is used suitably captures the main fiscal policy measures that were applied during the recent crisis. The chapter investigates how the presence of intermediary balance sheet constraints in interaction with portfolio adjustments can affect the effectiveness of those policies.

Chapter 5, which is based on joint work with Malte Rieth, analyzes the role of sovereign default risk as a driving factor of macroeconomic fluctuations. The analysis is based on Schabert and van Wijnbergen (2011), who set up a New Keynesian small open economy model that takes into account the possibility that a conventional fiscal rule with a feedback from higher debt levels on taxes can imply politically infeasible rates of taxation. In that case, the government defaults on (part of) its outstanding debt. Since investors rationalize this possibility, the latter leads to default premia that affect the expected return on government bonds and that are endogenously linked to the stock of real government liabilities. This model thus describes an environment where the possibility of sovereign debt default is a relevant concern.

The chapter extends this model by allowing for foreign currency denominated debt to reflect the typical situation in emerging market economies, where governments can usually not borrow in their own currency abroad (a.k.a. the “original sin” problem, Eichengreen and Hausmann, 1999). The model is then estimated by Bayesian full-information techniques on data for an emerging market economy, taking Turkey’s experience as a natural experiment. In particular, Turkey was hit by a severe financial crisis in November 2000 when nominal interest rates increased sharply, accompanied by a downgrading of government debt to below investment grade. The Turkish experience therefore reflects a situation where fears of sovereign debt default have played an important role, although a debt default did not actually occur. Based on the estimated model, the chapter assesses the role of sovereign default risk in explaining business

cycle fluctuations in this type of emerging market environment.

Chapter 6 summarizes the results of the analysis in Chapters 2 to 5 and provides an overall conclusion that emerges from those results. This final chapter also qualifies the results in the light of what has been done and what has not been done in this thesis. The chapter ends with a suggestion for future research.