Macroeconomic Implications of Fiscal Policy in a Small Open Economy

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MACROECONOMIC IMPLICATIONS OF FISCAL POLICY IN A SMALL OPEN ECONOMY

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This dissertation deals with the macroeconomic implications of fiscal policy in small open economies with a particular emphasis on emerging economies. I use both empirical and theoretical approaches to distinguish key difference in the design of fiscal policy between emerging and developed economies. I also analyze the macroeconomic consequences of differences in the conduct of fiscal policy. Thus, the dissertation is focused on the interplay between fiscal policy and business cycle dynamics. Recent policy challenges in developed economies, such as monetary authorities grappling with the zero lower bound on short run nominal rates and fiscal stimulus packages emerging as an important policy tool, have sparked renewed academic interest in the topic of fiscal policy and business cycles. Institutional and macroeconomic features in emerging economies make the macroeconomic aspects of fiscal policy an important research agenda and one to which this dissertation contributes.

A number of papers have documented fiscal policy pro cyclicality in terms of stronger co-movement between government expenditure and macroeconomic fundamentals in emerging and developing economies. This feature of the data raises a 2 important questions: 1) does fiscal policy reinforce the macroeconomic cycle in these countries leading to a heighten macroeconomic volatility ("when it rains, it pours"), and 2) is the fiscal stance in these economies due to unique macroeconomic features or is it the consequence of institutional and political imperfections? The first chapter, titled *"When it rains, it pours": fiscal policy, credit constraints and business cycles in emerging and developed economies*, sets out to answer these questions by comparatively studying a group of developed and emerging economies. I estimate a panel

structural vector autoregressive model to investigate if government consumption expenditure responds more pro cyclically to fundamentals and what role international financial conditions play for the fiscal stance and for the volatility of the cycle in emerging economies relative to developed. My findings suggest the response to output fluctuations is not systematically different in emerging governments relative to developed economies'. However, emerging governments curtail spending in response to increases in the sovereign borrowing rate which forces their consumption expenditure to act more pro cyclically. I find evidence of higher fiscal discretion in emerging economies. However, the efficacy of government consumption expenditure is substantially lower in emerging economies than in developed. Thus fiscal policy ends up being responsible for a lower share of business cycle volatility in emerging economies than in developed.

In the second chapter, titled *Estimating the Dynamics of Fiscal Financing in Emerging Economies*, I propose a strategy for estimating the government financing rule for an emerging economy. The estimation uses the structural VAR impulse responses obtained in the previous chapter to discipline the parameters of a small open economy real business cycle model with a public sector. The parameters can be split into two groups: those influencing the effectiveness of fiscal policy (i.e the multiplier M_Y^G) and the parameters governing the financing of the exogenous stream of government consumption. The empirical response to interest rate shocks puts restrictions on the first group of parameters governing the size of the multiplier. The empirical response to a government consumption shock can be used to obtain estimates of the fiscal policy rule. I construct a model with a role for both interest rate shocks and government consumption shocks. A natural estimation approach in this case is impulse response matching.

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Chapter 1

“When it rains, it pours”: fiscal policy, credit constraints and business cycles in emerging and developed economies

1.1 Introduction

The empirical international finance literature has long emphasized excess volatility that business cycles in emerging and poor economies exhibit. Relative to the developed world, these economies have higher volatility of all aggregate demand components as well as more frequent and deeper crises (Uribe and Schmitt-Grohe (2017)). Another strand of research sheds light on the tendency of fiscal policy to be procyclical in these economies. This paper explores the relationship between these two stylized facts. In particular, I study the question of business cycle volatility in emerging economies through the lens of the “when it rains, it pours” phenomenon. Dubbed so by Kaminsky et al. (2004), this is a situation in which recessions are reinforced by capital outflows coupled with a pro-cyclical policy stance.[1] Kaminsky et al. (2004) among others[2] document that while in general net capital flows are pro-cyclical across poor, emerging and developed economies, the cyclicality of (fiscal) policy variables differs between the developing and developed group. In particular, developing economies exhibit fiscal policy pro-cyclicality which is difficult to justify as a policy prescription.[3]

This paper aims to uncover the reasons for and the consequences of fiscal pro-cyclicality. On one hand, policymakers themselves could be the source of volatility through discretionary interventions. On the other hand, it is reasonable to expect that policymakers in the developing and emerging world face constraints which impede their role as insurers against macroeconomic volatility. International borrowing costs have been emphasized as important drivers of business cycle fluctuations in emerging economies. Finally, even if policy itself does not cause or contribute to macroeconomic volatility, the same policy design will lead to different outcomes both in terms of policy and private sector variables when the underlying macro shocks are different. In short we want to ask whether the macroeconomic woes of these economies are self-induced or the result of more volatile underlying shocks, coupled with potentially tighter constraints faced by these governments. If the latter is true, we also want to know if the excess volatility originates at home through a more volatile process for

[1]Kaminsky et al. (2004) explore both fiscal and monetary policy cyclicality among developing, emerging and developed countries. This paper focuses on fiscal policy although as a natural continuation the interaction between fiscal and monetary policy as well as exchange rate policy is to be considered.

[2]see Talvi and Vegh (2005), Gavin and Perotti (1997).

[3]The term pro-cyclicality itself requires a careful definition. As emphasized by Kaminsky et al. (2004), perhaps the most convenient measure to use to identify potential differences in the conduct of fiscal policy is government expenditure as opposed to revenue and primary balance in levels and as a share of GDP. In terms of government expenditure, fiscal pro-cyclicality is defined as a positive co-movement between government expenditure and GDP. Other researchers have defined pro-cyclicality in terms of taxes: the government raises tax rates in recessions. Direct evidence on tax rates is sparse so researchers have used government revenue statistics and anecdotal evidence to make the case for fiscal pro-cyclicality in developing economies. Finally, primary balance statistics highlight that fiscal outcomes are different for the developing world but they are hard to use to disentangle the causes behind those results.

GDP, for example, or abroad through asset price shocks. In this context, I try to assess what fraction of business cycle fluctuations can be attributed to sovereign rate shocks versus policy shocks.

In order to understand the causes behind the "when it rains, it pours" phenomenon, I estimate a panel SVAR on a large group of developed and emerging economies. I focus on government consumption expenditure as the fiscal policy variable with the largest cross-country data availability. The analysis has to overcome the issues of endogeneity between 1) fiscal policy and fundamentals 2) international borrowing cost and fundamentals and 3) international borrowing cost and fiscal policy. A number of papers have emphasized the feedback between fundamentals and borrowing costs for emerging economies.[4] Fiscal policy variables also both respond to and influence the state of the economy. Finally, fluctuations in the price of externally traded sovereign debt put a constraint on policymakers' ability to use fiscal policy for stabilization. There are several pass-through channels for a sovereign interest rate shock to influence the cycle. First, if government spending contracts in response to increases in the borrowing cost, there is a standard multiplier effect which decreases output and affects investment and consumption contingent on wealth effects and the strength of Ricardian equivalence. Second, the government might shift part of the debt burden domestically thus crowding out investment and consumption. Finally, rising sovereign rates can affect the private economy if interest rate shocks pass through to households and firms via the banking sector.[5] In order to shed light on these questions, the analysis needs to isolate orthogonal shocks to policy variables, fundamentals and international borrowing costs. Although fiscal pro-cyclicality is normally discussed in the context of emerging and developing economies, the European debt crisis made

[4] see Uribe and Yue (2006), Mendoza and Yue (2012).

[5] see De Marco (forthcoming) for quantifying government debt distress pass-through to firm loans in the context of developed economies and Arteta and Hale (2008) in the context of emerging economies.

the interaction between fiscal policy, government finances and the real economy a relevant issue for developed economies as well. In contrast to much of the literature, this paper studies both developed and emerging economies. I compare the behavior and the effect of government consumption spending across the two groups. I also characterize the effect of sovereign rate shocks on government consumption spending as well as their direct and indirect effect on private sector variables.

My identification strategy combines the Blanchard and Perotti (2002) SVAR approach to identify fiscal shocks and Uribe and Yue (2006) identification of external borrowing cost shocks. The methodology proposed by Blanchard and Perotti (2002) uses institutional knowledge to put constraints on the impact matrix in a VAR analysis. In particular, the identification scheme assumes that discretionary fiscal responses take place with one period delay. The use of quarterly data is essential for implementing this identification strategy. For the purpose of identifying external borrowing costs, Uribe and Yue (2006) propose an ordering of the impact matrix which leads to impulse responses consistent with the standard small open economy real business cycle model (SOE RBC). The current study offers a unified framework for considering the interactions among fundamentals, fiscal policy shocks and external financial conditions.[6]Apart from the variables commonly included in the analysis, I also consider the interplay among the government response function, the dependence of spreads on both aggregate conditions and the government policy stance. This approach allows

[6]Another strategy for identifying the effect of fiscal policy changes at business cycle frequency is the narrative approach advocated by Romer and Romer (2010) among others. The narrative approach uses information contained in government documents and announcements to identify periods of fiscal expansion or consolidation which are unrelated to the business cycle. The identification procedure which uses military build up in wartime to identify government spending episodes unrelated to the business cycle is a special case of the narrative approach. Examples of this approach used on U.S data include Barro (1981), Hall (1986), Hall (2009), Rotemberg and Woodford (1992), Barro and Redlick (2011). As military build-up episodes are not common during the same time as most detailed macroeconomic data is available for the developing world, I adhere to the SVAR identification approach to estimate the policy reaction function and the government spending multiplier.Sheremirov and Spirovska (2017) exploit a new military spending database to estimate multipliers for a large number of countries. Despite the difference in identification, our estimates are in line.

me to retrieve estimates of the policy response function to output and international borrowing costs as well as the coefficients on the government debt pricing function. I also trace out the dynamic effect of orthogonal shocks to income, sovereign yields and government spending.

My findings suggest that government consumption, a category of government expenditure, is pro-cyclical for both emerging and developed economies. The systematic response of both types of economies to output fluctuations is virtually the same. Emerging economies are however more sensitive for changes in international borrowing conditions. Higher output relaxes international borrowing constraints. As a result, GDP shocks lead to an overall bigger increase in government consumption in emerging economies. This finding suggests that as far as government consumption is concerned, increases in this fiscal expenditure component during good times are not symptomatic of political frictions. Instead, the higher fiscal pro-cyclicality in emerging economies is the result of these governments being more sensitive to international borrowing conditions. However, the analysis reveals that discretionary interventions are much more common in the emerging world. This raises concerns because a higher degree of policy discretion has been shown to have a negative effect on long run growth and volatility.

I investigate the differential role of international financial conditions for policy and business cycle outcomes of emerging and developed economies along two dimensions: shocks to the international safe borrowing rate and shocks to the price of a country's government debt on international markets. Fluctuations in the safe rate have a negligible impact on the business cycle and the fiscal stance in either group of countries. Shocks to the government borrowing rate have different implications for the developed versus the emerging group. An exogenous increase in the sovereign rate is contractionary in both economies. In the emerging group these shocks are more important for output fluctuations, while in the developed group they matter relatively more for investment dynamics.

My results also shed light on the efficacy of government consumption as a policy tool. The estimated long run multiplier effect of government consumption on output is less than 1 for both country groups. However, the government consumption multiplier is twice as high for the developed group, pointing to a substantially impaired ability of government consumption shocks to influence the economy in emerging countries. My results also imply that government consumption expenditure shocks account for a smaller fraction of business cycle fluctuations in emerging economies. Despite the high volatility of these shocks in the emerging world, they claim a smaller share of the volatility of macroeconomic variables because of the smaller multiplier. Shocks to government consumption also account for a smaller share of the sovereign rate fluctuations emphasizing the fact that these governments have been more careful about international borrowing conditions. The paper provides estimates based on the officially reported economic activity. Informality is currently outside the scope of the study.

In this paper I also document differences in fiscal statistics and their relationship with the cycle among a large group of poor, emerging and rich countries. I highlight that in terms of correlations to the cycle, government expenditure is pro-cyclical in poor and emerging economies as stressed in the literature. It is important however to look at individual components of government expenditure as this is a fairly large category which encompasses all of government expense as well as investment (Table 1.1). When focusing specifically on government consumption of goods and services, I find that this fiscal expenditure category is pro-cyclical across the board with group differences stemming from higher volatility of government consumption rather than cyclicality. The SVAR analysis currently focuses on government consumption expenditure. As confirmed by summary statistics the distinction among different components of government expenditure is important. Government consumption expenditure is only one component of automatic stabilization. Therefore, lack of *other* automatic stabilizers (e.g. social transfers (unemployment benefits, safety-net program), retirement and health benefits, progressive taxes and proportional taxes) in emerging economies might be behind the difference in government expenditure cyclicality.[7]

Recent policy challenges in developed economies, such as monetary authorities grappling with the zero lower bound on short run nominal rates and fiscal stimulus packages emerging as an important policy tool, have sparked renewed academic interest in the topic of fiscal policy and business cycles. In the next section I discuss how this paper relates to several branches of the literature: discretionary fiscal policy, political frictions and macroeconomic outcomes, cost of borrowing and business cycles, external shocks and macroeconomic volatility. Section 1.3 describes the sources and construction of the dataset used in the paper. Section 1.4 describes the behavior of key fiscal variables across poor, emerging and developed economies. Section 1.5 discusses the SVAR methodology while section 1.6 discusses the empirical results. Section 1.7 and section 1.8 focus on the variance and the variance decomposition of estimated shocks. Section 1.9 presents robustness checks which extend the analysis to subsets of the data or employ an alternative estimation strategy. Section 1.10 concludes.

[7] McKay and Reis (2016) provide model-based estimates of the ability of US built-in stabilizers to decrease consumption and output volatility. They find that the social insurance role (the tax-and-transfer system) of stabilizers is more important than the New Keynesian demand stabilization channel.

1.2 Links to the Literature

The vast majority of the studies on discretionary fiscal policy are conducted on US and to a lesser extent OECD data. Using US data and a VAR approach, Blanchard and Perotti (2002) estimate a government spending multiplier around 1; Fatas and Mihov (2001) obtain estimates well above 1 while Mountford and Uhlig (2009) find large debt financed tax multipliers but low government spending multipliers for the US. Based on the narrative approach, Ramey (2011) finds a wide range of multipliers for the US including estimates above 1 depending on the time period.[8],[9]

There is a nascent literature on quantifying the effects of fiscal policy outside developed economies. The influential paper by Ilzetzki et al. (2013) sets the beginning of an exciting strand of research by offering the first cross-country comparison of government consumption multipliers that spans poor, emerging and developed country groups. Jawadi et al. (2016) focuses explicitly on emerging economies and estimates a PVAR on the BRICs. Jawadi et al. (2016) find strong New Keynesian effects of government purchase shocks; they also find evidence of monetary accommodation

[8]Although the government spending multiplier emerges as a convenient statistic to describe the efficacy of discretionary changes in fiscal policy, there are three important channels government spending and government revenue shocks influence economic activity: 1) the effect of fiscal policy on the composition of GDP (private consumption and investment), 2) the effect on asset prices such as stocks and housing markets 3) the effect on the external sector. The question of whether private consumption increases in response to a positive government spending shock has been investigated at length by both the theoretical and the empirical literature. From a theoretical standpoint Gali et al. (2007) shows in the context of a New Keynesian model that breaking the Ricardian equivalence is essential for getting consumption to respond positively to an expansion in government spending. Gali et al. (2007) among many others consider the presence of hand-to-mouth consumers to decrease the negative wealth effect of present or future increase in taxes to finance the fiscal consumption which is responsible for the fall in consumption in the standard New Keynesian and neoclassical model. Offsetting the fall in consumption also leads to a higher output multiplier potentially above 1.

[9]Non-linearities in the effect of fiscal policy have been emphasized by the literature. Perotti (1999) finds that government spending decreases private consumption in debt-stressed economies. There is some evidence in the literature that composition of government expenditure matters for the value of the multipliers. Abiad et al. (2016) public investment increases output and employment in both the short and long run in advanced economies especially during periods of slack; the effect on investment has the opposite sign depending on the state of the economy with an expansionary effect during periods of low output.

in these economies raising concerns about monetary authority independence for this group. [10] The present study contributes to this strand of literature by comparing *the design* of fiscal policy across country groups in addition to the more commonly discussed fiscal multipliers. My particular focus is the importance of external borrowing costs for shaping the conduct of fiscal policy. Having estimates of the government response function allows me to quantify the extent to which the response of emerging governments to output fluctuations is different from that of developed. The comparison is a test for the existence of political frictions in emerging economies relative to developed. In terms of the government consumption multiplier, my results for the group of countries in my dataset are in line with those in Ilzetzki et al. (2013), particularly in the sense that higher level of development makes fiscal policy more effective.

One important question I set out to answer is whether observed differences in fiscal outcomes between emerging and developed countries stem from political frictions or whether they can be explained from a purely macroeconomic perspective. Woo (2009) and Ilzetzki (2011) motivate pro-cyclicality in government expenditure with political and social polarization. In these papers political underrepresentation or institutional infighting about the types of public good to be provided makes government expenditure more sensitive to revenue fluctuations. Frankel et al. (2012) relate government expenditure pro-cyclicality to lack of good institutions and find empirical evidence that improving the soundness of institutions helps the pro-cyclicality issue. Alesina and Tabellini (2008) propose a model of political agency problem to explain why more corrupt governments fail to insure efficiently private consumption.

[10] Another point of interest concerning the international dimensions of fiscal policy relates to the Mertens and Ravn (2011) focus on the real exchange depreciation puzzle in response to government expenditure shock present in developed countries' data. While output and consumption rise and the trade balance deteriorates in response to a government expenditure shock in these economies, the real exchange rate is empirically found to depreciate. The authors rationalize the depreciation through a model featuring deep habits in both private and public consumption and the decrease in mark-ups due to the increase in government consumption demand.

In their model public outlays rise in response to an expansionary income shock. These expansions in government spending are due to governments extracting higher rents when times are good. Overall models based on political frictions predict that government expenditures are more sensitive to output and revenue fluctuations relative to the efficient benchmark. The SVAR analysis presented in this paper suggests that emerging governments are indeed more sensitive to fundamentals, but in the sense of international borrowing constraints and not shocks to domestic income. Therefore, external borrowing costs seem to be more important in shaping fiscal policy design in emerging economies than political frictions.

International credit conditions have been emphasized in the literature on emerging economies business cycles as an important source of uncertainty. Models which allow credit frictions to affect directly not only consumption smoothing but also labor demand have been shown to deliver properties consistent with stylized facts.[11],[12]Given this evidence, it comes as no surprise that international credit markets and financial frictions have been among the suspected reasons for fiscal pro-cyclicality in emerging markets. Riascos and Vegh (2003) and Cuadra et al. (2010) propose models to justify why taxes on consumption in the former case and labor income taxes in the latter case might behave pro-cyclically when the international asset markets are incomplete or when premiums on government debt are determined a la Arellano (2008) respectively. In terms of pro-cyclicality on the expenditure side, Mendoza and Oviedo (2006) show that a government which faces a more volatile revenue stream sets lower debt limits for itself. Bi (2012) offers an alternative explanation; it is the volatility of

[11]see for instance Neumeyer and Perri (2005) and Mendoza and Yue (2012).

[12]Uribe and Yue (2006) and Akinci (2013) present a PVAR analysis of a group of emerging economies and find that the estimated impulse responses of fundamentals are consistent with the theoretical impulse responses arising from a model with a working capital constraint. Uribe and Yue (2006) find that international capital markets affect emerging economies through risk premium shocks and to much lesser extent through shocks to the global risk-free rate. Akinci (2013) shows that shocks to international risk appetites are another source of variation which can cause business cycle slumps in the emerging world.

government expenditure that leads to lower debt limits.[13] The current paper strives to offer a unified approach for measuring interactions between internal fundamentals, external shocks and government expenditure.

This paper also contributes to the literature on measuring the role of external shocks for business cycle fluctuation in emerging and developing economies.[14] Raddatz (2007) estimates the effect of external shocks emanating from commodity price fluctuations, natural disasters and the international economy on low income and poor economies and finds that external shocks are responsible for only a small share of output fluctuation in this group of economies. My conclusions are similar in regard to international sovereign rate shocks. I find that these shocks are more contractionary in emerging economies and account for a bigger share of output fluctuations. Nonetheless the overall share of business cycle fluctuations they account for is small.

1.3 Data

As the identification strategy for government consumption shocks hinges on the use of quarterly data, I compile a data set of quarterly output, investment, net trade and government consumption expenditure for a panel of emerging and developed economies. I use government consumption because among the components of total government expenditure it has the best cross-country availability at quarterly frequency. The data sources are IMF IFS and Eurostat. All series are deflated using the series specific price index when available or the Producer Price Index. Data are

[13]In the model in Bi (2012) government expenditure alternates between a stationary and a non stationary process with an exogenous probability.

[14]Using a BVAR analysis, Erten (2012) finds that external demand shocks accounted for roughly 50% of the variation in GDP growth for a sample of Latin American economies during the European debt crisis.

deseasoned and linearly detrended. [15]

To measure the external borrowing cost faced by the sovereign, I use the J.P.Morgan Emerging Market Bond Index Plus (EMBI+)[16] for emerging economies and the J.P.Morgan Government Bond Index (GBI) series for developed economies. Both indices are constructed by J.P.Morgan as a representative investment benchmark for a country's internationally traded sovereign debt and thus are a good proxy for how international investors price sovereign debt. Both indices cover debt instruments denominated in US dollars and span all available maturities. To proxy for the safe rate, I follow the rest of the literature and use the 10-year US treasury yield. In order to obtain measures of real return on government debt, I adjust both the sovereign yields and the safe rate by US expected inflation, which is proxied by a four-quarter rolling average of the US CPI. I obtain the quarterly GBI and EMBI+ as well as the 10-year US treasury series from Thomson Reuters Datastream.

The inclusion of countries in my dataset is guided by the coverage of the two sovereign bond indices- EMBI+ and GBI. The inclusion of a country in either index implies that it is viewed by international financial markets as belonging to either group. Therefore I can use the time series for these countries to measure how international investors price sovereign debt and to quantify group difference in that respect. Following the groups delineated by the two sovereign bond indices, I included the following countries in my analysis: 1) *developed economies*: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, HK, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden and the UK; 2) *emerging economies*: Argentina, Brazil, Bulgaria, Colombia, Ecuador, Mexico, Peru, Philippines, Russia, South Africa, Turkey,

[15] Similar results obtain if I detrend the data quadratically.

[16] According to the J.P.Morgan documentation provided by Datastream the EMBI+ contains only bonds or loans issued by sovereign entities form index-eligible countries.

Ukraine.[17] As a robustness check I also report results excluding the distressed European economies from the sample. The time series length for each panel is determined by the coverage of the sovereign bond indices. The beginning of the indices also roughly coincides with the beginning of the time series on government consumption for emerging economies. The resulting time series length is Q1 1994 to Q4 2014. My panel comprises a total of 30 countries and 84 quarters.

The annual data on fiscal variables is drawn from the IMF WEO. It covers the time period from 1980 to 2014 for 168 countries. The advantage of the annual data is the wider country and fiscal variable coverage relative to what is available at the quarterly frequency. I use this data to revisit the problem of fiscal pro-cyclicality and to verify if the pattern of greater procyclicality is present beyond the late 1990s as emphasized by the previous literature.

1.4 Pro-cyclicality at Annual Frequency

As a first stab at the data, I take a look at the annual series to determine if the pro-cyclicality of government expenditure and government consumption for emerging and developing economies characterizes the data once the sample is extended with recent data. I find that government expenditure does behave differently between rich economies and the rest. Figure 1.1 shows the contemporaneous correlation between the cyclical component of real GDP and real government expenditure. I calculate the group specific correlation using both data series in levels and in first difference to alleviate concerns about stationarity. I also summarize the group specific distribution in terms of a simple as well as a population weighted mean. Additionally, I provide a check by netting out interest payments from total expenditure. Because we

[17] I drop Croatia (15 quarters), Egypt (25 quarters), Hungary (14 quarters), Indonesia (32 quarters), Poland (51 quarters), Malaysia (12 quarters) as they were included in the EMBI+ for fewer than 15 years.

should anticipate that the composition and the yield curve of sovereign debt differs among the three country groups, interest payments might be confounding the degree of pro-cyclicality. [18] Across the board the correlation is different from 0 with the exception of the case of rich economies in levels. Overall there is strong evidence that government expenditure is pro-cyclical for the emerging and the poor group relative to the rich group. As the t tests suggest the correlation is indistinguishable between emerging and poor but the rich group is significantly different from the rest in terms of the cyclicality of government expenditure. The exception is the case for the population weighted correlation. In this case the poor group shows the most counter-cyclical stance. The population weights emphasize India and China for which the correlation is negative. As Figure 1.3 shows pro-cyclicality is decreasing in country size for poor and emerging, but particularly so for poor. I report population weighted correlations excluding India and China. In this case the pro-cyclicality pattern emerges again.

Figure 1.2 reports the volatilities among the 3 groups. As the literature has emphasized, the cycle is at least 50% more volatile for poor and emerging economies than for industrial economies. The table also reports the volatility of government expenditure relative to output. Across the three groups government expenditure is more volatile than output. While in terms of output volatility poor and emerging are indistinguishable from one another and more volatile than industrial economies, in terms of government expenditure volatility, the emerging group looks similar to the developed groups in terms of both magnitude of the statistic and the t test. Government expenditure is significantly more volatile in emerging economies than developed only for the series in difference and population weighted mean. To summarize, government expenditure for emerging economies is similar to the poor group in terms of cyclicality and similar to the developed group in terms of volatility.

[18] The contemporaneous correlation increases from expenditure to net expenditure for emerging and rich but nor for poor.

Another relevant statistic to look at is the amplitude of government expenditure growth defined as the difference between expenditure growth during booms relative to expenditure growth during recessions. As consistent business cycle dating is not available across a large number of economies, I take an approach exploited in the literature and report the average growth when real GDP growth is above median versus below median. Figure 1.4 reports the results. The amplitude of government expenditure for poor and emerging is in stark contrast to industrial. According to this statistic government expenditure is acyclical for industrial and strongly pro-cyclical for poor and emerging. The table also reports amplitude for government revenue. The literature has suspected that the revenue process for emerging and poor governments is more volatile and governments are more constrained in raising revenue. The amplitude statistic does show a modestly greater pro-cyclicality of revenue for poor and emerging but the difference is not as stark as in the expenditure case.

Finally figure 1.5 reports the OLS estimates of the elasticity of government revenue and expenditure to real GDP. The revenue elasticity of 1 for industrial is consistent with the literature. Government revenue is more responsive to fluctuation in real output in the case of emerging and poor economies. The pooled OLS estimate for the elasticity of expenditure to GDP uncovers again evidence of greater pro-cyclicality of government expenditure.

Next I report diagnostics for government consumption expenditure, which is a component of total government expenditure. While the literature on fiscal pro-cyclicality emphasizes the behavior of government expenditure over the cycle, the multiplier for non-industrial countries has been studied in the context government consumption expenditure. [19] The necessity for data spanning many economies at the quarterly frequency has been partially responsible for this. I calculate descriptive statistics for government consumption expenditure to see if its cyclical behavior is similar to that of government expenditure. Figure 1.6 reports the contemporaneous correlation and figure 1.7 summarizes the volatility of government consumption relative to output. It turns out that government consumption both in levels and first difference is highly pro-cyclical across the three groups. The magnitude of the statistic is similar across the three groups and the t tests suggest that we cannot reject the hypothesis that the correlation is the same across the three groups. As a share of real GDP government consumption is acyclical or counter-cyclical across the three groups. In levels there is no distinction between the counter-cyclicality of government consumption in developed and emerging. In difference, however, the share is more counter-cyclical in developed and the difference is statistically significant. In terms of volatility the poor group stands out from the rest as being substantially more volatile. Emerging economies have similar volatility as rich except for the population-weighted mean in difference. Government consumption is directly part of aggregate demand. We can decompose the cyclicality of the government consumption as follows:

$$corr(Y, Share_g) \approx corr(Y, G) - \sqrt{\frac{var_y}{var_g}}$$

where Y is the log of real output and $Share_g = G - Y$ is the share of government consumption. $\sqrt{\frac{var_y}{var_g}}$ is indistinguishable between emerging and rich while the $corr(Y, G)$ confounds the efficacy of government consumption expenditure with the government response to cyclical fluctuations. As the SVAR analysis discussed in the subsequent sections shows the government response in emerging economies is more pro-cyclical due to credit constraints while the efficacy of government consumption is substan-

[19] Ilzetzki et al. (2013) influential paper uses government consumption expenditure to estimate the government spending multiplier.

tially lower for emerging economies.

In the previous sections I review evidence of whether fiscal pro-cyclicality is still present in the data. The behavior of pro-cyclicality over time warrants attention because Frankel et al. (2012) offers evidence that fiscal pro-cyclicality (measured as the correlation between annual government expenditure and the cyclical component of GDP) has decreased over time for some developing and emerging economies. They relate this change to institutional improvement in this group of countries. Figure 1.8 plots the rolling window correlation between the cyclical component of GDP and government expenditure for the three groups of countries. I report the correlation for 5, 10 and 15 years horizons. While there is an improvement across the all groups over the 90s and early 2000s, the correlation is U-shaped. In other words there is a reversal to pro-cyclicality towards the end of the sample. Figure 1.9 repeats the same exercise for net government expenditure (excluding interest expense). The same pattern emerges. This ensures that the question of fiscal pro-cyclicality is still empirically relevant.

Although the analysis does not include direct measures of capital flows, I look at the cyclical behavior of the GBI and the EMBI Plus indices next. Figure 1.11 shows the empirical distribution of sovereign rate on international financial markets adjusted for inflation. The left pane excludes only realization during default while the right pane excludes defaulters in the sample altogether (Argentina, Ecuador, Greece and Russia). On average emerging governments pay up to 4% higher rates on international borrowing. The standard deviation of the pooled realized rates appears similar, but this clearly driven by the exorbitant yields faced by Greece during the European bond crisis. Excluding Greece as well as the other defaulters highlights the fact that the distribution for emerging yields is also more spread out. Figure 1.12 reports the median rate for each country in the sample. The fact that emerging governments pay a higher rate on external obligations emerges again. Within the developed group, the GIIPS pay higher rates than the rest of the developed economies. South Africa's median rate on the other hand is comparable to developed economies' rates. Towards the top of the two groups, we find governments that experienced default during the sample years: Greece for developed and Argentina and Ecuador for emerging. I report median rates to attenuate the effect of default episodes. Nonetheless the relative country order is barely changed in terms of the average rate and maximum realized rate for each country (Figure 1.13). Finally, Figure 1.14 reports the sovereign rates of the distressed European economies relative to several GBI averages during the European debt crisis. Clearly Greece experienced an exorbitant hike reflected in the Greek GBI index. Greece's interest spike is followed by Portugal and Ireland's and to a lesser extent by Spain and Italy. The GBI average excluding the distress economies are actually decreasing. As a robustness check (reported in a subsequent section), I discuss excluding the GIIPS from the analysis.

1.5 Identification

The widely accepted identification outlined by Blanchard and Perotti (2002) uses institutional knowledge. The paper as well as much of the subsequent literature constrain the government to respond to macroeconomic fundamentals with at least a quarter delay. In other words within a period, the government cannot respond to macroeconomic fundamentals. The assumption is justified by pointing out institutional delays in implementing fiscal changes. The delays are related to both collecting data on the private sector as well as legislating and executing fiscal reforms. For this reason the use of quarterly data is essential. This identification can be recast as an A model outlined in detail in Lutkepohl (2007). In particular I assume that the observed relationships in the data can be modeled as a stationary VAR of order p:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + u_t$$

y_t is a vector

$$\begin{bmatrix} g_t & gdp_t & i_t & tby_t & r_t^{us} & R_t \end{bmatrix}$$

g$_t$ is government consumption, gdp_t is output, i_t is in investment, tby_t is trade balance relative to GDP, r_t^{us} is the world safe rate proxy and R_t is the sovereign interest rate. All variables are expressed in real terms.

Further I assume that there is an A matrix such that:

$$Ay_t = A_1^* y_{t-1} + ... + A_p^* y_{t-p} + e_t$$

where e_t is a vector of orthogonal structural shocks with a diagonal Σ_e covariance matrix. The assumption implies the A-model formulation:

$$Au_t = e_t$$

with $AA_i = A_i^*$. After imposing appropriate restrictions on A we can bring the following system to the data:

$$y_t = \underbrace{[I - A]}_{A_{\text{estimate}}} y_t + A_1^* y_{t-1} + ... + A_p^* y_{t-p} + e_t$$

Finally I can express y_t in terms of orthogonal shocks:

$$y_t = \sum_{i=0}^{\infty} \Phi_i u_{t-i} = \sum_{i}^{\infty} \Phi_i A^{-1} A u_{t-i} = \sum_{i}^{\infty} \theta_i e_{t-i}$$

with $\Theta_i = \Phi_i A^{-1}$

The restriction I impose on A are based on Blanchard and Perotti (2002) for the public sector part of the model and on Uribe and Yue (2006) for the macroeconomic fundamentals. Uribe and Yue (2006) propose the identification I employ and verify that it is consistent with the canonical IRBC model of a small open economy. In particular their identification assumes that the interest rates respond to fundamentals within quarter while fundamental respond with 1 quarter delay. The restrictions are as follows:

$\mathrm{u}_t^g = e_t^g$

$u_t^{gdp} = a_{21} u_t^g + e_t^y$

$u_t^i = a_{31} u_t^g + a_{32} u_t^{gdp} + e_t^i$

$u_t^{tby} = a_{41} u_t^g + a_{42} u_t^{gdp} + a_{43} u_t^i + e_t^{tby}$

$u_t^{rus} = e_t^r$

$u_t^R = a_{61} u_t^g + a_{62} u_t^{gdp} + a_{63} u_t^i + a_{64} u_t^{tby} + a_{65} r_t^{us} + e_t^R$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ -a_{21} & 1 & 0 & 0 & 0 & 0 \\ -a_{31} & -a_{32} & 1 & 0 & 0 & 0 \\ -a_{41} & -a_{42} & -a_{43} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ -a_{61} & -a_{62} & -a_{63} & -a_{64} & -a_{65} & 1 \end{bmatrix} u = e_t$$

I assume that a country cannot single-handedly influence the world safe rate. Hence the impact and lagged feedback coefficients are set to 0. The literature is in general comfortable making this assumption about emerging markets. As I am interested in studying both emerging and developed economies in parallel to establish differences in their behavior, I have to consider to what extent this is a justifiable assumption. Ultimately we are looking for a measure of global factors i.e. a variable which has the same realization in all countries per time period.[20] Figure 1.16 displays Graner-causality test. The figure shows the coefficient for each country in the system. For the vast majority of countries we cannot reject the null that the country fundamentals do not affect the safe rate. The "exceptions" are not the countries we would have expected so I attribute the rejection of the null to the short time series.

The panel structure of the data allows us to get around the sparsity of individual country data. Data on fiscal variables as well as aggregate demand variables start mostly in the early 1990s. Apart from this consideration, the coverage of the EMBI and the GBI indices also imposes a similar constraint on the individual time series data. The dataset includes 84 quarters per country with some missing data for individual countries. This is by no means sufficiently long time-series to assure us in the validity of the estimates. This problem is alleviated by the panel dimension. At the same time, the panel structure of the data posits the challenge of dealing with cross-country heterogeneity. I follow the panel VAR literature in assuming that the dynamic response for a country are the same up to randomly distributed country specific fixed effect:

$$u_{it} = \mu_i + \nu_{it}$$

It is further assumed that the two disturbance components are mean 0 and orthogonal to each other.

$$E(\mu_i) = E(\nu_{it}) = E(\mu_i \nu_{it}) = 0$$

[20] In the dynamic panel (GMM) exercise the data has been deseasonalized only as the main equation is specified in first differences, while for the FE effect estimation, I use linearly detrended and deseasonalized data. Estimates are extremely close if I quadratically detrend or if I use detrended data for the GMM exercise.

with $i \in 1 : N$ and $t \in 1 : T$. The presence of a fixed country effect would bias pooled estimates of the system's coefficients.[21] Lagged dependent variables in the system raise concern about the fixed effect estimator suffering from Nickell bias (Nickell (1981)) i.e. the demeaned lagged regressors being correlated with the demeaned disturbances. For this purpose I employ dynamic panel estimation. In particular I use the difference GMM estimator: the equations are estimated in first difference with lags of the regressors used as instruments. First differencing the equations expunges the fixed effect. However, it introduces the problem that the first differenced disturbances ($\triangle u_{it} = u_{it} - u_{it-1}$) are endogenous to the lagged regressors ($\triangle y_{it-1} = y_{it-1} - y_{it-2}$). To address this issue the difference GMM uses past realizations of the lagged dependent variables to instrument for the endogenous first-differenced regressors with y_{t-T}, $T \in 2...t-1$ being all valid instruments in the absence of first order autocorrelation in ν_{it}. [22] I choose to use three lags of instruments and verify that the results are robust to using fewer or more instruments. To verify the validity of the instruments used in the GMM estimation, I report the Sargan / Hansen test for joint validity as well as the Arellano and Bond test for autocorrelation in the idiosyncratic disturbance ν_{it}. Since $\triangle u_{it}$ is correlated with $\triangle u_{it-1}$ by construction, testing for second order autocorrelation in the differenced errors is a valid test for first order autocorrelation in the residuals in levels.[23] Both the Sargan / Hansen test and the Arellano and Bond test confirm that the matrices y_{t-p-i} for $i \in [1 : 3]$ are valid instruments. Only for the investment equations is the null of no first order autocorrelation rejected. To alleviate this concern, I also report estimates of the third row of the A_i matrices using alternative dynamic panel estimators.[24],[25] While the dynamic panel estimators

[21] The bias would be less important, the longer is the time series.

[22] Autocorrelation in the error would force us to truncate the sequence of appropriate instruments.

[23] Autocorrelation test p+1 on the differenced residuals tests for p correlation in the residuals in levels.

[24] The Arellano Bond test statistic in constructed under the assumption of large N and small T as well as $E(e_{it}e_{jt}) = 0$. Controlling for the safe rate helps with the latter assumption, but the relatively small N in the empirical sample ($N = 30$) might be problematic.

[25] For a comprehensive discussion of dynamic panel estimators and literature review see Roodman

are less taxing in terms of degrees of freedom loss due to deeper-lag instruments, the time series length (T = 82) in the data is perhaps sufficient to make the dynamic bias small and to justify the use of a more straightforward estimation technique such as the fixed effect estimator. In turns out that in this particular empirical specification the fixed effect estimates of the system lead to instability issues. Empirically I demonstrate that the distressed European economies as a group are the potential culprit. Excluding them indeed fixes the problem. I report fixed effect estimation for the sample excluding this group (GIIPS: Greece, Italy, Ireland, Portugal, Spain) as a robustness check.

Finally in order to estimate differences in dynamic responses between developed and emerging economies I modify the estimation to include an emerging-dummy interaction[26]:

$$a_{l,ij} = \tilde{a}_{l,0}(ij) + \tilde{a}_{l,1}(ij) \times \mathbb{1}[EME]$$

$a_{l,ij}$ is the ij-th element of A_l for l $\in [0..p]$ and EME selects the emerging economies in the sample.

The AIC criterion selects one lag as optimal (see Figure 1.37). The autoregressive coefficients for the safe rate are estimated by OLS in first differences.

1.6 SVAR Analysis

Figure 1.31 and figure 1.32 show the GMM estimates of the system for both the developed and the emerging group. Figure 1.33 explicitly focuses on the government

(2009).

[26] This is equivalent to estimating the system separately for each group, but leads to a slight efficiency improvement.

response. Overall, the government responds pro-cyclically to output for both groups. The point estimates suggest that worsening international financial conditions decrease government consumption. Increases in the safe rate as well as the sovereign international borrowing rate lead to a decrease in government consumption for both groups. Both the group by group estimates and the joint estimates suggest that emerging economies are more mindful of international credit constraints and decrease government consumption in response to an increase in the safe borrowing rate and their own sovereign borrowing rate. Conversely, international credit constraints have a lower bite for governments in developed economies vis-à-vis those in emerging economies. Moreover, the government response to output is similar for the two groups and statistically indistinguishable. This juxtaposition sheds light on one of the main questions of the paper: whether emerging governments are more sensitive to the cycle and whether they respond more pro-cyclically to output fluctuations. Conditional on my identification, it turns out this is not the case.

Figure 1.34 reports results for the government response function estimated using private GDP instead. I confirm that emerging governments decrease consumption expenditure in response to increases in the borrowing rate they face on international markets. This is still the main difference between the two government response functions. If anything, the coefficient on the interest rate is even higher in magnitude when private GDP is used in the estimation. This is also the case with FE estimates (figure 1.35). The FE estimation confirms that the main difference between emerging and developed economies stems from their response to the sovereign rate. Differently from GMM, the fixed effect estimation suggests that government consumption does not respond to GDP fluctuations at all. The coefficient on real GDP is lower and imprecisely estimated. In the next section I show that the bootstrapped impulse response still implies an increase in government consumption following a positive output shock even in the FE estimation case. Finally, figure 1.36 shows another robustness check for the government response function. In particular, I report fixed effect estimates for a country subset which excludes Greece, Portugal and Italy. Greece and Portugal are the countries experiencing the largest increase in government yields relative to the rest of several subsets of the GBI index family during the European debt crisis. I choose to report this particular cut of the data because excluding all of the distressed European economies leads to stability issues in the VAR analysis. I revisit this issues in the robustness section. I exclude Greece, Portugal and Italy and re-estimate the system with FE. I also report results from GMM estimation which excludes all distressed European economies (Greece, Portugal, Ireland, Italy and Spain). This particular GMM estimation should be interpreted with care, because further decreasing the number of panels raises concerns. In the GMM case, the difference between the full sample and the sub-sample for the developed group is that the coefficient on the lagged dependent variable increases and there is no response of government consumption to fundamentals apart from that to the safe rate. For the emerging group the GMM estimates on the subset suggest just the opposite: government consumption is less persistent and more responsive to fundamentals relative to emerging. The fixed effect estimates on the full sample and subsample are quite similar. In both FE exercises governments do not respond to fundamentals apart from the sovereign rate. Increases in the international sovereign rate are contractionary for both the full sample and the subset albeit imprecisely estimated in the subsample case.

Returning to the rest of the variables in the model (figure 1.31 & figure 1.32), we already see that the efficacy of government consumption as a policy instrument is substantially lower as captured by the impact coefficient on GDP. As anticipated an increase in government consumption is expansionary. However, as the coefficient on the interaction (GC $\times$ I(Emerging)) suggests, the impact coefficient for emerging economies is a third that for developed. The crowding-out of investment on the other hand by government consumption is lower in emerging economies. The coefficient on L.GC is practically off-set by the coefficient on L.GC$\times$I(Emerging) for investment. Although the current analysis does not include measures of how the government finances government expenditure, the lack of crowding out for investment is symptomatic of revenue financed increases in government expenditure for emerging economies, which can be one factor behind the lower multiplier for this group (I discuss the multiplier in the next section). The estimates suggest that government consumption leads to a greater deterioration in the trade balance for developed economies which is consistent with either a greater share of imported goods and services in the government consumption basket or a stronger multiplier on private sector consumption. Finally, for either group fluctuations in government consumption do not impact directly sovereign borrowing constraints.

As anticipated, investment is strongly pro-cyclical for both emerging and developed. The trade balance is again as anticipated counter-cyclical due to the effect of investment as emphasized by the IRBC. Sovereign credit constraints do not directly affect fundamentals except in the case of investment for developed economies. On the other hand the sovereign rate shows a lot of persistence for developed economies and less so for emerging. As a matter of fact I estimate a significant feedback from output to the sovereign borrowing rate for emerging and not for developed. The sovereign rate is less persistent in the case of emerging economies. To capture the rich dynamics of the system I discuss the impulse response analysis in the next section.

1.6.1 Impulse Responses

Shocks to Government Consumption

Figure 1.17 reports the impulse response to a unitary orthogonal shock to government consumption expenditure. Government consumption expenditure is expansionary for both emerging and rich economies. For the rich group there is a greater evidence of investment crowding out during the initial quarters for which the impulse response is statistically indistinguishable from 0. For subsequent quarters developed economies investment is higher but the impulse responses for the two groups are still statistically indistinguishable from each other. The effectiveness of government consumption in stimulating output is ostensibly higher for the developed group. Government consumption shocks cause a slight deterioration in the trade balance. Finally the response of the interest rate is the mirror image for the two groups with borrowing conditions improving for emerging economies in response to a government consumption shock. As we saw in the estimates of the system the response of the borrowing rate is determined by the response of the rate to output fluctuations rather than the directly through government consumption. Finally there is no response of the world safe rate by construction. As the persistence of government consumption differs between the 2 groups I calculate the multiplier next.

Figure 1.18 reports the government consumption multiplier. Following the literature, I define the government consumption spending multiplier as:

$$\text{impact multiplier} = \frac{\triangle X_0}{\triangle G_0}$$

$$\text{cumulative multiplier} = \frac{\sum_{t=0}^{T} \triangle X_t}{\sum_{t=0}^{T} \triangle G_t}$$

$$X_t \in \begin{bmatrix} g_t & gdp_t & i_t & tby_t & r_t^{us} & R_t \end{bmatrix}$$

Normally the literature reports the multiplier effect of government (consumption) expenditure on GDP. To facilitate the comparison between the two groups, I report the multiplier effect of shocks on all variables in the system. There is a striking difference between the multiplier effect of government consumption on output in the two groups. In emerging economies government consumption is substantially less effective in stimulating output; the impact multiplier is roughly two times lower than the impact multiplier for developed economies. For both groups the multiplier is less than 1, which is consistent with estimates of the multiplier in Ilzetzki et al. (2013). However, differently from them I do not obtain negative multipliers. I do not find difference in the two groups for the investment multiplier which is consistent with bigger crowding out for the developed group. The deterioration in the trade balance is of similar magnitude for both groups. Finally, as fundamentals improve, the sovereign borrowing rate also improves for emerging economies. On impact, a unitary increase in government consumption leads to a 16 basis points decrease in the rate. The cumulative multiplier effect is as high as 12%. In other words, a 10% increase in government consumption decreases the sovereign borrowing rate by 1.23% for emerging economies and while the same increase in government consumption would induce an increases in the rate by 73 basis points for developed over the whole cycle. Figure 1.18 also reports the government consumption multiplier on private GDP. The comparison between the two groups still holds with the short-run multipliers being up to 3 times lower and the long run multiplier up to 2 times lower for emerging economies. It should be noted that estimates deal with officially reported GDP. If we had a measure of the informal sector or the shadow economy, estimates of the fiscal multiplier for the informal sector would be also very informative.

Shocks to Output

Next I consider shocks to output. Figure 1.19 reports the response of the variables in the model to a unitary shock to output. The empirical responses are consistent with the predictions of the SOE IRBC model: investment responds more than one for one with output and the trade balance is countercyclical. The impact response of investment in emerging economies is slightly higher. However the investment response converges to being indistinguishable between emerging and rich as the horizon increases. One of the key questions I am after is whether emerging governments respond differently to output fluctuations; in particular whether government consumption expenditure re-enforces the cycle. While the median response for emerging governments is higher, the response of government consumption to output fluctuation is indistinguishable from the developed group's. This results suggests that emerging governments do not necessarily have a more pro-cyclical stance. Instead as revealed by the response to interest rate shocks which is to be discussed next, government consumption expenditure is more sensitive to sovereign interest rate shocks. The sovereign rate responds to fundamentals in emerging economies while the response in developed is statistically indistinguishable from 0. Figure 1.20 reports the multiplier effect of an output shock on the rest of the model variables. The median multiplier effect of output on government consumption is higher- between 4 to 24 percentage points, in emerging economies. Given that the coefficients on the response function are the same, the higher multiplier is due to the fact that the increase in output relaxes the borrowing constants for emerging governments. In other words, emerging governments raise government consumption in response to a positive output shock because of the relaxed international borrowing constraints. In particular in emerging economies the median impact improvement in the government interest rate is 14 percentage points and the long run improvement- 33 percentage points. For the developed group the improvement in the long run is roughly 1 percentage point and is not statistically significant.

Shocks to the Sovereign Borrowing Rate

Figure 1.21 reports the impulse response of the model variables to a unitary shock in the sovereign borrowing rate. The shock leads to a contraction in emerging economies albeit a milder one relative to the estimates in Uribe and Yue (2006) and Akinci (2013). The developed group can weather the shock without a significant decrease in the government consumption or output. However, for the developed group, there is a substantial decrease in investment and an improvement in the trade balance. To account for the difference in persistence of the shock propagation I recast the impulse response in a multiplier form as shown in figure 1.22. The median multiplier for emerging governments' consumption to an interest rate shock is twice as high as that for developed. The median response for output is twice as high. However, as noted before investment in developed economies responds twice as strongly to an interest rate shock as investment in the emerging group.

Shocks to the Safe Rate

Figure 1.23 displays the impulse responses to a unitary shocks to the safe rate. As the autoregressive process for the safe rate (0.992 in level and 0.596 in difference) is close to non-stationary I report estimates with the rate in differences. The safe rate shocks matter mostly for the international borrowing rate faced by sovereigns with a limited implication for other fundamentals. This is consistent with the findings of Akinci (2013) who also finds that the global safe rate is the least important among the international financial conditions she considers. It should be noted that an increase in the safe rate decreases the sovereign rate for emerging and increases the sovereign rate for developed. My results concur with the analysis of Eichengreen and Mody (1998), which focuses on first issuance emerging markets spreads in the early 90s. The sign of the effect depends on whether supply or demand effects are stronger on net. On the one hand a fall in the US treasury rate shifts investor demand towards bond markets which offer a higher yield. The demand effect will lead to a same sign movement in the safe rate and the sovereign rate. On the other hand as shown by Eichengreen and Mody (1998) an increase in the US rate decreases the likelihood of a bond issuance in emerging markets which in turn limits the supply and leads to a decrease in the bond rate. Therefore, the impulse response suggest that the supply effects are leading when it comes to emerging sovereign bonds. As I do not have direct evidence on the dependence of issuance on the US rate for developed sovereign bonds, we I only conjecture that their issuance probability is either less sensitive to the US rate or that demand effects are stronger for this market.

1.7 Variance of Estimated Shocks

The A-model of identification I employ allows me to use the relationship: $Au_t = e_t$ to find an estimate of the diagonal elements of $\hat{e}_t = \hat{A}\hat{u}_t$. This allows me to back out estimates of the volatility of orthogonal shocks: $\hat{\Omega}_e = \hat{A}\hat{\Omega}_u\hat{A}'$. The analysis suggests that emerging economies are indeed subject to a more volatile shock process in terms of output, government consumption and sovereign yield. Figure 1.24 reports the country and group breakdown of the estimated government consumption shock volatility. In terms of policy shocks (to government consumption) I find evidence of substantially higher degree of discretion in the conduct of fiscal policy in emerging economies relative to developed. In particular the volatility of the fiscal shock is roughly 3 times higher for emerging government relative to developed. This result is important because the literature has highlighted the negative consequences of fiscal policy discretion / volatility on long-run growth (e.g. Fatas and Mihov (2003)). The country breakdown shows Portugal, Greece and Finland as the countries with the highest volatility in the developed group and Ukraine (with shock volatility more than twice the group average) for the emerging group. Excluding the countries with the highest volatility for the two groups still preserves the comparison. Another distinction is that while fiscal policy shocks have similar magnitude to output shocks in developed economies, their volatility is roughly twice that of output shocks in emerging economies.

The volatility of output shocks is summarized in figure 1.25. Output shock volatility in emerging economies is twice that of developed economies. The comparison is preserved even when excluding countries which look like outliers in their respective group. There is re-ordering of countries in the empirical distribution of estimated shock volatility among the three shocks considered. However, Greece and Finland are again at the top of the distribution for the two groups. In fact I find these two countries have the highest shock volatility in the developed group across all three shocks.

Emerging economies are also battered by substantially bigger sovereign rate shocks (figure 1.26). I find that the volatility of interest rate shocks is about four times larger for emerging economies. That being said, it should be noted that rate shocks exhibit lower volatility across both groups relative to policy and output shocks. In particular, I find that sovereign rate shocks are half as volatile as output shocks for both groups.

Noting that reduced form shock estimates are obtained in first differences (this is specific to the GMM estimation), I reconstruct the residuals in levels. While the reduced form residuals in differences are by construction mean zero, the level estimates are not. I use this feature of the GMM dynamic panel approach to obtain estimates of the coefficient variation of $\hat{\Omega}_e$. This statistic can be interpreted as a measure of uncertainty. In terms of policy volatility, the developed group outstrips the emerging group (figure 1.27). This is largely due to Greece, Finland and Portugal, which also have the highest policy volatility. Excluding these three countries reverses the comparison, with the emerging group having a high degree of policy uncertainty; the coefficient of variation for the emerging group is 2.4 versus 1.4 for the developed. Perhaps not surprisingly, Ukraine is at the top of the emerging group in terms of policy uncertainty. The uncertainty characterizing output shocks is comparable across both groups once I exclude Greece, Portugal and Finland (figure 1.28). This is not true for sovereign shocks. Emerging governments face twice the uncertainty in shocks to internationally traded debt prices (figure 1.29). This gives a sense of the extent to which emerging governments have to provide insurance to the private sector while they themselves are battered by shocks which are marked with both higher volatility and uncertainty.

1.8 Variance Decomposition

In this section I perform variance decomposition to establish the relative importance of each shock of interest for business cycle fluctuations. Figure 1.37, figure 1.38, figure 1.39 show the variance decomposition for an orthogonalized government consumption shock, output shock and for the international sovereign rate shock respectively. As is standard in the literature, I use a horizon of 20 quarters (5 years) for the purpose of variance decomposition at business cycle frequency. Each figure shows the share of the specified variable (government consumption, output and the rate) in the h-step forward error variance decomposition for each variable in the system. The h-step ahead forecast is given by:

$$y_t - y_{t+h|t} = u_{t+h} + \Phi_1 u_{t+h-1} + ... + \Phi_{h-1} u_{t+1}$$

We can represent the forecast as a MA in terms of the structural errors:

$$y_t - y_{t+h|t} = \sum_{m=0}^{h-1} \theta_m e_{t+h-m}$$

Then the FEV for a particular variable k in the system:

$$\sigma_k^2(h) = \sum_{\kappa} \sum_{m=0}^{h-1} \theta_{k\kappa,m}^2 \Omega^e(\kappa, \kappa)$$

We can express $FEVD_{k,j}$: the share of variable j in the forecast error variance of variable k setting $\kappa = j$:

$$\mathbb{S}_{k,j}(h) = \frac{\sum_{m=0}^{h-1} \theta_{kj,m}^2 \Omega^e(j,j)}{\sigma_k^2(h)}$$

The reported results for the government consumption shock suggest that innovations to government consumption are responsible for 16% of output fluctuations in emerging economies and up to 34% in developed. This result is rationalized by recalling that despite the high volatility of government shocks, the efficacy of those shocks is roughly 50% lower in emerging economies. The importance of government consumption shocks for investment is similar to their contribution to output for the emerging group, while for the developed group government consumption shocks contribute substantially more to output fluctuations than to investment fluctuations.

The contribution of sovereign rate fluctuations is arguably small for both country groups- 2% of output in emerging and less than 1% in developed. My estimates are in the lower end of the literature for emerging economies; Akinci (2013) for example estimates the contribution of international rate fluctuations to the variance decomposition of output in emerging economies to be roughly 20%. My estimates are based on similar data. However, I explicitly account for the role of government consumption, jointly estimate the model on both emerging and developed countries, increase the time dimension by three years to include the taper tantrum and double the number of panels. In contrast to the aforementioned paper I consider both dynamic panel estimates as well as fixed effect estimation. It should be acknowledged that much in the spirit of the rest of the literature, I find that sovereign rate shocks play a more important role for the emerging group: they account for twice the share of forecast error variance in emerging than in developed economies. Another difference between the two groups is that in emerging economies interest rates account for a smaller share of their own fluctuations. Thus the feedback between fluctuations in fundamentals and international borrowing rates is stronger in emerging countries.

Of central interest to this paper is whether output fluctuations play a bigger role for government consumption in the emerging group. It should be noted that both output and government consumption shocks are more volatile in the emerging group as highlighted in the previous section. It turns out that governments (in the sense of government consumption) are responsible for a similar share of real GDP fluctuations across the two groups with developed countries actually surpassing their emerging counterparts. The observation that government consumption is responsible for a smaller share of output fluctuations in emerging economies while at the same time output being responsible for a similar share of government consumption fluctuations leads me to conclude that there is no dramatic difference in fiscal stabilization between the two groups as far as government consumption is concerned. There is also a stark comparison between the role of output for interest rate fluctuation in emerging economies. Output fluctuations are responsible for more than 20% of the fluctuations in the price of international debt in emerging economies with this share being substantially smaller in the developed group. Similarities emerge when looking at the share of investment and trade balance fluctuations. Output fluctuations are responsible for a similar share of investment and trade balance variance. For both groups output accounts for almost half of the fluctuations in investment.

1.9 Robustness

In this section I explore to what extent results are sensitive to the choice of countries and to including the European debt crisis in the sample. One concern would be related to the distressed European economies and whether the identification imposing the same dynamic matrices across both the core and the GIIPS is not too restrictive. Because decreasing the number of panels might be problematic in the GMM cases, I choose to explore different country subsets in the context of FE estimation. Before proceeding further I discuss some stability issues which emerge in the case of Fixed Effect. Figure 1.43 shows the eigenvalues for selected dynamic matrices. The full sample GMM is stable, but FE estimation for both the full sample and the sample excluding the GIIPS is not. In both cases one of the eigenvalues is not strictly inside the unit circle. The issue pertains specifically to the developed group; the eigenvalues for the emerging group are strictly inside the unit circle for all cases. The issues for the developed group are due to the coefficient on the sovereign rate. The fixed effect estimation implies an autoregressive coefficient for the developed sovereign rate of 1.025 (standard error = 0.019) and 0.844 (standard error = 0.023) for emerging. The autoregressive coefficient increases if the sovereign yield is specified in first difference; in particular for developed economies the coefficient increases to 1.763 (standard error = 0.173) while for the emerging group the coefficient drops to 0.421 (standard error

= 0.18). To shed more light on the issue I estimate the bottom row of the dynamic matrices country by country. Figure 1.44 displays the autoregressive coefficient for each country. Excluding Greece, Italy and Portugal induces stationarity as shown by the eigenvalues.[27]

After excluding Greece, Portugal and Italy I redo the impulse response analysis. Figure 1.40 reports the result for a government consumption shock. Generally the two estimators agree on the role and propagation of government consumption shocks. Overall the fixed effect estimation implies a lower multiplier effect of a government consumption shock on output. However, the comparison in terms of how effective policy shocks in emerging economies relative to developed are, still holds. Government consumption is substantially more effective in developed economies. The sign of the median investment, trade balance and sovereign rate impulse responses is unchanged relative to the GMM estimation. However, the investment response is estimated with much wider confidence bands for developed and is indistinguishable from 0 for emerging. The GMM estimation attributes a bigger movement to investment, while the fixed effect estimation- to the trade balance. The fixed effect estimation still implies an increase in international borrowing rates in response to a policy shock for the developed group and just the opposite for the emerging group.

Figure 1.41 reports the impulse response of the system to output shocks for the FE effect estimation case. This robustness check confirms that government consumption does not respond more procyclically in the emerging group. It also confirms that output expansion decreases the international borrowing rate for the emerging group. The biggest difference between the two estimators stems from the behavior of the sovereign yield for developed. In contrast with the GMM estimates, the FE impulse

[27] Excluding Portugal is enough to induce stationarity, however results are very close to the case of excluding all three distressed economies, which I report.

response is much more persistent and implies an increase in the sovereign rate in response to an expansionary output shock.

Finally figure 1.42 provides estimates of the impulse response to a sovereign yield shock. The result confirms that sovereign yield shocks are contractionary for emerging economies. The impulse response for the developed group leads us to believe that the shock is contractionary for government consumption and investment but expansionary for output. Because it would be difficult for most open economy models to justify an expansion in output, I conclude that the GMM interest rate impulse response is more plausible.

1.10 Conclusion

International borrowing costs and business cycles are interrelated in a complex way. The international finance literature suggests that this relationship is stronger for emerging economies. Default risk priced into their international borrowing costs makes these costs more tightly linked to fluctuations in macroeconomic fundamentals. At the same time, emerging economies presumably have less perfect shock absorption mechanisms relative to their developed counterparts. The contribution of this paper is two-fold; first, I evaluate the hypothesis that external borrowing costs are more important drivers of business cycles in emerging economies by studying the question in a panel of both emerging and developed economies. Second, I investigate the role that fiscal policy plays for the relationship between borrowing costs and business cycle fluctuations. Led by identification demands on data availability, I focus on government consumption as a fiscal policy tool. Developed economies provide a benchmark against which the performance of emerging sovereigns is studied. Relative to their developed counterparts, emerging economies' governments are more responsive to fluctuations in their sovereign yields and contract government consumption in response to interest rate shocks. This creates a propagation mechanism allowing interest rate increases to lead to business cycle contractions. As measured by the contraction in output, interest rate shocks indeed lead to deeper contractions in emerging economies than in rich economies.

I also find that government consumption is a substantially weaker policy tool in emerging economies. The impact government consumption multiplier in emerging economies is three times smaller than the impact multiplier in developed economies. The long run multiplier in emerging economies is half the long-run multiplier in developed. The finding echoes the literature in that the level of development affects the efficacy of fiscal policy. One natural extension of the paper would be to investigate the reasons behind why government consumption is less effective in the emerging group. A few reasonable suspects are: 1) due to the larger share of the informal / shadow economy a larger part of the multiplier is "invisible" to the econometrician 2) structural differences: the higher level of product and labor market regulations in these economies[28] 3) soundness of institutions: for instance, if government contracts and orders are allocated in a noncompetitive way by corrupt bureaucrats and civil servants, government spending would be more wasteful or go towards groups with a lower propensity to consume.

1.11 Tables and Figures

[28] I suspect that differences in product and labor market regulations might be able to partly explain the substantial difference in the multiplier between developed and emerging economies. Loayza et al. (2004) show evidence that developing countries are more regulated and find that a higher degree of labor and product market regulations leads to a slower GDP growth and a higher GDP volatility. Using US data and a model based identification, Dawson and Seater (2013) find that government regulation tends to slow down GDP growth.

Figure 1.1: Contemporaneous correlation between government expenditure and real GDP. The data in levels is linearly detrended and deseasoned in logs; the data in differences is expressed in log difference and deseasoned; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP per capita falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The left panel contains the correlation between government expenditure and output for all 3 groups as well as for all countries overall. I perform a simple t test for the statistic being different from 0. The bolded statistics are significant at the 10%. The right panel shows 2 sample t tests; again bolded t statistics depict significance at the 10% level. The average statistic for a group is calculates as either a simple or as a population weighted group average of the country level statistics. The table reports the cyclicality of both total government expenditure and government expenditure net of interest rate payments.

FULL SAMPLE : correlations (ρ)

		All	Poor	EM	Rich
annual: simple average					
ρ(expenditure,Y)	levels	**0.30**	**0.35**	**0.34**	0.08
	difference	**0.18**	**0.26**	**0.23**	**-0.14**
ρ(net expenditure,Y)	levels	**0.33**	**0.34**	**0.40**	**0.13**
	difference	**0.2**	**0.26**	**0.28**	**-0.12**
annual; pop weighted					
ρ(expenditure,Y)	levels	-0.03	**-0.17**	**0.19**	**0.15**
	difference	**-0.04**	**-0.05**	**0.12**	**-0.22**
ρ(net expenditure,Y)	levels	**0.06**	**-0.11**	**0.37**	**0.19**
	difference	0.01	**-0.06**	**0.32**	**-0.22**
annual; pop weighted; excl China and India					
ρ(expenditure,Y)	levels	**0.23**	**0.35**	**0.19**	**0.15**
	difference	**0.07**	**0.27**	**0.12**	**-0.22**
ρ(net expenditure,Y)	levels	**0.3**	**0.28**	**0.37**	**0.19**
	difference	**0.16**	**0.26**	**0.32**	**-0.22**
number of obs.		168	65	73	30

FULL SAMPLE: correlation test

		ANOVA F	Poor ≠ EM	Poor ≠ Rich	EM ≠ Rich
annual: simple average					
ρ(expenditure,Y)	levels	**6.57**	0.20	**3.21**	**3.08**
	difference	**22.41**	0.60	**6.44**	**5.95**
ρ(net expenditure,Y)	levels	**6.44**	1.02	**2.47**	**3.24**
	difference	**22.68**	0.26	**5.99**	**6.23**
annual; pop weighted					
ρ(expenditure,Y)	levels	**5.08**	0.55	**2.58**	**3.09**
	difference	**21.23**	0.51	**5.36**	**4.93**
ρ(net expenditure,Y)	levels	**13.31**	**1.34**	**1.82**	**2.94**
	difference	**39.32**	0.36	**4.93**	**5.22**
annual; pop weighted; excl China and India					
ρ(expenditure,Y)	levels	**5.21**	0.19	**2.88**	**3.09**
	difference	**41.94**	0.82	**5.62**	**4.93**
ρ(net expenditure,Y)	levels	**4.83**	1.04	**2.06**	**2.94**
	difference	**54.90**	0.06	**5.19**	**5.22**
number of obs.		168	65	73	30

Figure 1.2: Volatility of government expenditure and real GDP. The data in levels is linearly detrended and deseasoned in logs; the data in difference is expressed in log difference and deseasoned; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP per capita falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The left panel contains the standard deviation of output and the standard deviation of government expenditure relative to output for all 3 groups as well as for all countries overall. The right panel shows 2 sample t tests; again bolded t statistics depict significance at the 10% level. The average statistic for a group is calculates as either a simple or as a population weighted group average of the country level statistics. The table reports the cyclicality of both total government expenditure and government expenditure net of interest payments.

FULL SAMPLE : variance

		All	Poor	EM	Rich
annual: simple average					
σ(Y)	levels	0.091	0.093	0.097	0.069
σ(Y)	difference	0.047	0.049	0.051	0.034
σ(expenditure)	levels	1.703	2.141	1.427	1.424
σ(expenditure)	difference	2.534	3.259	2.136	1.931
σ(net expenditure)	levels	1.749	2.229	1.440	1.462
σ(net expenditure)	difference	2.635	3.411	2.210	1.985
annual; pop weighted					
σ(Y)	levels	0.078	0.091	0.082	0.055
σ(Y)	difference	0.039	0.043	0.045	0.022
σ(expenditure)	levels	1.574	2.300	1.334	1.014
σ(expenditure)	difference	2.588	4.114	2.032	1.497
σ(net expenditure)	levels	1.491	2.171	1.222	1.041
σ(net expenditure)	difference	2.714	4.446	2.019	1.587
number of obs.		168	65	73	30

FULL SAMPLE: variance

		ANOVA F	Poor neq EM	Poor neq Rich	EM neq Rich
annual: simple average					
σ(Y)	levels	1.87	0.32	**1.81**	**2.00**
σ(Y)	difference	**3.18**	0.46	**2.26**	**2.39**
σ(expenditure)	levels	**8.35**	**3.63**	**3.24**	0.01
σ(expenditure)	difference	**14.01**	**4.43**	**4.29**	0.77
σ(net expenditure)	levels	**10.61**	**4.09**	**3.33**	0.11
σ(net expenditure)	difference	**16.01**	**4.71**	**4.52**	0.86
annual; pop weighted					
σ(Y)	levels	**6.49**	0.10	0.91	0.84
σ(Y)	difference	**13.55**	0.19	1.30	1.35
σ(expenditure)	levels	**14.32**	**2.98**	**3.97**	0.95
σ(expenditure)	difference	**29.41**	**3.76**	**5.55**	**2.09**
σ(net expenditure)	levels	**25.91**	**3.33**	**3.92**	0.85
σ(net expenditure)	difference	**27.36**	**3.98**	**5.68**	**2.30**
number of obs.		168	65	73	30

Figure 1.3: Government expenditure cyclicality and country size. The data in levels is linearly detrended and deseasoned in logs; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP per capita is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The table shows the correlation between country size (population) and the cyclicality of government expenditure.

	Poor	EM	Rich
ρ(ρ1,population)	-0.2922***	-0.2222***	0.0827***
ρ(ρ2,population)	-0.3138***	-0.0473**	0.0522*

Figure 1.4: Government expenditure cyclicality in terms of amplitude. The data is deseasoned in logs and expressed in first difference; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP per capita is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The table shows the correlation between country size (population) and the cyclicality of government expenditure.

	Government Expenditure Growth			**Government Revenue Growth**		
	Amove median gdp growth	**Below median gdp growth**	**Amplitude**	**Amove median gdp growth**	**Below median gdp growth**	**Amplitude**
poor	7.85	1.88	5.97	8.52	1.53	6.99
emerging	6.60	2.31	4.29	7.71	1.52	6.19
industrial	2.59	3.06	-0.47	6.06	0.19	5.87

Figure 1.5: Elasticity of government expenditure and revenue with respect to real output. The data in levels is linearly detrended and deseasoned in logs; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The table shows the pooled OLS elasticity estimates by country group; 3 lags of gap and the dependent variable are included.

	Elasticity of Revenue to Y	Elasticity of Expenditure to Y
poor	**1.38**	**0.88**
	(0.108)	*(0.083)*
emerging	**1.21**	**0.52**
	(0.046)	*(0.063)*
industrial	**1.00**	**-0.29**
	(0.095)	*(0.088)*

Figure 1.6: Contemporaneous correlation between government consumption and real GDP. The data in levels is linearly detrended and deseasoned in logs; the data in difference is expressed in log difference and deseasoned; the number of countries is 168; the time period is 1960 to 2014; the frequency is yearly; the data source is IFS IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP per capita falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The left panel contains the correlation between government expenditure and output for all 3 groups as well as for all countries overall. I perform a simple t test for the statistic being different from 0. The bolded statistics are significant at the 10%. The right panel shows 2 sample t tests; again bolded t statistics depict significance at the 10% level. The average statistic for a group is calculates as either a simple or as a population weighted group average of the country level statistics.

ρ CORRELATION

	All	Poor	EM	Rich
		levels		
ρ(G,Y)	**0.52**	**0.50**	**0.50**	**0.58**
ρ(G/Y,Y)	**-0.06**	0.03	**-0.16**	0.00
		in difference		
ρ(G,Y)	**0.30**	**0.32**	**0.30**	**0.23**
ρ(G/Y,Y)	**-0.20**	**-0.09**	**-0.22**	**-0.37**
		pop weighted		
		levels		
ρ(G,Y)	**0.52**	**0.66**	**0.48**	**0.69**
ρ(G/Y,Y)	**-0.20**	**-0.33**	-0.05	0.04
		in difference		
ρ(G,Y)	**0.26**	**0.23**	**0.34**	**0.27**
ρ(G/Y,Y)	**-0.29**	**-0.33**	**-0.12**	**-0.43**
number of obs	153	55	67	31

ρ CORRELATION: tests

	Anova F	Poor ≠ EM	Poor ≠ Rich	EM ≠ Rich
		levels		
ρ(G,Y)	0.55	0.01	0.96	1.00
ρ(G/Y,Y)	**3.22**	**2.37**	0.30	**1.74**
		in differene		
ρ(G,Y)	0.93	0.31	1.47	1.27
ρ(G/Y,Y)	**11.51**	**2.51**	**6.26**	**3.32**
		pop weighted		
		levels		
ρ(G,Y)	**7.19**	0.86	0.99	0.20
ρ(G/Y,Y)	**11.43**	**2.06**	0.64	1.04
		in difference		
ρ(G,Y)	**3.75**	0.24	1.58	1.45
ρ(G/Y,Y)	**11.47**	**2.53**	**6.69**	**3.73**
number of obs	153	55	67	31

Figure 1.7: Volatility of government consumption and real GDP. The data in levels is linearly detrended and deseasoned in logs; the data in difference is expressed in log difference and deseasoned; the number of countries is 168; the time period is 1960 to 2014; the frequency is yearly; the data source is IFS IMF; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP per capita is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The left panel contains the correlation between government expenditure and output for all 3 groups as well as for all countries overall. I perform a simple t test for the statistic being different from 0. The bolded statistics are significant at the 10%. The right panel shows 2 sample t tests; again bolded t statistics depict significance at the 10% level. The average statistic for a group is calculates as either a simple or as a population weighted group average of the country level statistics.

VOLATILITY

	All	Poor	EM	Rich
	levels			
σ(y)	0.15	0.15	0.16	0.10
σ(g)	1.99	2.62	1.55	1.81
	in difference			
σ(y)	0.07	0.08	0.07	0.04
σ(g)	2.53	3.41	2.12	1.86
	pop weighted			
	levels			
σ(y)	0.13	0.14	0.13	0.08
σ(g)	1.62	1.47	1.94	1.66
	in difference			
σ(y)	0.04	0.05	0.05	0.03
σ(g)	2.23	2.27	2.63	1.44
number of obs	153	55	67	31

VOLATILITY: tests

	Anova F	Poor ≠ EM	Poor ≠ Rich	EM ≠ Rich
	levels			
Y (output)	1.19	0.39	**2.25**	**1.86**
G (gov. consumption)	**6.98**	**3.12**	**2.32**	1.44
	in differene			
Y (output)	**2.72**	0.74	**3.73**	**2.36**
G (gov. consumption)	**9.00**	**3.08**	**3.73**	1.36
	pop weighted			
	levels			
Y (output)	**2.52**	0.42	**2.20**	**1.83**
G (gov. consumption)	2.11	**3.20**	**2.62**	1.10
	difference			
Y (output)	**4.24**	0.71	**3.62**	**2.29**
G (gov. consumption)	**6.80**	**3.15**	**4.07**	**1.90**
number of obs	153	55	67	31

Figure 1.8: Contemporaneous correlation between the cyclical component of GDP and government expenditure by group. The data in levels is linearly detrended and deseasoned in logs; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP per capita is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. I report the rolling window correlation for 5, 10 and15 years windows.

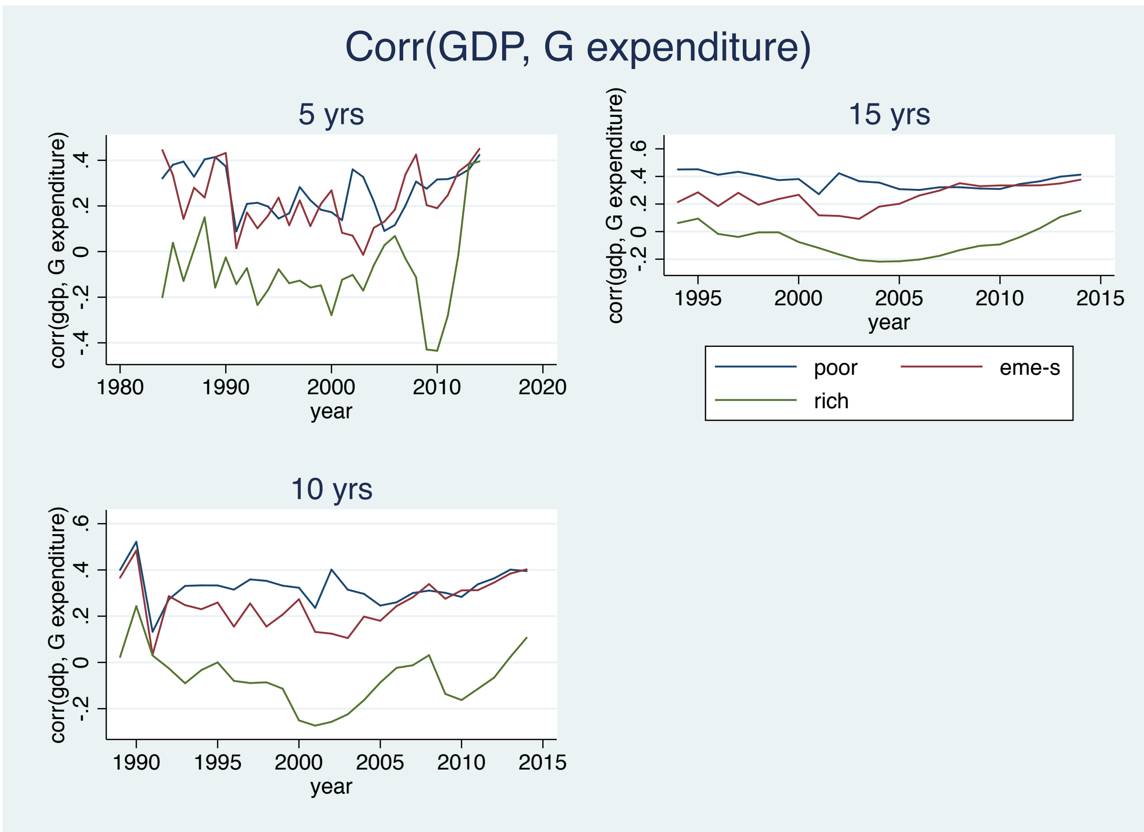


Figure 1.9: Contemporaneous correlation between the cyclical component of GDP and net government expenditure by group; government expenditure is net of interest rate payments; The data in levels is linearly detrended and deseasoned in logs; the number of countries is 168; the time period is 1980 to 2014; the frequency is yearly; the data source is WEO IMF; variables are expressed in real terms; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP per capita falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. I report the rolling window correlation for 5, 10 and15 years windows.

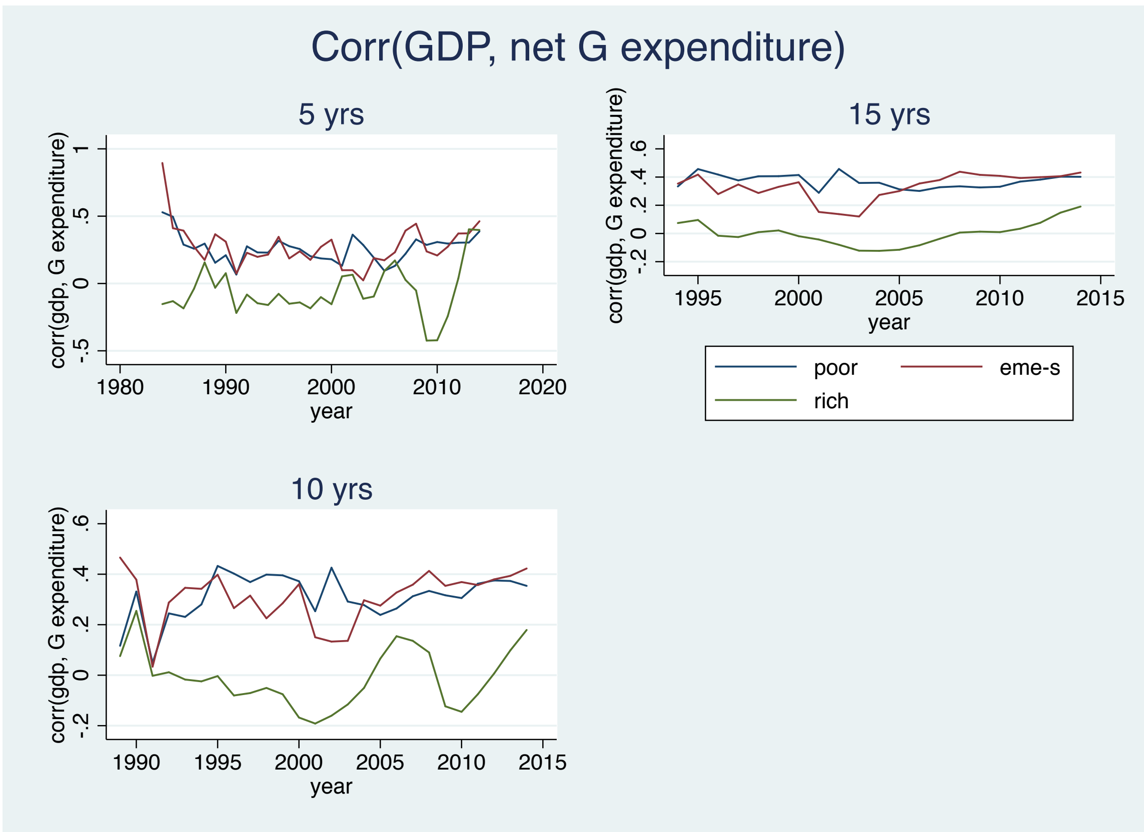


Figure 1.10: Government size across groups; the time period is 1960 to 2014; the frequency is yearly; the data source is WEO IMF; the country groups are determined according to PPP adjusted annual GDP: a country is classified as **poor** if its 2011 PPP adjusted GDP per capita falls below 6000, as **emerging** if its average 2011 PPP adjusted GDP is between 6000 and 30000, and as **rich** if its PPP adjusted GDP surpasses 30000. The average statistic for a group is calculated as either a simple or as a population weighted group average of the country level statistics; All statistics are calculated and reported as a share of a country's GDP. The definitions of Government Expenditure, Government Consumption (GC) are as emphasized earlier in the paper. Revenue (General Government) is defined as taxes, social contributions and grants receivable; Primary Balance (PB) is net lending/ net borrowing (revenue minus net expenditure) i.e. a measure of whether the general government is putting into or taking away financial resources from the pubic sector. Gross Debt (GD) is defined as all current general government's liabilities (SDRs, currency and deposits, debt securities, loans, insurance, pension and standardized guarantee schemes.) Debt excludes financial derivatives, equity and investment fund shares. Debt can be valued at market, nominal or face value. Net Debt (ND) nets out debt assets held by the government from the general government gross debt.

		poor	eme-s	rich
Expenditure		27.6	32.7	42.2
	pop weight	26.5	32.5	43.1
GC		14.7	16.1	18.1
	pop weight	9.3	13.4	17.1
Revenue		25.4	30.2	41.3
	pop weight	23.5	30.2	41.7
PB		-0.1	0.2	1.1
	pop weight	-0.5	0.7	0.8
Gross Debt		**73.4**	**55.9**	**60.0**
	pop weight	**69.3**	**57.2**	**65.6**
Net Debt		**60.5**	**46.6**	**26.0**
	pop weight	**57.0**	**47.1**	**30.4**

Figure 1.11: Distribution of the yield-to-maturity for the EMBI+ and the GBI index; statistics pooled across countries; quarterly data (1994q1-2014q4); the yield is deflated by my constructed measure of US expected inflation; the right panel excludes the four countries which experienced default in my sample

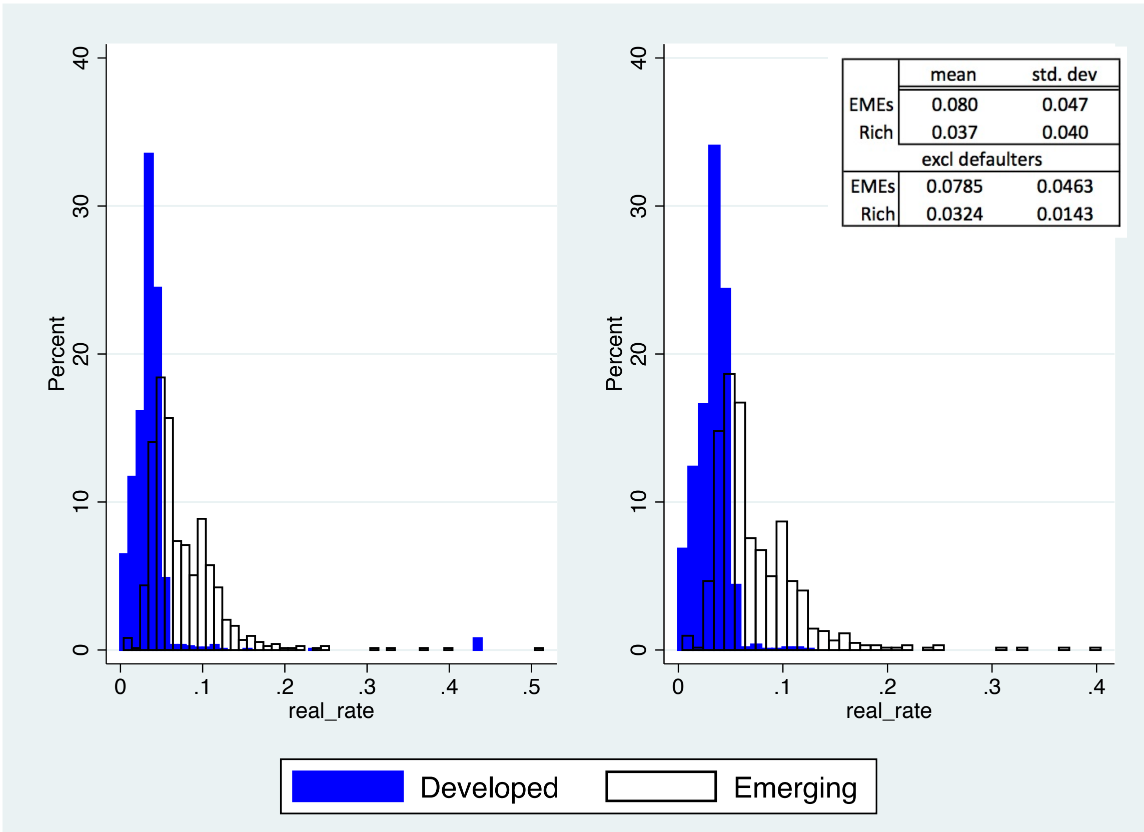


Figure 1.12: Median yield for the countries in the sample (EMBI+ for emerging economies and GBI for developed); quarterly data (1994q1-2014q4); the yield is deflated by my constructed measure of US expected inflation

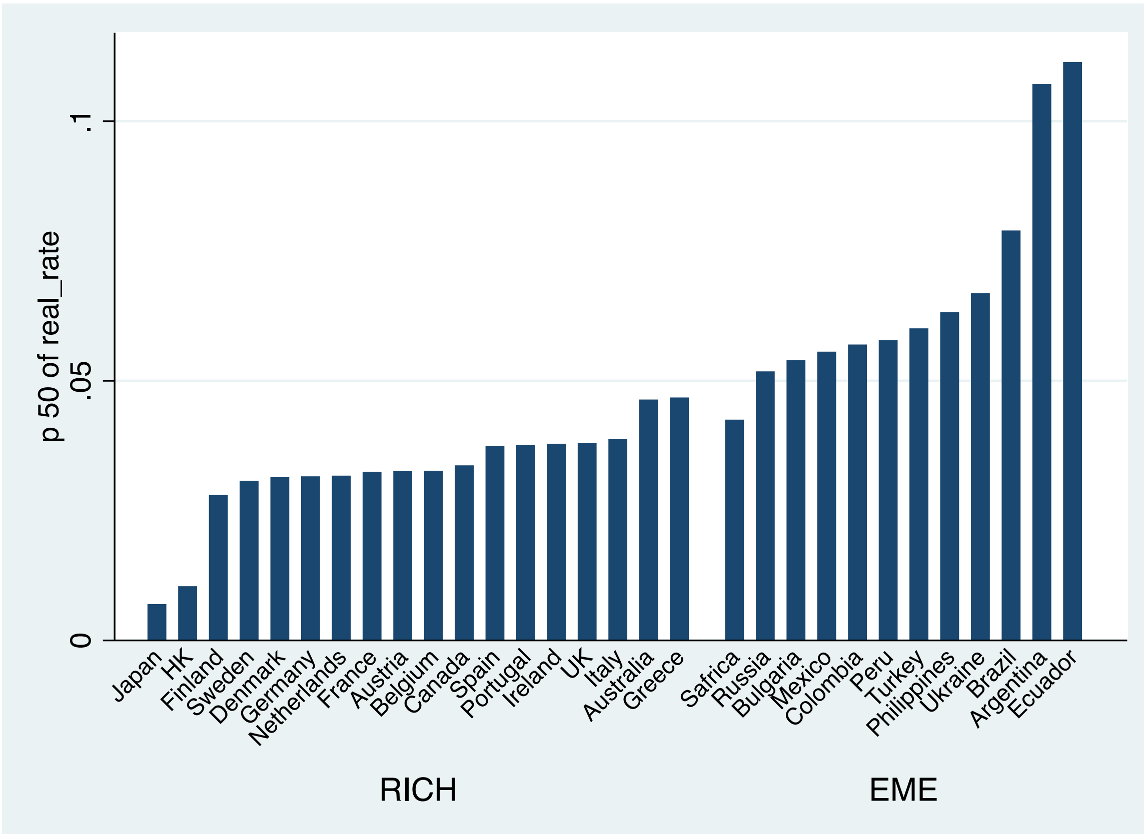


Figure 1.13: Median (top left), mean (top right), maximum (bottom left) realized yield for the countries in the sample (EMBI+ for emerging economies and GBI for developed); quarterly data (1994q1-2014q4); the yield is deflated by my constructed measure of US expected inflation

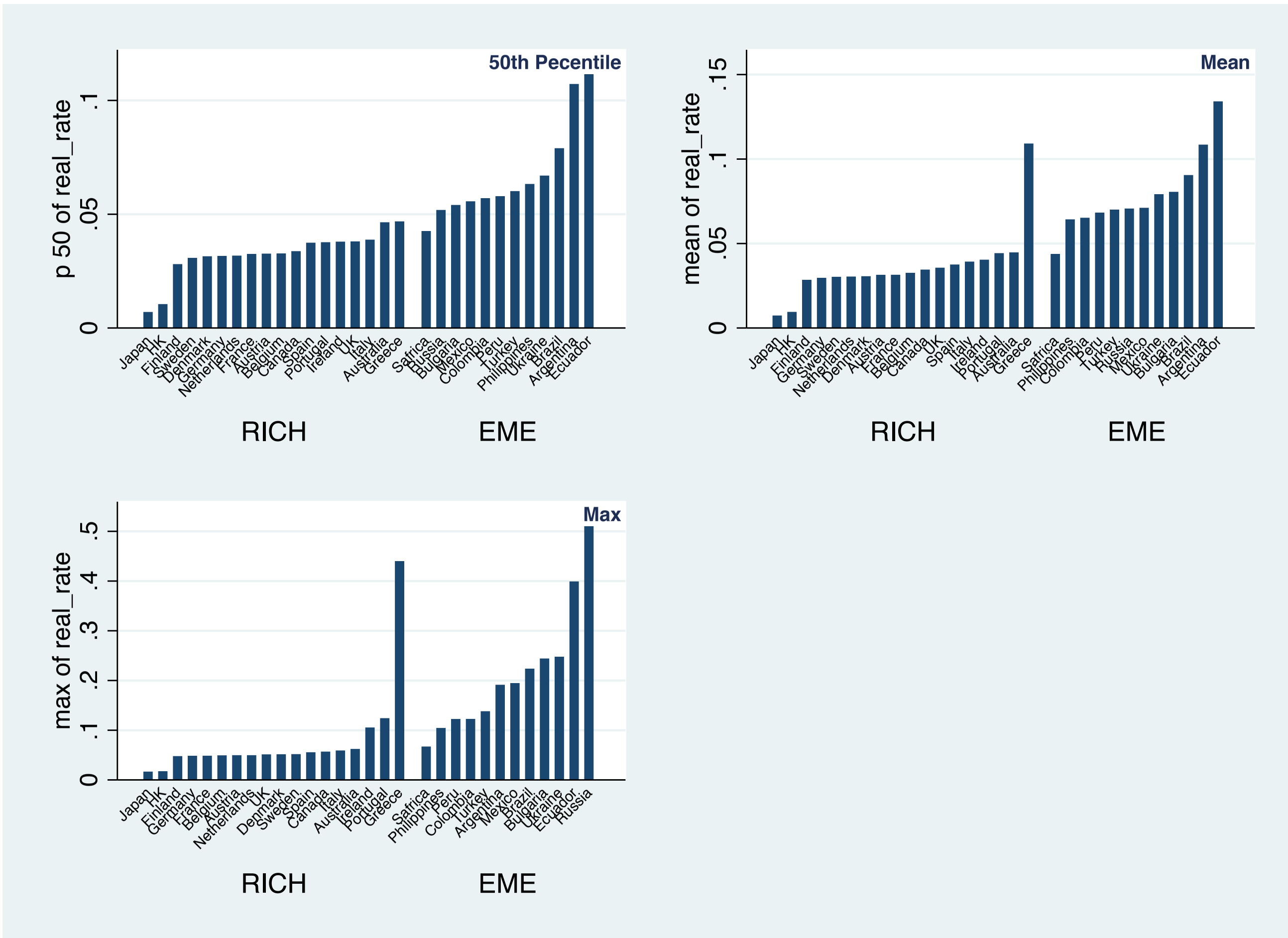


Figure 1.14: Yields for the distressed European economies during the European debt crises relative to the GBI Average (all GBI countries except distressed), the GBI Average: Europe (all European GBI economies except distressed) and GBI Average: Eurozone (all Eurozone GBI economies except distressed)

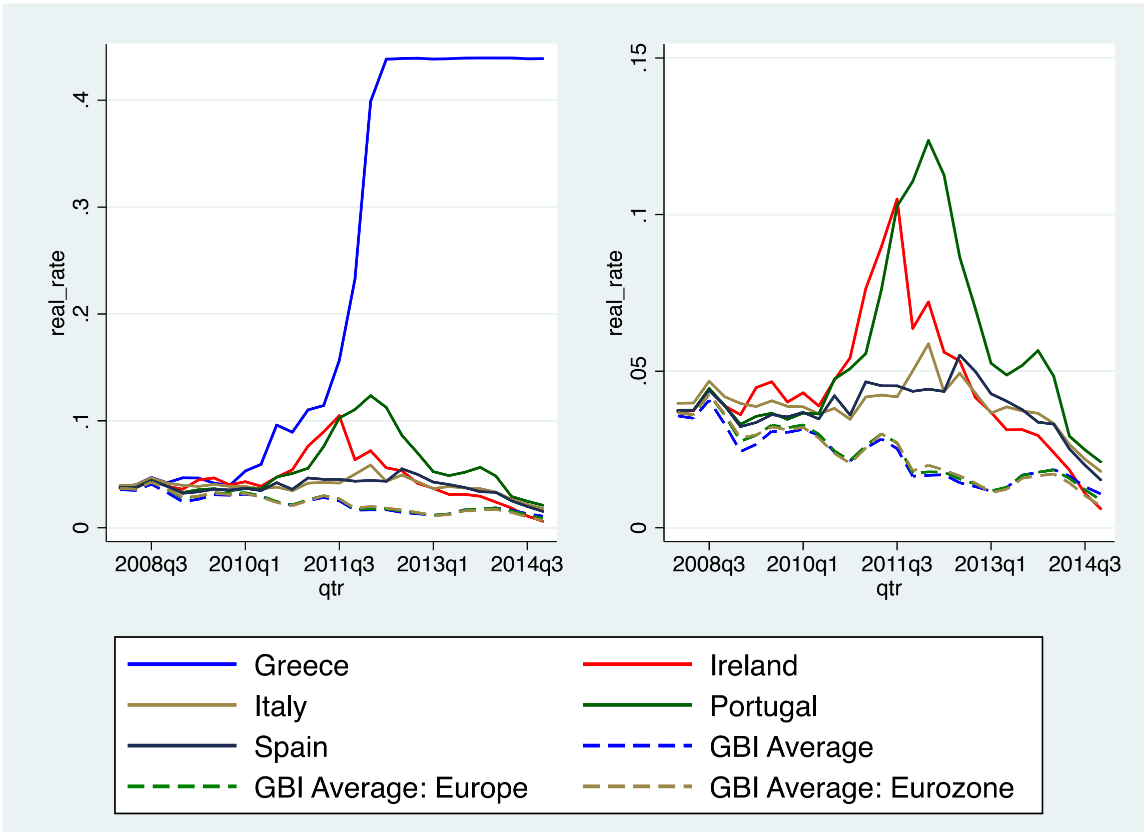
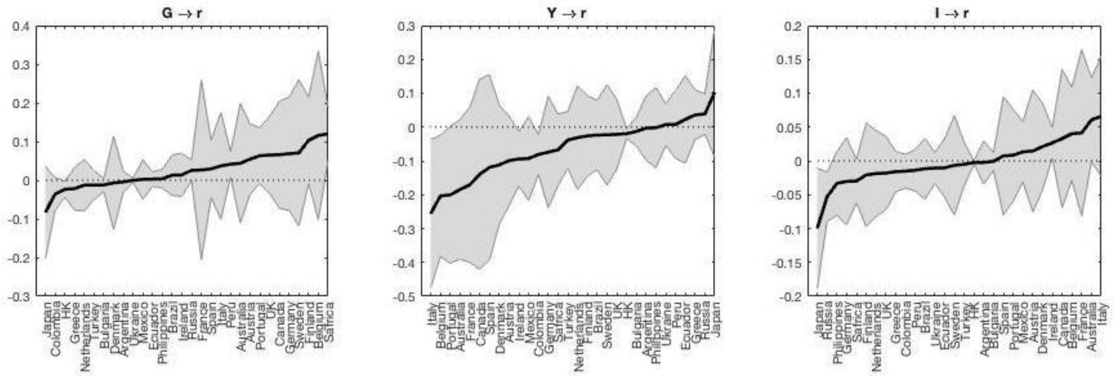
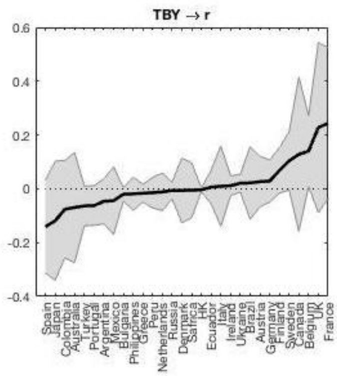


Figure 1.15: Unconditional correlation between yield and real output

EMEs			Rich		
	ρ	p-values		ρ	p-values
Argentina	-0.0882	0.4780	Australia	0.7181	0.0000
Brazil	-0.2012	0.0735	Austria	0.4806	0.0001
Bulgaria	-0.1641	0.1654	Belgium	0.5082	0.0000
Colombia	0.179	0.1638	Canada	0.7106	0.0000
Ecuador	-0.5379	0.0000	Denmark	0.5224	0.0000
Mexico	-0.263	0.0156	Finland	0.7205	0.0000
Peru	-0.3915	0.0007	France	0.8032	0.0000
Philippines	-0.7212	0.0000	Germany	0.5179	0.0000
Russia	-0.4219	0.0007	Greece	-0.8117	0.0000
South Africa	0.4632	0.0007	HK	0.0542	0.7969
Turkey	-0.5501	0.0000	Ireland	-0.2241	0.0727
Ukraine	-0.4135	0.0028	Italy	0.0031	0.9802
			Japan	-0.0785	0.5344
			Netherlands	0.7938	0.0000
			Portugal	-0.3925	0.0012
			Spain	-0.1469	0.2430
			Sweden	0.5558	0.0000
			UK	0.7283	0.0000
average	**-0.2592**			**0.3035**	

Figure 1.16: Country by country estimates of the effect of the first lag of the designated variable on the safe rate with 2(SE) bands; table lists countries for which bands do not include 0.





G	Y	I	TBY	R
HK	Belgium	Ireland	Belgium	HK
Peru	Colombia	Japan		Turkey
Safrica	HK	Russia		
	Ireland			
	Italy			

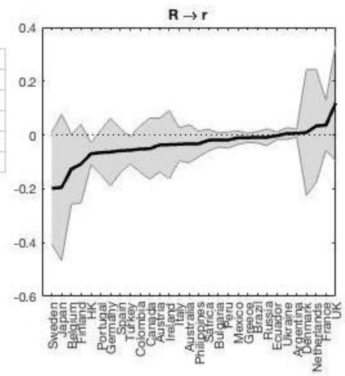


Figure 1.17: Shock to government consumption; impulse response of model variables to an orthogonal government consumption shocks. Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations

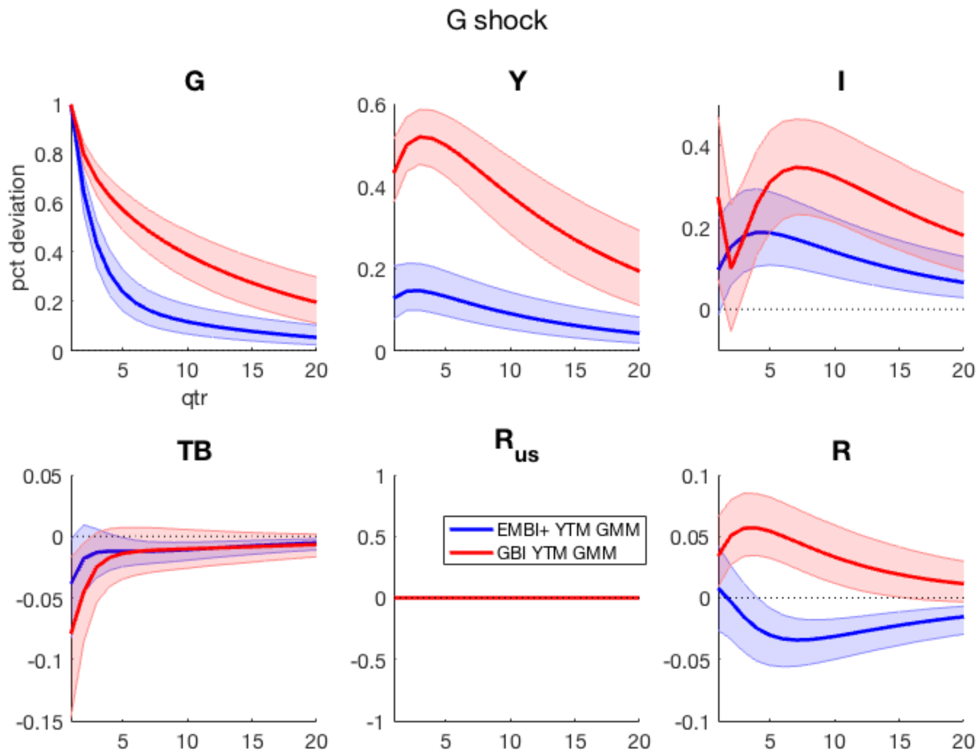
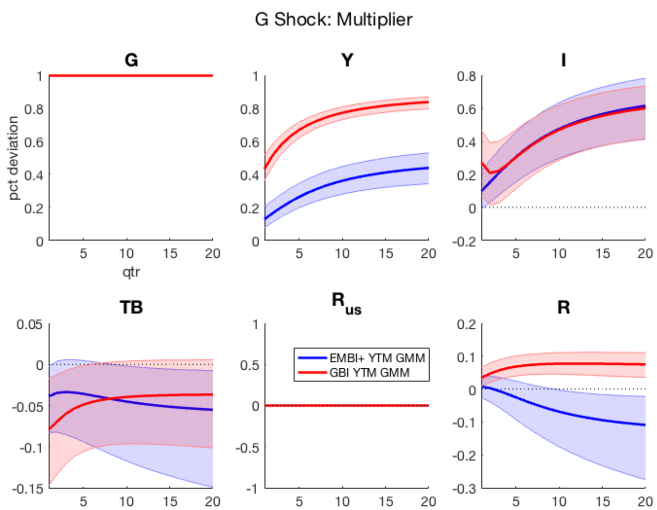


Figure 1.18: Government Consumption Multiplier; Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations



Multiplier: G shock; GMM estimates

	EMEs							Rich						
qtrs	G	Y	Yprivate	I	TB	Rus	R	G	Y	Yprivate	I	TB	Rus	R
1	1	0.1454	0.0302	0.1418	-0.0233	0	-0.0026	1	0.4429	0.2788	0.2035	-0.0778	0	0.032
2	1	0.186	0.0794	0.1986	-0.0261	0	-0.0094	1	0.5271	0.3877	0.161	-0.0676	0	0.045
3	1	0.2234	0.1241	0.2549	-0.028	0	-0.0187	1	0.5894	0.4687	0.1865	-0.0587	0	0.0545
4	1	0.2572	0.1639	0.3084	-0.0302	0	-0.0291	1	0.6369	0.5304	0.2325	-0.0525	0	0.0613
5	1	0.2871	0.1986	0.3574	-0.0326	0	-0.0399	1	0.6742	0.5786	0.2815	-0.0483	0	0.0663
20	1	0.465	0.3889	0.6687	-0.0547	0	-0.1238	1	0.842	0.7952	0.5962	-0.0368	0	0.0737

Figure 1.19: Shock to output; impulse response of model variables to an orthogonal government consumption shocks. Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations

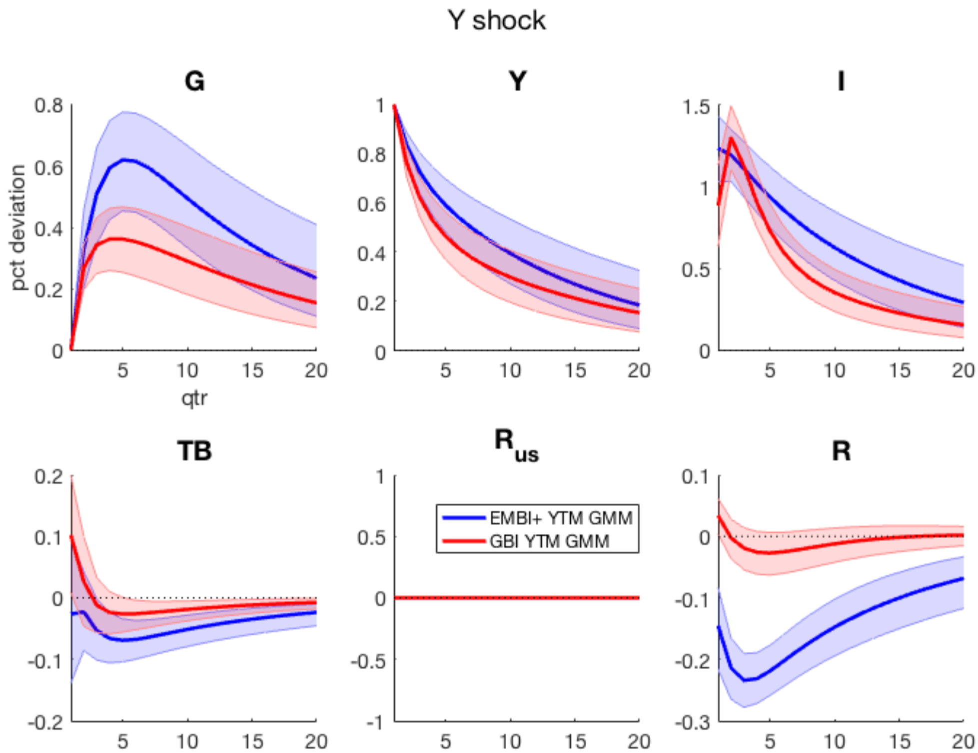
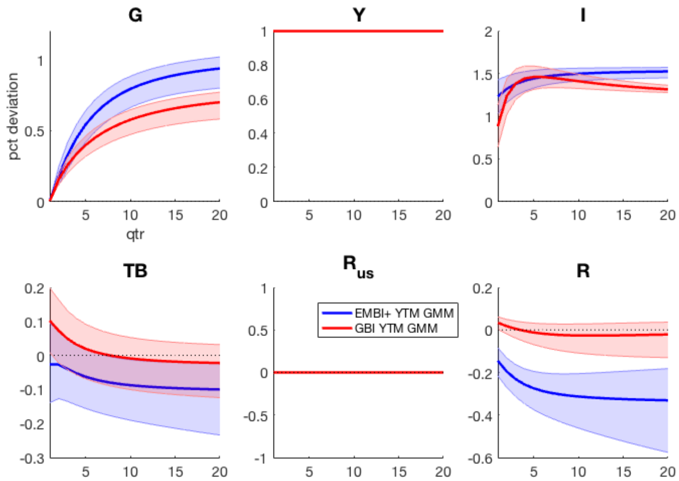


Figure 1.20: Multiplier effect of an orthogonal output shock on the rest of the model variables; Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations



Multiplier: Y shock; GMM estimates

	EMEs						Rich					
qrts	G	Y	I	TB	Rus	R	G	Y	I	TB	Rus	R
1	0	1	1.3405	-0.0662	0	-0.1603	0	1	1.0766	0.0929	0	0.0027
2	0.182	1	1.4104	-0.0562	0	-0.2068	0.1467	1	1.403	0.0621	0	-0.0151
3	0.3309	1	1.4527	-0.0634	0	-0.2402	0.248	1	1.5343	0.0378	0	-0.0289
4	0.4495	1	1.4796	-0.072	0	-0.2636	0.3249	1	1.5817	0.0208	0	-0.0393
5	0.5433	1	1.4977	-0.0792	0	-0.2802	0.386	1	1.5918	0.0087	0	-0.047
...												
20	0.9384	1	1.5499	-0.1072	0	-0.3329	0.6926	1	1.3993	-0.0309	0	-0.0495

Figure 1.21: Shock to the country's sovereign rate; impulse response of model variables to an orthogonal government consumption shocks. Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations

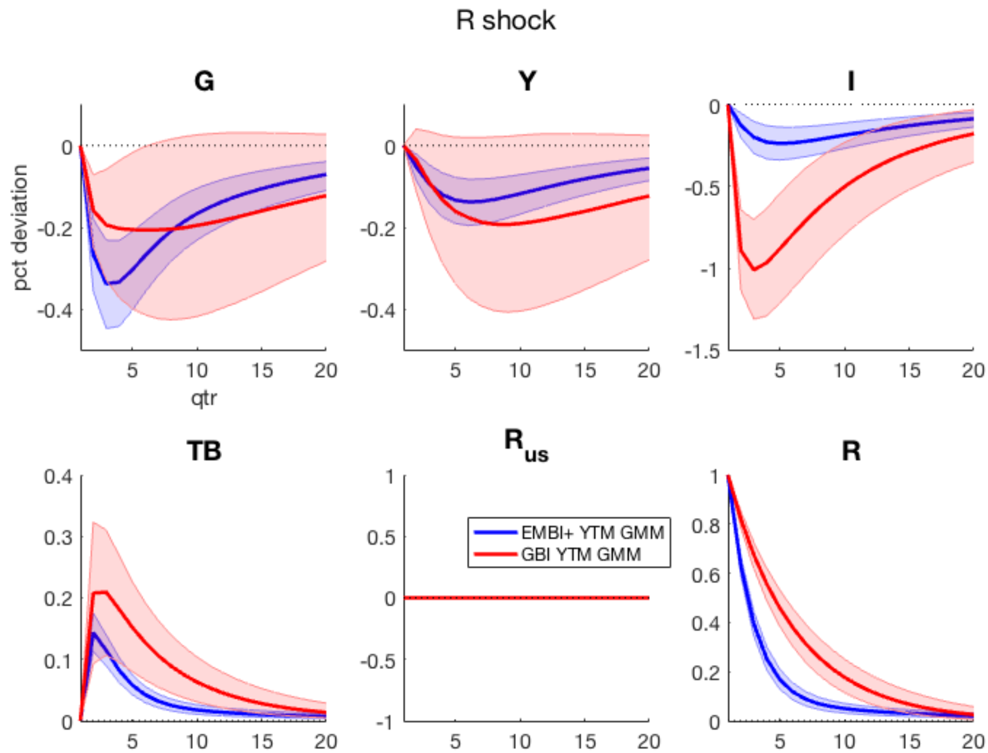
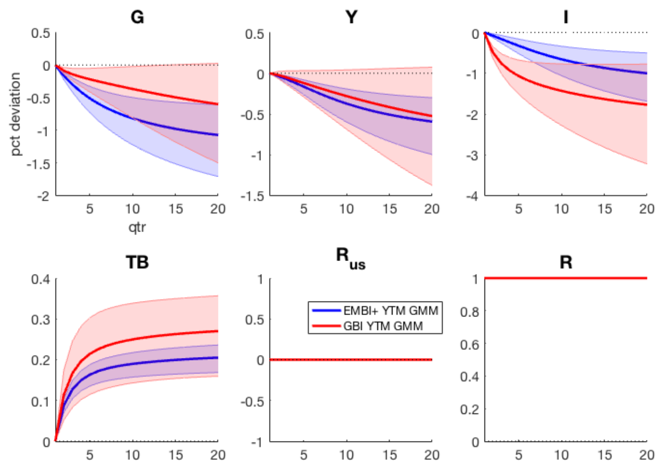


Figure 1.22: Multiplier effect of an orthogonal shock to the country's sovereign rate on the rest of the model variables; Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations



Multiplier: R shock; GMM estimates

	EMBI +						GBI					
qts	G	Y	I	TB	Rus	R	G	Y	I	TB	Rus	R
1	0	0	0	0	0	1	0	0	0	0	0	1
2	-0.1639	-0.0324	-0.0785	0.088	0	1	-0.0859	-0.0192	-0.4878	0.1131	0	1
3	-0.2988	-0.0723	-0.1619	0.1274	0	1	-0.1395	-0.0494	-0.7601	0.1657	0	1
4	-0.4124	-0.1168	-0.2451	0.1494	0	1	-0.1797	-0.0825	-0.9377	0.1947	0	1
5	-0.5085	-0.1632	-0.3258	0.1629	0	1	-0.2137	-0.1163	-1.0663	0.2123	0	1
...												
20	-1.0729	-0.5922	-1.001	0.205	0	1	-0.5885	-0.5144	-1.7651	0.2684	0	1

Figure 1.23: Shock to the safe rate (US rate) expressed in difference; impulse response of model variables to an orthogonal safe rate shock. Quarterly data (1994q1-2014q4); GMM estimates; bootstrapped 95% confidence intervals based on 10000 simulations

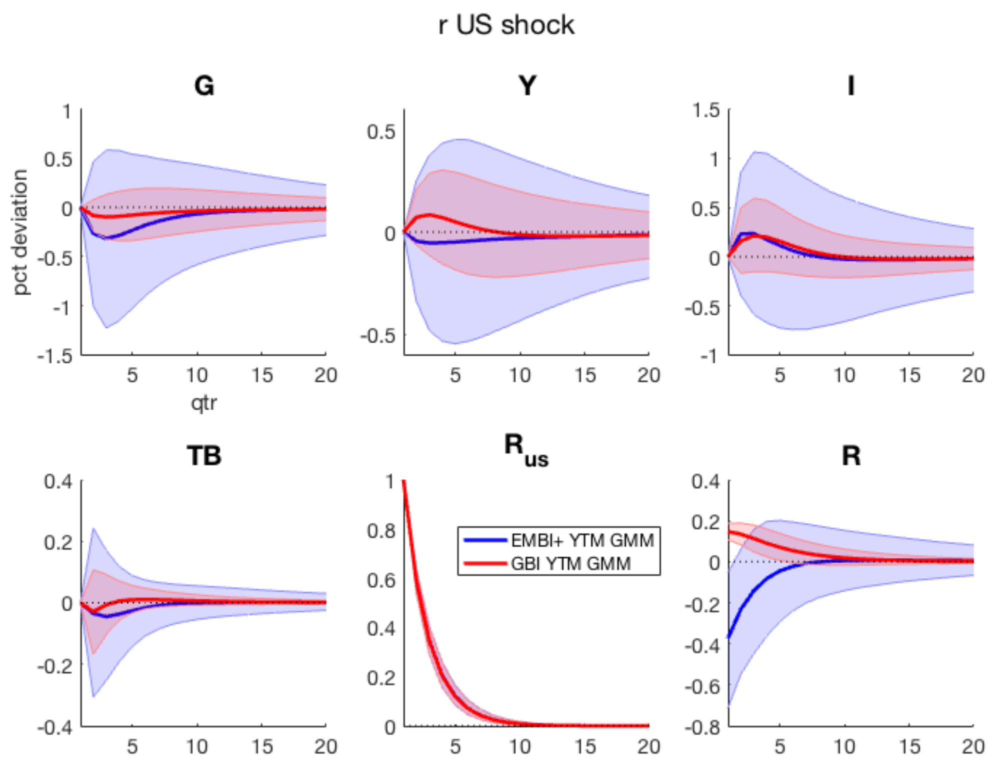
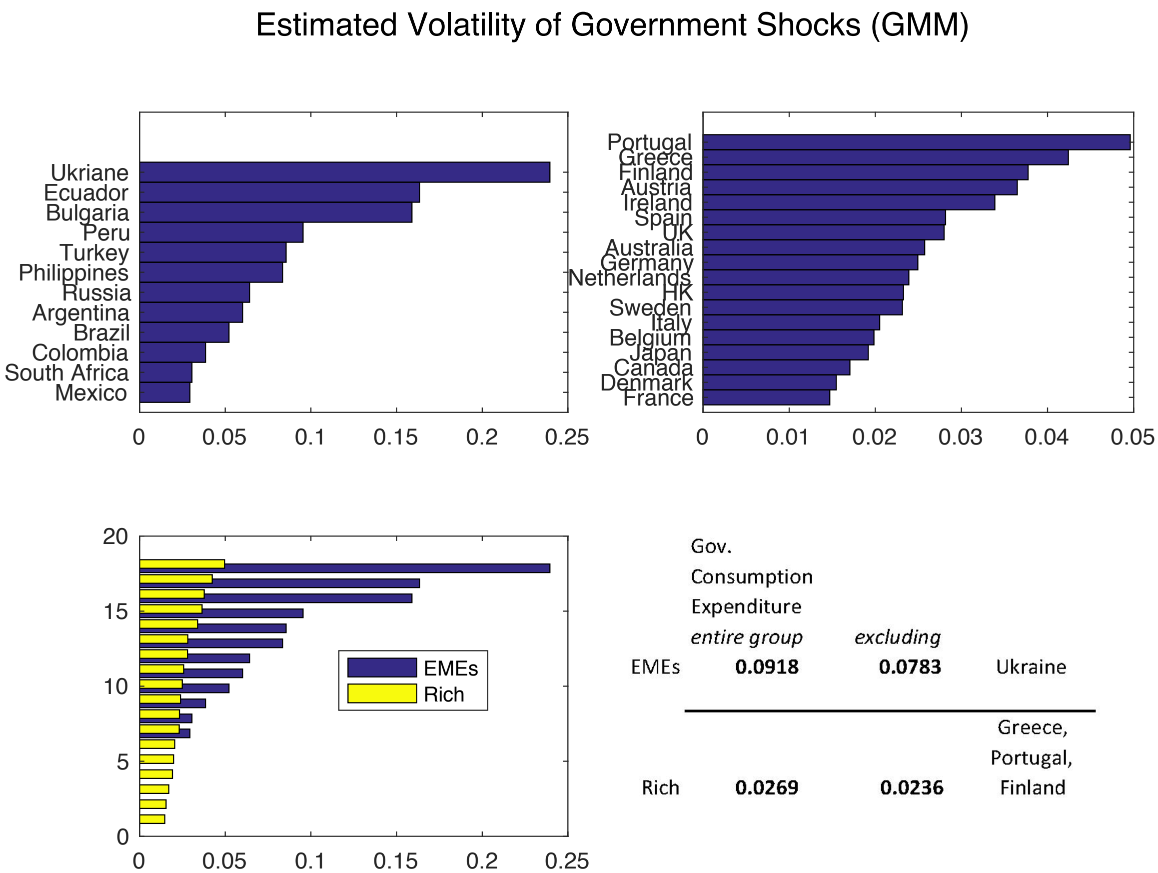
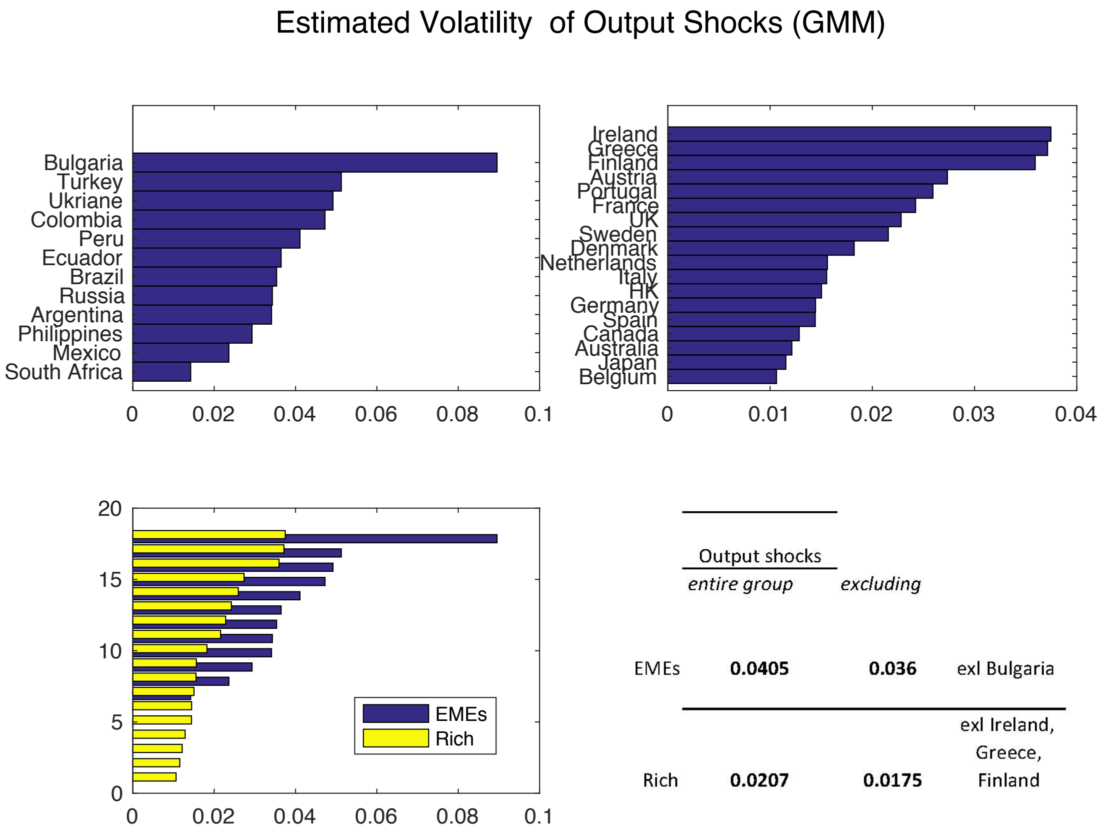


Figure 1.24: Government shock volatility by country; author's calculations based on identifying orthogonal shocks from GMM estimates; Reduced form residuals in first difference; Quarterly data (1994q1-2014q4)



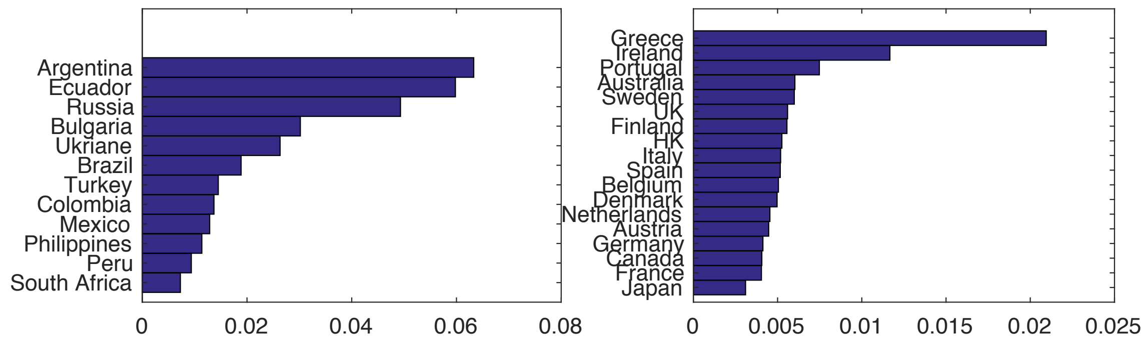
Gov. Consumption Expenditure	*entire group*	*excluding*	
EMEs	**0.0918**	**0.0783**	Ukraine
Rich	**0.0269**	**0.0236**	Greece, Portugal, Finland

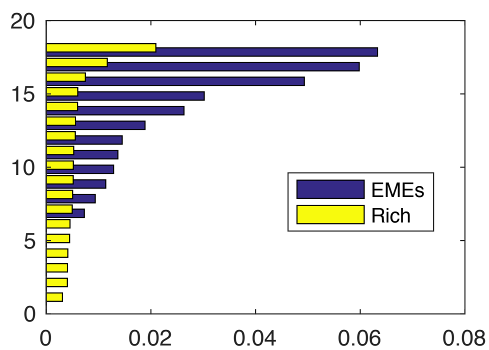
Figure 1.25: Output shock volatility by country; author's calculations based on identifying orthogonal shocks from GMM estimates; reduced form residuals in first difference; Quarterly data (1994q1-2014q4)



	Output shocks		
	entire group	*excluding*	
EMEs	**0.0405**	**0.036**	exl Bulgaria
Rich	**0.0207**	**0.0175**	exl Ireland, Greece, Finland

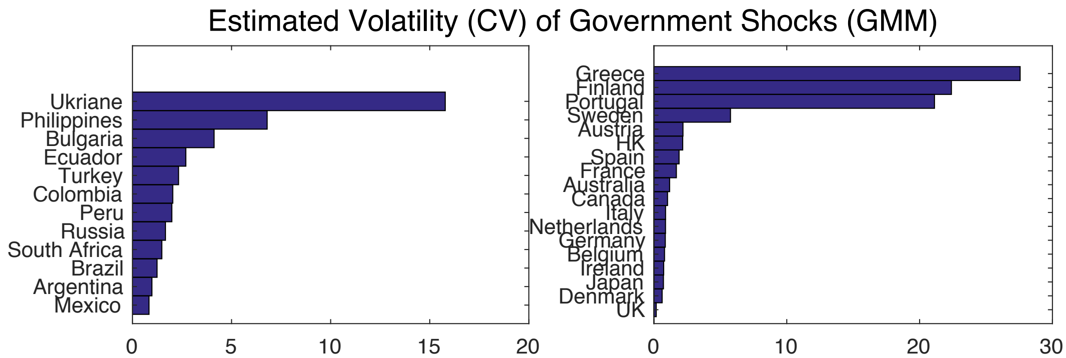
Figure 1.26: Sovereign rate shock volatility by country; author's calculations based on identifying orthogonal shocks from GMM estimates; reduced form residuals in first difference; Quarterly data (1994q1-2014q4)

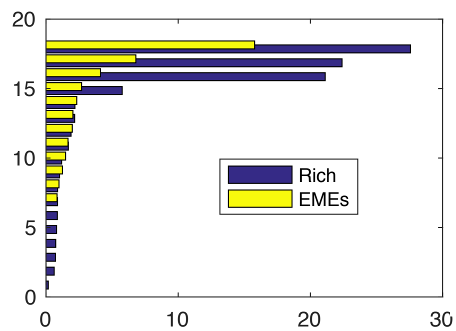




	Sovereign Rate shocks		
	entire group	*excluding*	
EMEs	0.0264	0.0161	Argentina, Ecuador, Russia
Rich	0.0063	0.0049	Greece, Ireland, Portugal

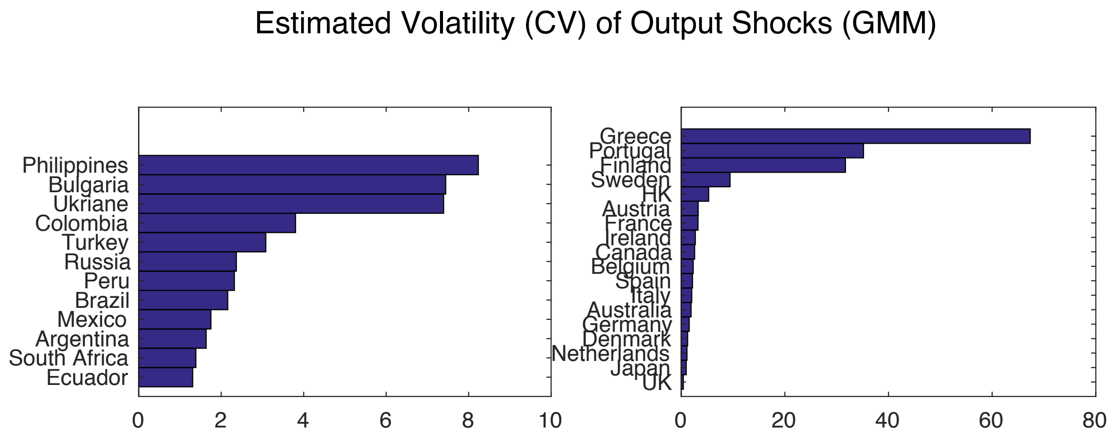
Figure 1.27: Government shock volatility by country (coefficient of variation); author's calculations based on identifying orthogonal shocks from GMM estimates; Reduced form residuals in levels; Quarterly data (1994q1-2014q4)

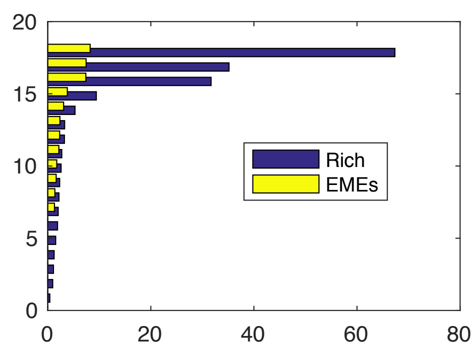




	Gov. Consumption Expenditure		
	entire group	*excluding*	
EMEs	3.4956	2.3787	exl Ukraine
Rich	5.1465	1.4371	exl Greece, Portugal, Finland

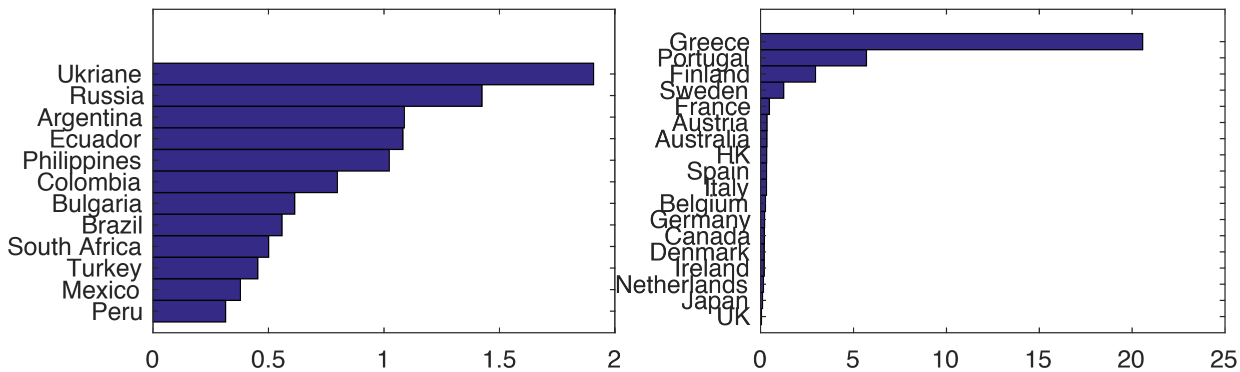
Figure 1.28: Output shock volatility by country (coefficient of variation); author's calculations based on identifying orthogonal shocks from GMM estimates; Reduced form residuals in levels; Quarterly data (1994q1-2014q4)

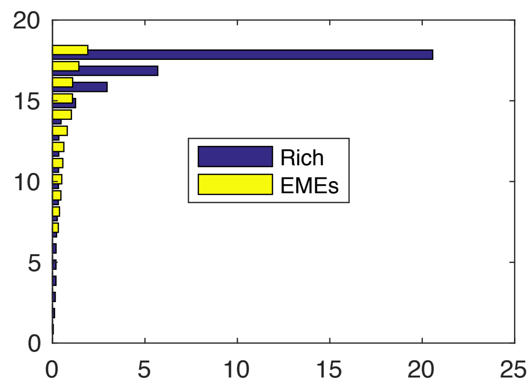




	Output		
	entire group	*excluding*	
EMEs	3.5737	2.2012	exl Ukraine, Bulgaria, Philippines
Rich	9.6934	2.6845	exl Greece, Portugal, Finland

Figure 1.29: Sovereign rate shock volatility by country (coefficient of variation); author's calculations based on identifying orthogonal shocks from GMM estimates; Reduced form residuals in first difference; Quarterly data (1994q1-2014q4)





	Sovereign Rate shocks		
	entire group	*excluding*	
EMEs	0.8453	0.6811	exl Ukraine, Bulgaria, Philippines
Rich	1.8845	0.3139	exl Greece, Portugal, Finland

Figure 1.30: AIC for GMM and fixed effects; $p = 1 : 5$

	AIC			
	GMM		FE	
lags	developed	EMEs	developed	EMEs
1	-46.7119	-38.1053	-49.309	-41.2971
2	-46.1426	-37.4819	-48.9648	-40.5906
3	-45.0822	-37.0076	-48.5105	-39.8988
4	-45.9714	-37.758	-48.3197	-39.8856
5	-44.3563	-36.9211	-48.0406	-40.032

Table 1.1: The table shows the statement of operations according to the IMF Government Finance Statistics Manual; The breakdown of revenue and expense by components as accounted for by statistical agencies as well as the definition of expenditure is of interest; source: IMF (2014)

Transactions affecting Net Worth	
1	**Revenue**
11	Taxes
12	Social Contributions [GFS]
13	Grants
14	Other Revenue
2	**Expense**
21	Compensation of Employees [GFS]
22	Use of Goods and Services
23	Consumption of fixed capital [GFS]
24	Interest [GFS]
25	Subsidies
26	Grant
27	Social Benefits [GFS]
28	Other expenses
NOB / GOB	**Net Operating Balance (1-2)**
Transactions in Non Financial Assets	
31	Net/gross investment in nonfinancial assets
311	Fixed Assets
312	Inventories
313	Valuables
314	Nonproduced Assets
2M	**Expenditure (2+31)**
NLB	**Net lending (+) / Net Borrowing (-) [GFS] (1-2-31) or (1-2M)**
Transactions in Financial Assets and Liabilities (Financing)	
32	Net acquisition of financial assets
321	Domestic
322	External
33	Net incurrence of liabilities
331	Domestic
332	External

Figure 1.31: Estimates of $A_{i=0,1}$; Dynamic panel data estimation, one-step difference GMM; quarterly data; deseasoned; (1994q1-2014q4); Npanels = 30; standard errors clustered by country are reported in parenthesis; last three rows report the p-values for the Hansen test of overidentifying restrictions (H_0: instruments are jointly valid i.e $(1/N)Z'\hat{U}$ is mean 0, N is the number of panels) and the Arellano-Bond test for autocorrelation in the error (H_0: error are not l-order serially correlated i.e $(1/N)E\hat{U}'_{-l}\hat{U} = 0$) **estimates shown for the base group (developed economies)**

	GC	Y	Inv	TBY	Safe R	Sov. R
GC		0.325***	0.014	-0.150**		0.006
		(0.069)	(0.135)	(0.053)		(0.022)
Y			0.955***	0.222*		0.025
			(0.113)	(0.102)		(0.016)
Inv				-0.135***		-0.035
				(0.019)		(0.019)
TBY						-0.021
						(0.011)
Safe R						0.056***
						(0.007)
Sov. R						
L.GC	0.729***	-0.061	-0.421**	0.014		0.024*
	(0.059)	(0.061)	(0.151)	(0.045)		(0.009)
L.Y	0.246**	0.683***	-0.084	0.004		-0.029
	(0.072)	(0.077)	(0.138)	(0.112)		(0.015)
L.Inv	-0.025	0.013	0.564***	0.003		0.011**
	(0.017)	(0.022)	(0.048)	(0.024)		(0.004)
L.TBY	-0.057	-0.062	-0.069	0.153		-0.008
	(0.044)	(0.081)	(0.097)	(0.092)		(0.010)
L.Safe R	-0.073***	0.097***	0.212**	-0.014	0.596***	-0.024
	(0.019)	(0.017)	(0.073)	(0.019)	(0.087)	(0.014)
L.Sov. Rate	-0.052	0.013	-0.542***	0.003		0.943***
	(0.029)	(0.042)	(0.127)	(0.042)		(0.018)
N	1896	1896	1896	1896	82	1895
hansenp	1.000	1.000	1.000	1.000		1.000
ar1p	0.028	0.003	0.003	0.086		0.049
ar2p	0.436	0.751	0.023	0.653		0.946

Figure 1.32: Estimates of $A_{i=0,1}$; Dynamic panel data estimation, one-step difference GMM; quarterly data; deseasonalized; (1994q1-2014q4); standard errors clustered by country are reported in parenthesis; Npanels = 30; last three rows report the p-values for the Hansen test of overidentifying restrictions (H_0: instruments are jointly valid i.e $(1/N)Z'\hat{U}$ is mean 0, N is the number of panels) and the Arellano-Bond test for autocorrelation in the error (H_0: error are not l-order serially correlated i.e $(1/N)E\hat{U}'_{-l}\hat{U} = 0$) **estimates shown for the interacted coefficients: emerging economies relative to developed**

	GC	Y	Inv	TBY	Safe R	Sov. R
GC x EME		-0.231**	-0.052	0.116		0.003
		(0.082)	(0.140)	(0.062)		(0.026)
Y x EME			0.291	-0.111		-0.075**
			(0.200)	(0.112)		(0.021)
Inv x EME				0.023		0.003
				(0.034)		(0.032)
TBY x EME						0.101
						(0.072)
Safe Rate x EME						-0.313**
						(0.098)
Sov. Rate x EME						
L.GC x EME	0.053	0.046	0.436*	-0.041		-0.029*
	(0.069)	(0.063)	(0.162)	(0.047)		(0.014)
L.Y x EME	0.000	0.049	-0.820**	0.076		0.050
	(0.083)	(0.145)	(0.230)	(0.142)		(0.036)
L.Inv x EME	-0.018	0.051	0.237***	0.011		0.011
	(0.033)	(0.044)	(0.059)	(0.037)		(0.026)
L.TBY x EME	-0.002	0.048	-0.011	0.314		-0.065
	(0.054)	(0.122)	(0.132)	(0.209)		(0.055)
L.Safe Rate x EME	-0.083	-0.130*	-0.038	-0.006		0.246**
	(0.048)	(0.061)	(0.091)	(0.044)		(0.072)
L.Sov. Rate x EME	-0.122*	-0.042	0.547***	0.064		-0.123**
	(0.045)	(0.093)	(0.140)	(0.049)		(0.040)

Figure 1.33: Dynamic panel data estimation, one-step difference GMM; quarterly data; deseasonalized; (1994q1-2014q4); Npanels = 30; standard errors clustered by country are reported in parenthesis; last three rows report the p-values for the Hansen test of overidentifying restrictions (H_0: instruments are jointly valid i.e $(1/N)Z'\hat{U}$ is mean 0, N is the number of panels) and the Arellano-Bond test for autocorrelation in the error (H_0: error are not l-order serially correlated i.e $(1/N)E\hat{U}'_{-l}\hat{U} = 0$) **Government response function to fundamentals across the two groups (developed and emerging); the first two columns show estimates based on group by group estimation; last two columns show estimates for the whole sample with developed economies being the base group.**

	GMM Estimates				
	GC	GC	GC		
	Rich	*Emerging*	**Joint**		
L.GC	0.729***	0.782***	0.729***	L.GC x EME	0.053
	(0.060)	(0.036)	(0.059)		(0.069)
L.Y	0.246**	0.247***	0.246**	L.Y x EME	0.000
	(0.073)	(0.043)	(0.072)		(0.083)
L.Inv	-0.025	-0.043	-0.025	L.Inv x EME	-0.018
	(0.018)	(0.029)	(0.017)		(0.033)
L.TBY	-0.057	-0.059	-0.057	L.TBY x EME	-0.002
	(0.044)	(0.033)	(0.044)		(0.054)
L.Safe Rate	-0.073**	-0.156**	-0.073***	L.Safe Rate x EME	-0.083
	(0.019)	(0.046)	(0.019)		(0.048)
L.Sov. Rate	-0.052	-0.174***	-0.052	L.Sov. Rate x EME	-0.122*
	(0.030)	(0.034)	(0.029)		(0.045)
N	1094	802	1896		
hansenp	1	1	1		
ar1p	0.001	0.04	0.028		
ar2p	0.078	0.549	0.436		

Figure 1.34: Dynamic panel data estimation, one-step difference GMM; quarterly data; deseasoned; (1994q1-2014q4); Npanels = 30; standard errors clustered by country are reported in parenthesis; last three rows report the p-values for the Hansen test of overidentifying restrictions (H_0: instruments are jointly valid i.e $(1/N)Z'\hat{U}$ is mean 0, N is the number of panels) and the Arellano-Bond test for autocorrelation in the error (H_0: errors are not l-order serially correlated i.e $(1/N)E\hat{U}'_{-l}\hat{U} = 0$) **Government response function to fundamentals across the two groups (developed and emerging); baseline estimation compared with estimates using private real GDP**

	GMM Estimates: GC				
		Y = Yprivate			Y = Yprivate
L.GC	0.729***	0.773***	L.GC x EME	0.053	-0.048
	(0.059)	(0.094)		(0.069)	(0.116)
L.Y	0.246**	0.209	L.Y x EME	0.000	0.035
	(0.072)	(0.105)		(0.083)	(0.105)
L.Inv	-0.025	-0.026	L.Inv x EME	-0.018	-0.004
	(0.017)	(0.064)		(0.033)	(0.102)
L.TBY	-0.057	-0.115	L.TBY x EME	-0.002	0.165
	(0.044)	(0.084)		(0.054)	(0.150)
L.Safe Rate	-0.073***	-0.105*	L.Safe Rate x EME	-0.083	-0.183
	(0.019)	(0.038)		(0.048)	(0.105)
L.Sov. Rate	-0.052	-0.067	L.Sov. Rate x EME	-0.122*	-0.230*
	(0.029)	(0.067)		(0.045)	(0.102)
N	1896	1896			
hansenp	1	1			
ar1p	0.028	0.034			
ar2p	0.436	0.445			

Figure 1.35: Government response function to fundamentals across the two groups (developed and emerging); baseline estimation compared with estimates from FE estimation; quarterly data; data is deseasoned in the case of GMM estimation and linearly detrended in the FE estimation. (1994q1-2014q4); Npanels = 30; standard errors clustered by country are reported in parenthesis; last three rows report the p-values for the Hansen test of overidentifying restrictions (H_0: instruments are jointly valid i.e $(1/N)Z'\hat{U}$ is mean 0, N is the number of panels) and the Arellano-Bond test for autocorrelation in the error (H_0: error are not l-order serially correlated i.e $(1/N)E\hat{U}'_{-l}\hat{U} = 0$)

	GC				
	Joint		Interacted		
	GMM	FE		GMM	FE
L.GC	0.729***	0.766***	L.GC x EME	0.053	-0.009
	(0.059)	(0.061)		(0.069)	(0.063)
L.Y	0.246**	0.138	L.Y x EME	0.000	-0.099
	(0.072)	(0.094)		(0.083)	(0.114)
L.Inv	-0.025	0.009	L.Inv x EME	-0.018	0.010
	(0.017)	(0.039)		(0.033)	(0.046)
L.TBY	-0.057	-0.070	L.TBY x EME	-0.002	0.119
	(0.044)	(0.078)		(0.054)	(0.095)
L.Safe Rate	-0.073***	-0.016	L.Safe Rate x EME	-0.083	0.112
	(0.019)	(0.154)		(0.048)	(0.242)
L.Sov. Rate	-0.052	-0.053	L.Sov. Rate x EME	-0.122*	-0.178**
	(0.029)	(0.056)		(0.045)	(0.068)
N	1896	1924			
hansenp	1				
ar1p	0.028				
ar2p	0.436				

Figure 1.36: Government response function to fundamentals across the two groups (developed and emerging); baseline estimation compared with estimates from FE estimation for the full sample of countries as well as excluding distressed economies; quarterly data; data is deseasonalized in the case of GMM estimation and linearly detrended in the FE estimation. (1994q1-2014q4); Npanels = 30; standard errors clustered by country are reported in parenthesis; last three rows report the p-values for the Hansen test of overidentifying restrictions (H_0: instruments are jointly valid i.e $(1/N)Z'\hat{U}$ is mean 0, N is the number of panels) and the Arellano-Bond test for autocorrelation in the error (H_0: error are not l-order serially correlated i.e $(1/N)E\hat{U}'_{-l}\hat{U} = 0$)

	GC								
	GMM	FE	GMM: excl GIIPs	FE (excl Greece, Portugal, Ireland)		GMM	FE	GMM: excl GIIPs	FE (excl Greece, Portugal, Ireland)
L.GC	0.729***	0.766***	0.905***	0.799***	L.GC x EME	0.053	-0.009	-0.123*	-0.042
	-0.059	(0.061)	(0.028)	(0.076)		(0.069)	(0.063)	(0.045)	(0.077)
L.Y	0.246**	0.138	0.027	0.092	L.Y x EME	0.000	-0.099	0.219***	-0.053
	-0.072	(0.094)	(0.034)	(0.121)		(0.083)	(0.114)	(0.054)	(0.139)
L.Inv	-0.025	0.009	0.026	0.019	L.Inv x EME	-0.018	0.010	-0.069*	-0.000
	-0.017	(0.039)	(0.017)	(0.049)		(0.033)	(0.046)	(0.033)	(0.054)
L.TBY	-0.057	-0.070	0.050	-0.057	L.TBY x EME	-0.002	0.119	-0.109*	0.106
	-0.044	(0.078)	(0.040)	(0.104)		(0.054)	(0.095)	(0.052)	(0.118)
L.Safe Rate	-0.073***	-0.016	-0.049***	-0.034	L.Safe Rate x EME	-0.083	0.112	-0.107*	0.130
	-0.019	(0.154)	(0.011)	(0.180)		(0.048)	(0.242)	(0.046)	(0.266)
L.Sov. Rate	-0.052	-0.053	-0.075	-0.079	L.Sov. Rate x EME	-0.122*	-0.178**	-0.098	-0.152
	-0.029	(0.056)	(0.065)	(0.230)		(0.045)	(0.068)	(0.073)	(0.234)
N	1896	1924	1581						
hansenp	1		1						
ar1p	0.028		0.032						
ar2p	0.436		0.476						

Figure 1.37: Variance decomposition at different horizons ($H = 1 : 20$): **government consumption shocks**; calculated based on GMM estimation on the deseasoned data; (1994q1-2014q4); Npanels = 30;

	Variance Decomposition: Government Consumption Shock											
	EMBI +						GBI					
H	G	Y	I	TB	Rus	R	G	Y	I	TB	Rus	R
1	1.000	0.004	0.010	0.006	0.000	0.000	1.000	0.018	0.013	0.017	0.000	0.000
2	0.988	0.017	0.018	0.006	0.000	0.001	0.933	0.043	0.019	0.019	0.000	0.010
3	0.967	0.037	0.036	0.007	0.000	0.003	0.876	0.086	0.019	0.020	0.000	0.024
4	0.943	0.059	0.055	0.008	0.000	0.008	0.835	0.129	0.017	0.020	0.000	0.037
5	0.919	0.079	0.074	0.008	0.000	0.014	0.805	0.168	0.019	0.020	0.000	0.049
6	0.898	0.095	0.089	0.010	0.000	0.020	0.781	0.200	0.023	0.020	0.000	0.059
7	0.880	0.108	0.103	0.011	0.000	0.027	0.763	0.226	0.029	0.020	0.000	0.068
8	0.864	0.118	0.113	0.012	0.000	0.033	0.748	0.247	0.036	0.020	0.000	0.075
9	0.851	0.127	0.122	0.013	0.000	0.038	0.736	0.264	0.043	0.020	0.000	0.080
10	0.840	0.134	0.129	0.014	0.000	0.043	0.726	0.278	0.050	0.020	0.000	0.085
	....											
15	0.803	0.154	0.151	0.018	0.000	0.060	0.693	0.319	0.078	0.020	0.000	0.098
16	0.799	0.156	0.153	0.018	0.000	0.062	0.689	0.324	0.082	0.020	0.000	0.100
17	0.795	0.158	0.155	0.019	0.000	0.064	0.686	0.328	0.085	0.020	0.000	0.101
18	0.791	0.160	0.157	0.019	0.000	0.066	0.682	0.331	0.089	0.020	0.000	0.102
19	0.789	0.162	0.159	0.019	0.000	0.067	0.680	0.334	0.092	0.020	0.000	0.102
20	0.786	0.163	0.160	0.020	0.000	0.069	0.677	0.337	0.094	0.020	0.000	0.103

Figure 1.38: Variance decomposition at different horizons ($H = 1 : 20$): **output shocks**; calculated based on GMM estimation on the deseasoned data; (1994q1-2014q4); Npanels = 30;

	Variance Decomposition: Output Shock											
	EMBI +						GBI					
H	G	Y	I	TB	Rus	R	G	Y	I	TB	Rus	R
1	0.000	0.996	0.343	0.008	0.000	0.033	0.000	0.982	0.113	0.003	0.000	0.00
2	0.006	0.971	0.304	0.023	0.000	0.044	0.048	0.951	0.198	0.003	0.000	0.01
3	0.019	0.934	0.315	0.023	0.000	0.072	0.092	0.904	0.275	0.003	0.000	0.01
4	0.035	0.898	0.334	0.024	0.000	0.100	0.126	0.857	0.324	0.004	0.000	0.01
5	0.052	0.867	0.351	0.026	0.000	0.124	0.152	0.815	0.353	0.005	0.000	0.02
6	0.068	0.842	0.365	0.028	0.000	0.143	0.172	0.779	0.372	0.006	0.000	0.02
7	0.082	0.822	0.376	0.031	0.000	0.158	0.189	0.750	0.384	0.007	0.000	0.02
8	0.093	0.806	0.385	0.033	0.000	0.170	0.203	0.727	0.393	0.008	0.000	0.02
9	0.104	0.793	0.391	0.035	0.000	0.179	0.214	0.707	0.398	0.008	0.000	0.02
10	0.112	0.783	0.397	0.037	0.000	0.187	0.223	0.691	0.402	0.009	0.000	0.02
...												
15	0.140	0.752	0.412	0.044	0.000	0.210	0.253	0.644	0.411	0.010	0.000	0.02
16	0.144	0.748	0.414	0.045	0.000	0.213	0.257	0.639	0.412	0.010	0.000	0.02
17	0.147	0.745	0.416	0.045	0.000	0.215	0.260	0.634	0.413	0.010	0.000	0.02
18	0.149	0.743	0.417	0.046	0.000	0.217	0.263	0.630	0.413	0.011	0.000	0.02
19	0.152	0.740	0.418	0.047	0.000	0.219	0.266	0.627	0.414	0.011	0.000	0.02
20	0.154	0.738	0.419	0.047	0.000	0.221	0.268	0.624	0.414	0.011	0.000	0.02

Figure 1.39: Variance decomposition at different horizons ($H = 1 : 20$): **sovereign rate shocks**; calculated based on GMM estimation on the deseasoned data; (1994q1-2014q4); Npanels = 30;

	Variance Decomposition: Sovereogn Yield Shock											
	EMBI +						GBI					
H	G	Y	I	TB	Rus	R	G	Y	I	TB	Rus	R
1	0.000	0.000	0.000	0.000	0.000	0.941	0.000	0.000	0.000	0.000	0.000	0.934
2	0.004	0.000	0.002	0.014	0.000	0.935	0.001	0.000	0.009	0.003	0.000	0.946
3	0.010	0.001	0.005	0.023	0.000	0.906	0.002	0.000	0.019	0.007	0.000	0.935
4	0.015	0.003	0.009	0.028	0.000	0.874	0.003	0.001	0.028	0.010	0.000	0.920
5	0.019	0.005	0.013	0.030	0.000	0.843	0.003	0.001	0.034	0.012	0.000	0.906
6	0.022	0.008	0.016	0.031	0.000	0.817	0.004	0.002	0.039	0.013	0.000	0.894
7	0.024	0.010	0.018	0.032	0.000	0.793	0.005	0.003	0.042	0.014	0.000	0.884
8	0.026	0.012	0.020	0.033	0.000	0.774	0.005	0.003	0.045	0.015	0.000	0.876
9	0.027	0.014	0.022	0.033	0.000	0.757	0.006	0.004	0.047	0.016	0.000	0.869
10	0.028	0.016	0.024	0.033	0.000	0.743	0.006	0.005	0.049	0.016	0.000	0.864
	….											
15	0.030	0.021	0.028	0.033	0.000	0.697	0.008	0.007	0.052	0.018	0.000	0.850
16	0.030	0.022	0.029	0.033	0.000	0.691	0.009	0.007	0.052	0.018	0.000	0.848
17	0.031	0.022	0.029	0.033	0.000	0.687	0.009	0.008	0.052	0.018	0.000	0.847
18	0.031	0.023	0.030	0.033	0.000	0.682	0.009	0.008	0.052	0.018	0.000	0.846
19	0.031	0.023	0.030	0.034	0.000	0.679	0.009	0.008	0.052	0.018	0.000	0.845
20	0.031	0.023	0.030	0.034	0.000	0.675	0.010	0.009	0.052	0.018	0.000	0.844

Figure 1.40: Government consumption shock; Quarterly data (1994q1-2014q4); FE estimates; bootstrapped 95% confidence intervals based on 10000 simulations; the sample excludes Portugal, Greece and Italy

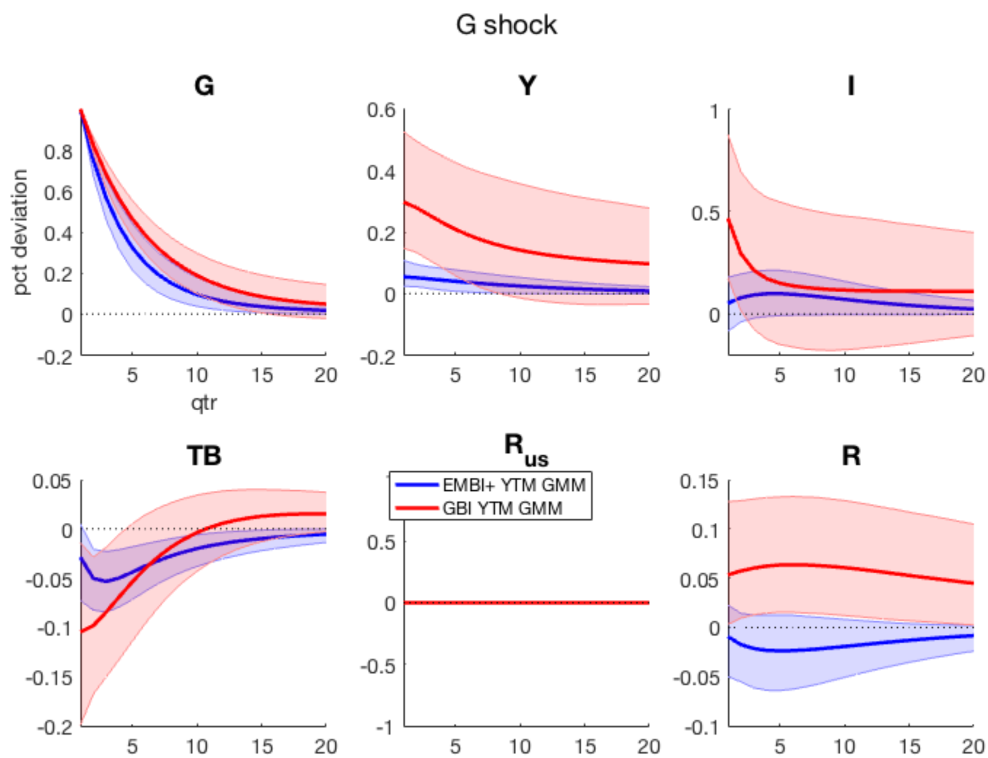


Figure 1.41: Output shock; Quarterly data (1994q1-2014q4); FE estimates; bootstrapped 95% confidence intervals based on 10000 simulations; the sample excludes Portugal, Greece and Italy

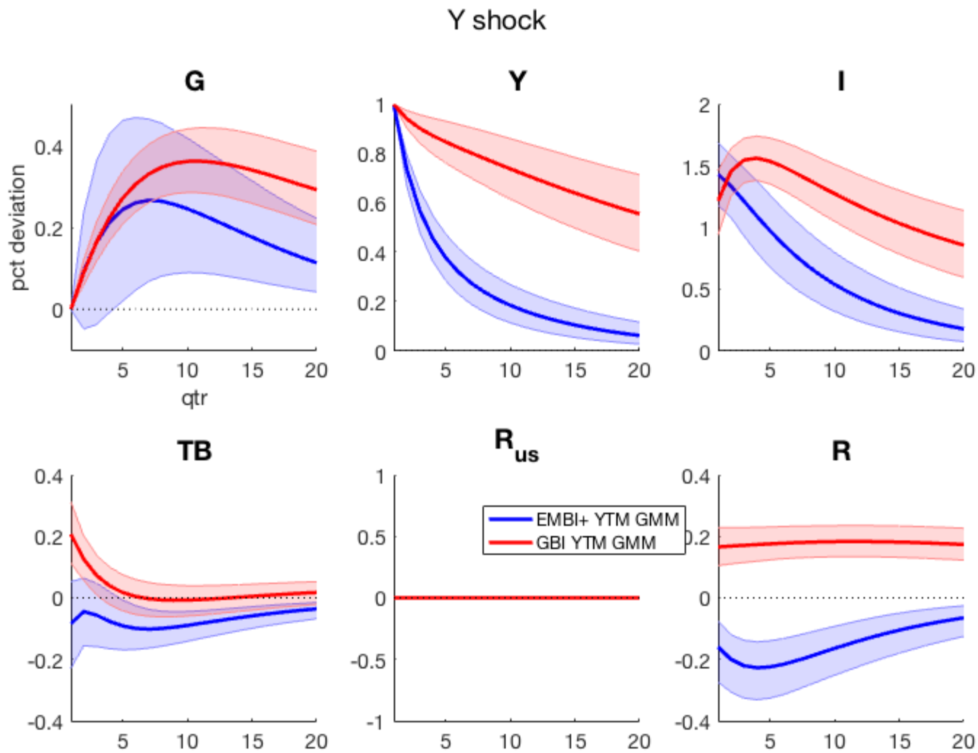


Figure 1.42: Sovereign rate shock; Quarterly data (1994q1-2014q4); FE estimates; bootstrapped 95% confidence intervals based on 10000 simulations; the sample excludes Portugal, Greece and Italy

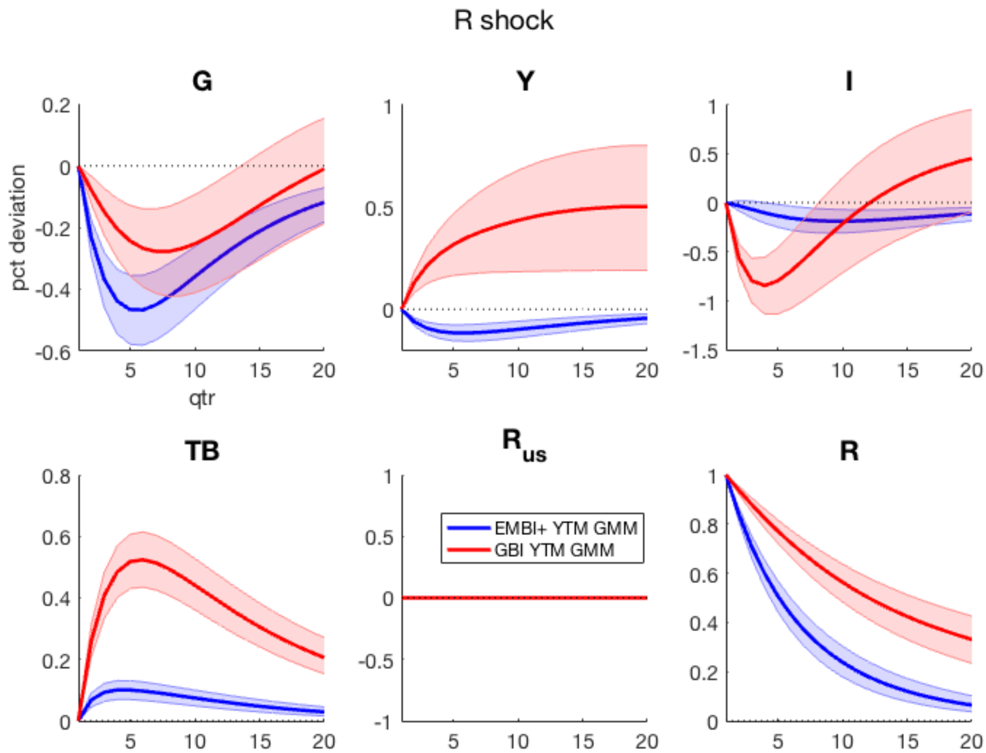
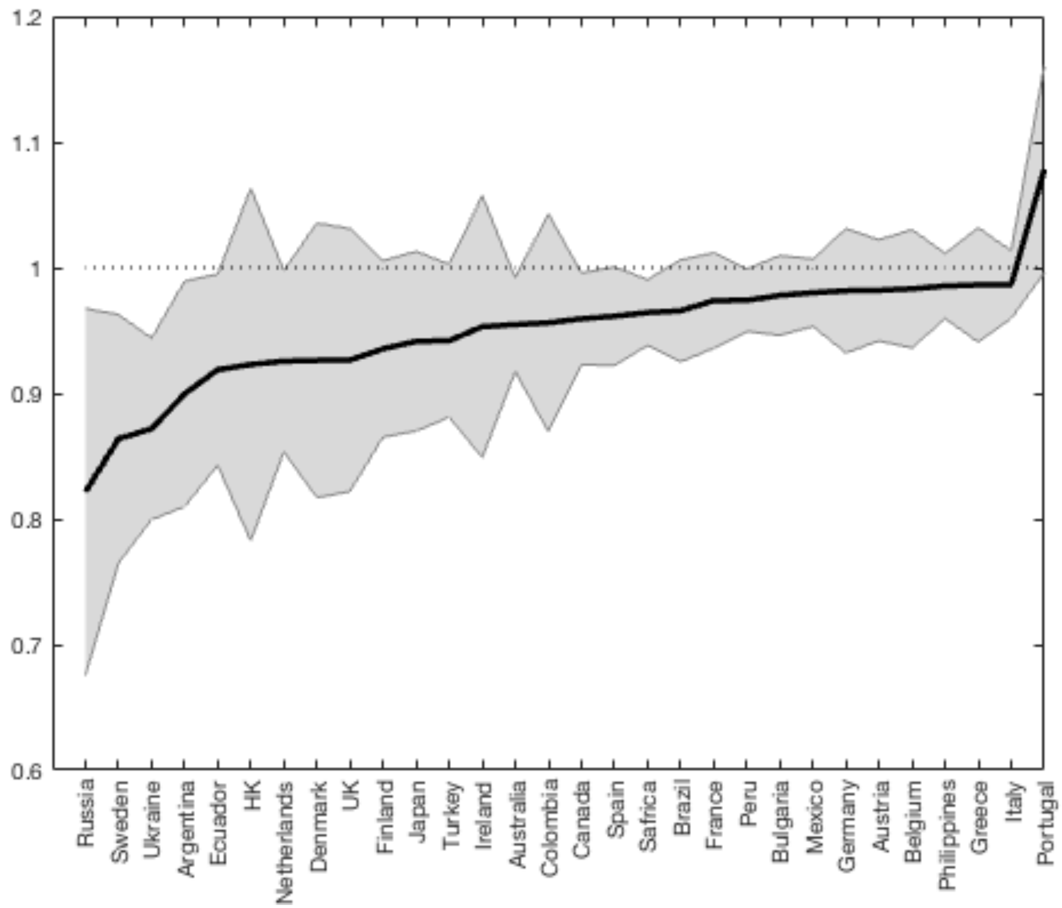


Figure 1.43: Eigenvalues of selected matrices

FE: full sample	Group	Eigen Values	Group	Eigen Values	GMM: Full Sample	Group	Eigen Values	Group	Eigen Values
	EME = 0	0.3670	EME = 1	0.462		EME = 0	0.1239	EME = 1	0.9397
		0.6234		0.915			0.2216		0.1017
		0.8096		0.752			0.6426		0.5766
		1.0106		0.817			0.9504		0.5766
		0.9790		0.627			0.8534		0.4929
		0.5959		0.596			0.5961		0.5961
FE: excl GIIPS									
	EME = 0	0.5559							
		1.0024							
		0.8670							
		0.7157							
		0.7157							
		0.5955							
FE excl Portugal, Greece, Italy									
	EME = 0	0.4871							
		0.6306							
		0.8548							
		0.9894							
		0.8996							
		0.5957							

Figure 1.44: Autoregressive coefficient of the government rate; estimates by country



Chapter 2

Estimating the Dynamics of Fiscal Financing in Emerging Economies

2.1 Introduction

In this paper I propose a strategy for estimating the government financing rule for an emerging economy. The estimation uses the structural VAR impulse responses obtained in the previous chapter to discipline the parameters of a small open economy real business cycle model with a public sector. The parameters can be split into two groups: those influencing the effectiveness of fiscal policy (i.e the multiplier M_Y^G) and the parameters governing the financing of the exogenous stream of government consumption. The empirical response to interest rate shocks puts restrictions on the first group of parameters governing the size of the multiplier. The empirical response to a government consumption shock can be used to obtain estimates of the fiscal policy rule. I construct a model with a role for both interest rate shocks and government consumption shocks. A natural estimation approach in this case is impulse response matching.

A few stylized facts emerge from the analysis in the first chapter. The response of government consumption expenditure to domestic fundamentals for both developed and emerging economies is the same. Government consumption expenditure decreases in response to an interest rate increase in emerging economies. Finally, government consumption multipliers are lower for emerging economies. This paper focuses on the last stylized fact and aims to uncover the reasons for the lower multiplier. The revenue side of government financing is outside of the scope of the empirical chapter. As revenue data for a panel of countries (particularly the emerging groups) is hard to obtain, this chapter discusses the use of model based estimates of government financing.

The theoretical literature has emphasized the mode of financing for how effective fiscal expansions are: for instance Gali et al. (2007) in a closed economy context and Garcia and Restrepo (2007) for a small open economy. Model based estimates of fiscal policy rules for developed economies using Bayesian techniques exist: for example Leeper et al. (2010) and references therein and Christoffel et al. (2011). The emphasis in this paper is accounting for the feedback between the interest rate and domestic fundamentals as well as the feedback between government consumption and the interest rate. The estimation approach is in the spirit of Uribe and Yue (2006). Figure 2.1 is a stylized summary of their approach; using the estimated effect of domestic fundamentals on the interest rate, they obtain model based estimates of the parameters governing the propagation of interest rate shocks. Figure 2.2 schematically shows my estimation approach. It builds on the intuition that the propagation of both an interest rate shock and a government consumption shock depends on the same groups of parameters. Estimating those as a first stage would allow the estimation of a lump sum financing rule in the second stage. Figure 2.3 summarizes the approach when taxes are distortionary. In the next sections, I outline a model to be used in the estimation.

2.2 Stylized Model

In this section I adopt the stylized approach in Hall (2009) to demonstrate the key features of a small open economy model which can meaningfully propagate both interest rate and government consumption shocks. Starting with the closed economy real business cycle model, this model implies a trade-off between consumption and output in response to a government consumption shock. While the government consumption multiplier implied by the model is always positive under separable utility, consumption must fall for output to increase. The increase in the equilibrium level of labor is solely due to the increase in labor supply. Higher output is the result of higher labor supply induced by the negative income /wealth effect due to the higher level of government consumption spending. The stronger the income effect, the higher is the government spending multiplier on output. However, the fact that consumption must fall for output to increase guarantees that the government spending multiplier on output is less than 1.

Counter-cyclical mark-ups remove the trade-off between consumption and output in a closed economy setting. The labor wedge allows the real wage and labor demand to increase in response to a government consumption shock. While in the real business cycle model, a bigger decrease in consumption also induces a bigger increase in the consumption-constant labor supply leading to a higher output multiplier, the opposite is true in a model which features a labor wedge distortion. Figure 2.4 shows a stylized representation.

To elucidate, I follow Hall (2009) in specifying a stylized economy in which a counter-cyclical labor wedge is introduced in the labor demand schedule. The capital stock is assumed to be fixed and normalized to 1. The aggregate price level is normalized to 1. The household optimizes: $E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, h_t)$ subject to $w_t h_t + \pi_t = c_t + g_t$ i.e period consumption is financed from labor income and the firm's profit net of government consumption expenditure. The government runs a balanced budget and finances lump sum expenditures. Production is $y_t = h_t^{\alpha}$.[1] The aggregate resource constraint implies that production output goes to household and government consumption. $y_t = c_t + g_t$. In this simple model:

Labor Demand:

$$\hat{w}_t = -(1-\alpha)\hat{h}_t$$

Labor Supply:

$$\hat{w}_t = F_h \hat{h}_t + F_c(\hat{y}_t - \hat{g}_t)$$

$F_h = \frac{u_{hh} h}{u_h}$, $F_c = \frac{-u_{cc} c}{u_c}$

For separable utility ($u(c,h) = \frac{c^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} - \gamma \frac{h^{1+\frac{1}{\psi}}}{1+\frac{1}{\psi}}$): $F_h = \frac{1}{\psi} \equiv$ the inverse of the Frisch elasticity of labor supply, $F_c = \frac{1}{\sigma} \equiv$ the inverse of the intertemporal elasticity of substitution.[2]

Introducing a simple counter-cyclical mark-up resolves the trade-off between consumption and output. As labor demand increases in response to the increase in aggregate demand, it is possible for both consumption and output to increase in response to an increase in government consumption.

While in the perfectly competitive case a larger drop in consumption leads to a

[1]With capital fixed, the production function exhibits decreasing returns, which generates profits even in the absence of a labor wedge. Profits are rebated to the household.

[2]For GHH preferences (commonly used in the SOE literature) $\frac{u_{hh}}{u_h}\hat{h} = \frac{u_c c}{u_c} c + \frac{1}{\psi}\hat{h}$ and the labor supply becomes: $\psi \hat{w} = \hat{h}$.

high multiplier (M_G^Y), just the opposite is true in the case of when a labor wedge distortion is introduced. In this case I assume market power and monopolistic markup which varies counter-cyclically: $P = \mu(y)C_y$ with $\mu(y) = y^{-\omega}$. Recalling that the aggregate price is normalized to 1, labor demand becomes:

$$w_t = \frac{\alpha}{y_t^{-\omega}} y_t^{\frac{-(1-\alpha)}{\alpha}} = \frac{\alpha}{y_t^{-\omega}} h_t^{-(1-\alpha)}$$

The implied multiplier under separable preferences and perfect competition is:

$$\frac{\hat{y}_t}{\hat{g}_t} = (1 + \frac{\sigma}{\psi\alpha} + \frac{(1-\alpha)\sigma}{\alpha})^{-1}$$

The multiplier is higher for less important decreasing returns to labor (higher α), higher Frisch elasticity and lower σ i.e. lower intertemporal elasticity of substitution.

The implied multiplier under separable preferences and a labor wedge is:

$$\frac{\hat{y}_t}{\hat{g}_t} = (1 + \frac{\sigma}{\psi\alpha} + \frac{(1-\alpha)\sigma}{\alpha} - \sigma\omega)^{-1}$$

While the multiplier is strictly lower than 1 in the perfectly competitive case, for a sufficiently high mark-up elasticity in the case with a labor wedge, the multiplier can be higher than 1. For standard parameterization, an elasticity higher than 1.18 is required for the multiplier to be larger than 1 (figure 2.5). For $\omega = 0.5$, the multiplier is 0.75. This is not substantially different from the multiplier when $\omega = 0$, which is 0.63.

Figure 2.6 reports the impulse response to a unitary shock to government consumption for three different levels of the mark-up elasticity. For all three, output increases. However, in the absence of a labor wedge, the decrease in consumption which brings about the expansion in output is too large to be supported by empirical evidence. Increasing the mark-up elasticity decreases / reverses the decrease in consumption and the wage. In turn, the multiplier increases.

With this intuition in hand, I analyze how the multiplier changes once the household can borrow from abroad. The period budget constraint becomes: $w_t h_t + \pi_t + b_t - Rb_{t-1} = c_t + g_t + \Psi(b_t)$. Relaxing the closed economy assumption leads to two important differences. First, domestic absorption need not equal output and the consumption multiplier is not one minus the output multiplier. Second, up to a negligible equilibrium inducing portfolio adjustment cost, the household faces a perfectly elastic supply of loanable funds. Figure 2.7 compares the impulse response of consumption, hours worked, the wage, output and the multiplier to the same government consumption shock in the closed and in the small open economy case in the absence of a labor wedge. In terms of the signs of the impulse responses, the same logic transpires in the SOE: consumption falls, which through the income effect leads to an increase in hours and output. The multiplier in the SOE case, however, is lower. The drop in consumption is also smaller, approaching the empirical estimates (Hall (2009) reviews the empirical literature on the response of consumption to a government shock). Because the household can borrow from abroad, they can smooth consumption without increasing labor effort as much as in the closed economy counterpart. For a relatively smaller increase in labor effort, a much higher level consumption is sustained in the SOE. In other words part of the negative income effect is offset by international borrowing. For this reason, the fall in the real wage is also smaller.

Figure 2.8 explores the effect of the elasticity of the labor wedge on the multiplier in the open and in the closed economy variant of the model. For lower values of the mark-up counter-cyclicality ($\omega \leq 1.03$), the SOE multiplier is lower than the closed economy multiplier. This can be explained with the previous finding that the income effect induces a smaller increase in labor effort in the small open economy. As ω increases, the SOE multiplier approaches the closed economy multiplier. For $\omega \in (1.03, 1.04]$, the SOE multiplier surpasses the closed economy one.

The stylized model suggests that a key model feature for the propagation of government consumption shocks is the behavior of the counter cyclical labor wedge. Commonly nominal rigidities would be responsible for generating the wedge.[3] Gali et al. (2007) show that price rigidity increases the multiplier and dampens the decrease in consumption, but cannot alone lead to a multiplier higher than 1.

The propagation of interest rate shocks also depends on the parameters governing the labor wedge. Neumeyer and Perri (2005) introduce a working capital constraint for firms as a propagation mechanism for interest rate shocks. The working capital constraint introduces a labor wedge analogous to the labor wedge discussed above, which however depends on the interest rate:

$$\hat{w}_t = \begin{cases} \text{-}\alpha \hat{h}_t \text{ if } \eta = 0 \\ \\ -\frac{\eta(\text{wedge})}{R} \hat{R}^d_t - \alpha \hat{h}_t \text{ if } \eta \neq 0 \end{cases}$$

where η is the fraction of the wage subject to the working capital constraint.[4] To the extent that output affects the interest rate, this leads again to a counter-cyclical wedge, which puts restrictions on how effective government spending is i.e. $\omega = \frac{\eta(\text{wedge})}{R} \epsilon^R_y$, ϵ^R_y is the elasticity of the interest rate to real output. Hevia (2014) estimates the cyclical behavior of a labor wedge (in addition to four other wedges) and shows

[3] Bilbiie et al. (2012) is an example of a real model in which countercyclical mark-ups arise because of product creation.

[4] I provide more details on introducing the working capital constraint in the next section.

that the wedges of the estimated prototype economy are consistent with a model with a working capital and a collateral constraint.

2.3 Model

Below I present a heterogenous agent, small open economy model with a public sector. The model nests both the cases of distortionary and non-distortionary taxation. There are two types of households: Ricardian and non-Ricardian. The Ricardian household has access to a one period, internationally-traded, non-state-contingent bond while the Non-Ricardian household has no financial means for consumption smoothing. Following seminal work by Neumeyer and Perri (2005), I impose a working capital constraint on firms. The firm's production technology also features a learning by doing externality. The interest rate on government borrowing is determined in international financial markets. It is depends on fundamentals and is subject to unexpected, transitory shocks. This is in keeping with the small open economy literature emphasis on international borrowing conditions as one of the key drivers of business cycles in these economies.

A heterogenous agent model is particularly relevant in the context of emerging economies as a non-negligible share of households having no access to financial markets is even more plausible for these economies. The model-based Bayesian estimation results on data from the Philippines reported by Mandelman (2013) put the mean value for the share of Non-Ricardian households at 62% with a plausible range between 42% and 90%. Using similar methodology, Barrail Halley (2017) reports similar, even slightly higher estimates of this parameter on data for Mexico with the mean of the posterior distribution at 75%.

2.3.1 Ricardians

There is a continuum of infinitely-lived Ricardian households. The mass of these households is $1-\kappa$. Each of them maximizes a life-time utility given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t^R, h_t^R)$$

where β is the discount factor, h^R and c^R are total hours worked and consumption respectively for a Ricardian household.

Each Ricardian household faces the following resource constraint in period t:

$$(1-\tau_t)w_t h_t^R + d_{kt}^R + d_t^R = (1+\tau_t^c)c_t^R + z_t^R + R_{t-1}d_{t-1}^R + (1-\kappa)\Psi(d_t^R)$$

Variables with an R superscript denote quantities describing a Ricardian household. Income for this household consists of payments to labor, where the real wage is denoted by w_t, dividend payments denoted by d_{kt}^R, which are rebated to the Ricardian household by a perfectly competitive capital goods firm and the household's borrowing d_t^R in the form of one period non state contingent debt. These assets are used for consumption, paying down the previous period's debt or extracted by the government as a lump sum tax $z_t > 0$ (or a lump sum transfer $z_t < 0$). Each household is subject to the weighted portfolio adjustment costs $\Psi(d_t^R)$. As is standard in the small open economy literature, a small quadratic portfolio adjustment cost is included simply as a stationarity inducing device as in Schmitt-Grohe and Uribe (2003b). Ricardian households borrow at the R_t gross interest rate. The government levies taxes on labor income τ_t and on consumption τ_t^c. The tax levied on capital income is paid by the capital goods firm. Finally β is the discount factor for both the Ricardian and the non-Ricardian household.

The implied first order conditions for the Ricardian households are:

$$\frac{-u_h(c_t^R, h_t^R)}{u_c(c_t^R, h_t^R)} = \frac{(1-\tau_t)}{(1+\tau_t^c)} w_t$$

$$\frac{1-\Psi'(d_t)}{R_t} = \beta E_t \frac{\lambda_{t+1}}{\lambda_t}$$

$$\lambda_t = \frac{u_c(c_t^R, h_t^R)}{1+\tau_t^c{}_t}$$

d_t is the private sector debt as defined in the aggregation section. The interpretation of these conditions is as follows. The first condition denotes the Ricardian household labor supply and equates the marginal disutility of labor effort to the after-tax utility value of the wage rate. The second condition is the asset pricing relationship for the Ricardian household. The condition also defines the economy-wide interest rate $R_t^d = \frac{R_t}{1-\Psi'(d_t)}$. Finally, the third condition equates the marginal utility of wealth to the marginal utility of consumption with τ_t^c increasing the shadow value of real income. It is clear from the first order conditions that when $\tau_t^c \neq -\tau_t$, the taxes distort the marginal rate of transformation. The model also features a tax on capital returns paid by the capital goods firm. Coleman (2000) shows that taxing consumption and subsidizing labor at the same, constant rate is optimal in the context of a dynamic closed economy model with capital and a complete set of tax instruments. The result generalizes the uniform taxation principle to the dynamic setting that all final goods (consumption and leisure) should be taxed at the same rate. Schmitt-Grohe and Uribe (2003a) provides examples why this need not be the case for a small open economy due to the household's access to international financial markets. The focus of this study is a positive analysis of fiscal financing; establishing the optimal tax policy is outside the scope the paper.

2.3.2 Non-Ricardians

The rest of the households with mass κ in the economy are Non-Ricardians. The lifetime utility for these households is:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t^{NR}, h_t^{NR})$$

The face the following budget constraint:

$$(1-\tau_t) w_t h_t^{NR} = (1+\tau_t^c) c_t^{NR} + z_t^{NR}$$

Non-Ricardian households face the same tax rates as the Ricardians. However, Non-Ricardians have no access to financial or capital markets to borrow or save in i.e. they consume their income in a hand-to-mouth fashion. Hence they solve only an intra-temporal allocation problem defining their labor supply schedule:

$$\frac{-u_h(c_t^{NR}, h_t^{NR})}{u_c(c_t^{NR}, h_t^{NR})} = \frac{(1-\tau_t)}{(1+\tau_t^c)} w_t$$

As a natural modeling approach, I assume that the government does not differentiate between Ricardian and Non-Ricardian households in terms of taxes and sets the same labor and consumption tax across both types of households. In the same way, when revenue is lump sum financed, $\hat{z}_t^{NR} = \hat{z}_t^R$ in deviations from the model's steady state. I allow for differences in the steady state level of the lump sum tax / transfer to ensure the same level of steady state consumption and hours worked for the both households.

2.3.3 Capital Goods Firm

A perfectly competitive capital goods firm owns the capital stock and maximizes the discounted stream of dividends d_{kt}, which are rebated to the household:

$$E_0 \sum_{t=0}^{\infty} M_t\{(1-\tau_t^k)u_t k_t - i_t\}$$

τ_t^k is the tax rate on capital returns and $M_t = \beta^t \lambda_t$ is the shadow value of income for the Ricardian households. The capital stock accumulation is standard:

$$k_{t+1} = (1-\delta)k_t + \Phi(\frac{i_t}{k_t})k_t$$

The first order conditions for the capital goods firm are:

$$-1 + q_t \Phi_i(\frac{i_t}{k_t})k_t = 0$$

$$-q_t + E_t M_{t,t+1}((1-\tau_{t+1}^k)u_{t+1} + q_{t+1}(1-\delta-\Phi_i(\frac{i_{t+1}}{k_{t+1}})i_{t+1})) = 0$$

The first order conditions recover conventional results from the q-theory of investment. q_t is the shadow value of capital. As the model features a single good economy whose price is normalized to 1, marginal q would be also 1 in the absence of capital adjustment costs.[5]

[5] Recasting the firm's problem as a Bellman equation:

$$v(k_t;\epsilon_t) = max_{i_t}\{r_t k_t - i_t - \phi(i_t,k_t) + \beta E_t M_{t,t+1} v(i_t + (1-\delta)k_t, \epsilon_{t+1})\}$$

optimality requires:

$v_1(k_t;\epsilon_t) = r_t - \frac{\partial\phi(i_t,k_r)}{\partial k_t} + \beta(1-\delta)E_t M_{t,t+1} v_1(k_{t+1};\epsilon_{t+1})$

$-1 - \frac{\partial\phi(i_t,k_t)}{\partial i_t} + \beta E_t M_{t,t+1} v_1(k_{t+1};\epsilon_{t+1}) = 0$

combining the two equations:

$v_1(k_t;\epsilon_t) = r_t - \frac{\partial\phi(i_t,k_r)}{\partial k_t} + (1-\delta)(1+\frac{\partial\phi(i_t,k_t)}{\partial i_t})$.

2.3.4 Consumption Good Firm

The consumption good firm faces a working capital constraint. It is required to hold a fraction of its wage bill in the form of non-interest-bearing securities: $\varsigma_t \geq \eta w_t h_t$. It is optimal that the constraint binds. The firm can also borrow at the economy-wide interest rate R^d. The firm maximizes the discounted stream of profits:

$$E_0 \sum_{t=0}^{\infty} M_t \pi_t = E_0 \sum_{t=0}^{\infty} M_t \{F(k_t, h_t) - w_t h_t - u_t k_t - \eta w_t h_t + \eta w_{t-1} h_{t-1} + d_t^f - R_t^d d_{t-1}^f\}$$

$M_t = \beta^t \lambda_t$ is the discount factor for the firm.

Capital and labor demand schedules are defined below:

$$u_t = F_k(k_t, h_t)$$

$$w_t = (1 + \eta \frac{R_t^d - 1}{R_t^d})^{-1} F_h(k_t, h_t)$$

As shown in Uribe and Yue (2006) in equilibrium $d_t^f = \varsigma_t$ and $\pi_t = 0$.

I assume a production function which exhibits a learning by doing externality. In particular:

$$y_t = a_t^{\zeta} k_t^{\alpha} h_t^{1-\alpha-\zeta}$$

Having found an expression for today's marginal value, we can get the pricing of capital: $\left(1 + \frac{\partial \phi(I_t, K_t)}{\partial I_t}\right) = \beta M_{t,t+1} \left(r_{t+1} + (1-\delta) \frac{\partial \phi(I_{t+1}, K_{t+1})}{\partial I_{t+1}} - \frac{\partial \phi(I_{t+1}, K_{t+1})}{\partial K_{t+1}} \right) = 0.$

$q_t = \beta E_t M_{t,t+1} v_1(k_{t+1}; \epsilon_{t+1}) = 1 + \frac{\partial \phi(i_t, k_t)}{\partial i_t}$ is the marginal value of capital i.e the marginal benefit of increasing the stock K_{t+1}. Hayashi: under regularity assumptions $q_t = Q_t$. Then:

$q_t K_t = v_t$ and $v_t = d_t + \beta E_t \sum M_{t,t+1} v_{t+1}$.

where $a_t = (a_{t-1})^{\mu^a}(\bar{y}_{t-1})^{1-\mu^a}$ is managerial capital. Based on Garcia-Cicco and Kawamura (2015), $\mu^a = 0.6$ and ζ is a parameter to be estimated. The assumed functional form implies: $\hat{a}_t = (1-\mu^a)\sum_{i=0}(\mu^a)^i \hat{y}_{t-i-1}$ The firm does not internalize the externality and the fact that in equilibrium $y_t = \bar{y}_t$. This friction has been used in the literature on Dutch disease. A few examples include Garcia-Cicco and Kawamura (2015), Lama and Medina (2012) and Magud and Sosa (2010).

2.3.5 The Public Sector

The government must finance a stream of unproductive consumption g_t with tax revenue and borrowing in international financial markets. The budget constraint for the government is:

$$g_t = z_t + \tau_t^c c_t + \tau_t^k u_t k_t + \tau_t w_t h_t + b_t - R_{t-1}^g b_{t-1}$$

c_t , k_t, h_t are aggregate levels of consumption, capital and hours worked. b_t denotes the stock of one period risk-free government debt issued in international financial markets.

The choice of financing for the government is rule-based.

$$FV_t = Zy_{t-1} + \Xi b_{t-1} + \rho FV_{t-1} + \sigma e_t$$

FV_t is a vector of fiscal variables expressed in deviations from the steady state. Z, Ξ and ρ, σ are coefficient matrices, e_t is a vector of serially uncorrelated Standard Normal shocks $e_t \sim N(0,1)$.

$$\mathrm{FV}_t = \begin{bmatrix} \hat{g}_t \\ r\hat{e}v_t \end{bmatrix}; Z = \begin{bmatrix} Z_g \\ Z_{rev} \end{bmatrix}; \Xi = \begin{bmatrix} \Xi_g \\ \Xi_{rev} \end{bmatrix}; \rho = \begin{bmatrix} \rho_{gg} & 0 \\ 0 & \rho_{rev} \end{bmatrix}$$

In the case of distortionary taxation, it is reasonable to allow for cross correlations in the taxes shock matrix: [6]

$$\rho = \begin{bmatrix} \rho_g & 0 & 0 & 0 \\ 0 & \rho_{kk} & \rho_{kl} & \rho_{kc} \\ 0 & \rho_{kl} & \rho_{ll} & \rho_{lc} \\ 0 & \rho_{kc} & \rho_{lc} & \rho_{cc} \end{bmatrix}$$

In the case of non-distortionary taxation:

$$\rho = \begin{bmatrix} \rho_g & 0 \\ 0 & \rho_z \end{bmatrix}$$

Finally, σ is a diagonal matrix with the fiscal shocks' standard deviations:

$$\sigma = \begin{bmatrix} \sigma_g & 0 \\ 0 & \sigma_{rev} \end{bmatrix}$$

[6] Leeper et al. (2010) specify and estimate a shock process for the US, in which a reduced form tax shock depends on a linear combination of its own shocks as well as the shocks to the other taxes.

Combining the government constraint and the financing rule (and setting ρ_g and ρ_z to 0), the following equation determines the evolution of government debt:

$$b_t = (Z_g - Z_{rev} + R^g_{t-1})b_{t-1} + (\Xi_g - \Xi_{rev} + R^g_{t-1})y_{t-1} + \sigma^g e_t$$

For stability it is required that $Z_g - Z_{rev} + R^g_{t-1} < 1$.

2.3.6 Aggregation

I require that the following aggregation relationships hold:

$$c_t = \lambda c^R_t + (1-\lambda)c^{NR}_t$$

$$h_t = \lambda h^R_t + (1-\lambda)h^{NR}_t$$

$$(1-\lambda)d^R_t = d_t$$

$$(1-\lambda)d^R_{kt} = d_{kt}$$

The trade balance and net foreign lending are:

$$tb_t = w_t h_t + u_t k_t - (i_t + c_t + \Psi(d_t) + g_t)$$

$$R_{t-1}(d_{t-1} + \frac{R^g_{t-1}}{R_{t-1}}b_{t-1}) = d_t + b_t + tb_t$$

2.3.7 Borrowing Costs and Shocks

The steady-state rate for the private ($R = R^f$) and public (R^g) sector are parameterized. Outside of the model's non-stochastic steady state, the government borrowing rate is determined by the estimated coefficients of the SVAR model.

Estimates for the Emerging Group

$$
\begin{aligned}
R_t^g \;\; = \;\; & 0.017G_t - 0.078Y_t - 0.036INV_t + 0.091TBY_t - 0.347Rus_t + \\
& 0.001G_{t-1} - 0.055Y_{t-1} + 0.032INV_{t-1} - 0.069tby_{t-1} + 0.233Rus_{t-1} + 0.628R_{t-1} + \sigma^r e_t^r
\end{aligned}
$$

Estimates for the Developed Group

$$
\begin{aligned}
R_t^g \;\; = \;\; & 0.003G_t - 0.055Y_t - 0.046INV_t - 0.021TBY_t - 0.033Rus_t + \\
& 0.007G_{t-1} - 0.03Y_{t-1} + 0.013INV_{t-1} - 0.007TBY_{t-1} - 0.005Rus_{t-1} + 0.804R_{t-1} + \sigma^r e_t^r
\end{aligned}
$$

The response of the rate for the Ricardians is determined by the pass-through to the private sector: $R_t = \mu^r R_t^g$. Akinci (2013) and Arteta and Hale (2008) provide estimates of μ^r.

2.4 Discussion

The model provides a flexible way to switch between distortionary and non-distortionary taxation by either setting $\tau_t^k = \tau_t^c = \tau_t = 0$ or $z_t = \bar{z^i}$. While more realistic, distortionary taxation increases the number of parameters to be estimated. Additionally, it might be impossible to identify those without data on individual tax revenue components. Leeper et al. (2010) provide estimates of the tax rates shock cross-correlation matrix ρ based on the US.

The specified model does not feature any nominal frictions as I have aimed to specify as stylized a model as possible. A model with nominal frictions as in Gertler et al. (2007) and Mandelman (2013) would also introduce a counter-cyclical labor wedge and make the economy sensitive to both interest rate fluctuations and government consumption spending. The challenge in this setting is specifying a realistic monetary policy rule for an emerging economy. Mandelman (2013) estimates a small open economy model on data from the Philippines with Bayesian methods and obtains estimates for an open economy version of the Taylor rule which smooths the nominal interest rate, inflation, the nominal exchange rate and the output gap.

2.5 Estimation Strategy

There are 10 parameters of interest: $\theta = [\eta\ \phi\ \kappa\ \zeta\ Z_g\ Z_{rev}\ \Xi_g\ \Xi_{rev}\ \rho_{gg}\ \rho_{rev}]$ in the lump sum taxation case. η is the fraction of the wage subject to a working capital constraint, ϕ is capital adjustment cost, κ is the fraction of non-Ricardian consumers, ζ governs the importance of the learning by doing externality in the production function, Z and Ξ are the response of fiscal variable to output and debt and ρ is the autocorrelation of fiscal variables. The parameter space can be further reduced if the SVAR estimates for $[Z_g\ \rho_{gg}]$ are used and eliminating the shocks to revenue. Then the parameters to be estimated are: $\theta = [\eta\ \phi\ \kappa\ \zeta\ Z_{rev}\ \Xi_g\ \Xi_{rev}]$. An estimation approach which utilizes the impulse responses obtained in the previous chapter is to perform an impulse response matching exercise as in Garcia-Cicco and Kawamura (2015), Uribe and Yue (2006) among others. In this exercise, θ minimizes the following criterion:

$$min_{\hat{\theta}}[IR^e - IR^m(\hat{\theta})]'\Sigma_{IR^e}^{-1}[IR^e - IR^m(\hat{\theta})]$$

where IR^e are the estimated impulse responses and $R^m(\theta)$ are the model generated responses.

In what follows I illustrate the key features of the model and how they relate to the estimation approach. For the impulse response analysis I have set $\kappa = 0$ and introduced preferences with external habit formation (Abel (1990)). The model is summarized in the appendix. Figure 2.9 reports the impulse response to an interest rate shock with and without a working capital constraint. In both cases the interest rate shock is contractionary. Due to the wealth effect, consumption, investment and output decrease. In the absence of a working capital constraint, the impact response of labor demand is nil. In the following periods, depressed demand reduces output, the real wage and hours worked. Once the working capital constraint is imposed, setting $\eta = 0.5$, labor demand responds on impact. The overall response of labor demand is magnified. This leads the response of consumption to the interest rate shock to more than double relative to the case when $\eta = 0$. Due to the capital adjustment costs, η has little bearing on the response of investment and the trade balance. Figure 2.10 reports the impulse responses to a range of values for η.

The exercise illustrates the importance of η for the magnitude of the response of output. Whether the labor wedge introduced through a working capital constraint can respond to government consumption shocks depends on the strength of the feedback from output to the real rate. Figure 2.13 reports the impulse responses to an interest rate shock with and without a feedback from fundamentals to the real rate. Although, the feedback increases the overall sensitivity of the model variables to an interest rate shock, the overall difference is admittedly small. To reinforce the sensitivity of the labor wedge to shocks other than those to the interest rate, I introduce a learning by doing externality.

Figures 2.11 and 2.12 show the impulse response of model variables to an interest rate shock under different parameter values for habit (μ) and capital adjustment costs (ϕ). The exercise is instructive in terms of the household's ability to adjust consumption and investment in the face of a wealth shock. When capital adjustment costs are high, most of the variation is absorbed by the adjustment cost itself. Outside of the trade balance and investment, Φ matters for the convergence of output and consumption. The external habit formation parameter, on the other hand, predominantly influences the consumption-saving decision and the stock of debt with a meaningful, but relatively short lived effect on consumption and the trade balance.

2.6 Future work

Obtaining estimates of the government financing rule for emerging economies will allow the construction of counterfactual government consumption multipliers under alternative financing rules. Such counterfactual exercises will shed light on how much debt intolerance as coined by Reinhart et al. (2003) limits the scope of fiscal policy in emerging economies. Counterfactual financing can also quantify the effect on aggregate volatility and the welfare implications of alternative financing rules.

2.7 Figures

Figure 2.1: Schematic representation of the estimation approach in Uribe and Yue (2006)

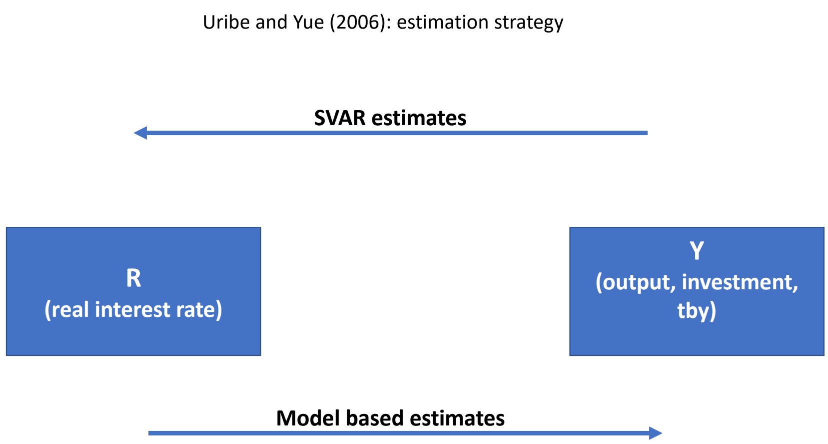


Figure 2.2: Schematic representation of proposed estimation strategy: the lump sum taxation case

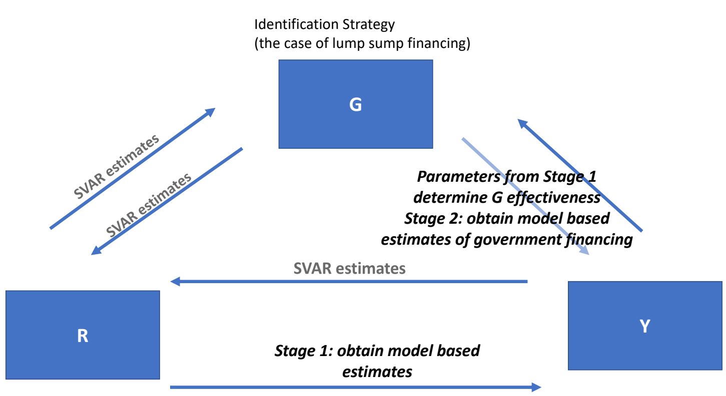


Figure 2.3: Schematic representation of proposed estimation strategy: distortionary taxation

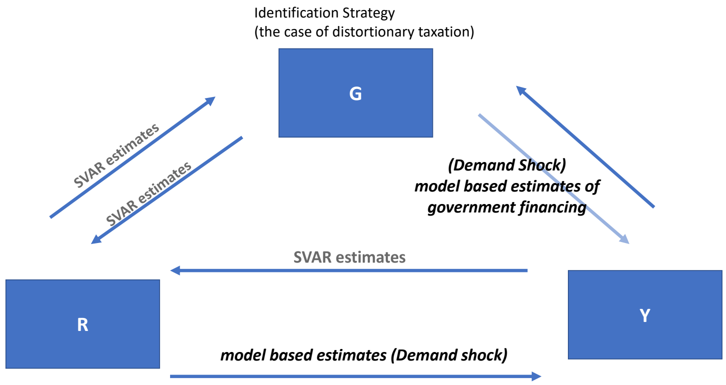


Figure 2.4: Schematic representation of the labor market in a closed economy model

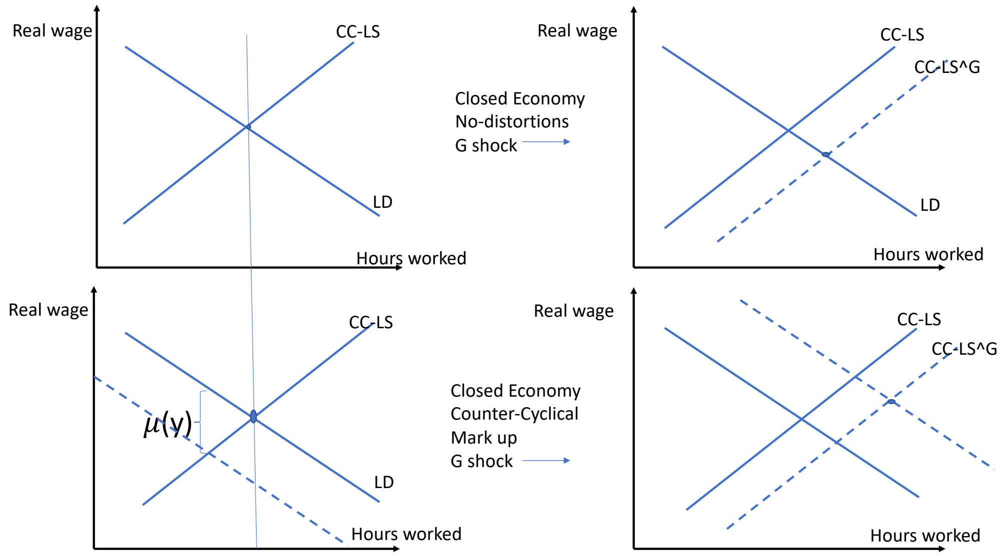


Figure 2.5: Parameterization and implied parameter values in the closed economy stylized model

	SEPARABE UTILITY			
Parameter	**Meaning**	**high omega**	**low omega**	**no mark up**
gam	labor disutility weight	1.10		
xi	complemetarity (c and h)	-		
sigma	IES	0.50		
alpha	decreasing returns to labor	0.70		
psi	labor Frisch elasticity	1.90		
omega	mark up elasticity to output	1.18	0.50	0.00
m(dy/dg)	multiplier	1.00	0.75	0.63

Figure 2.6: Impulse response to a government consumption shock in the closed economy

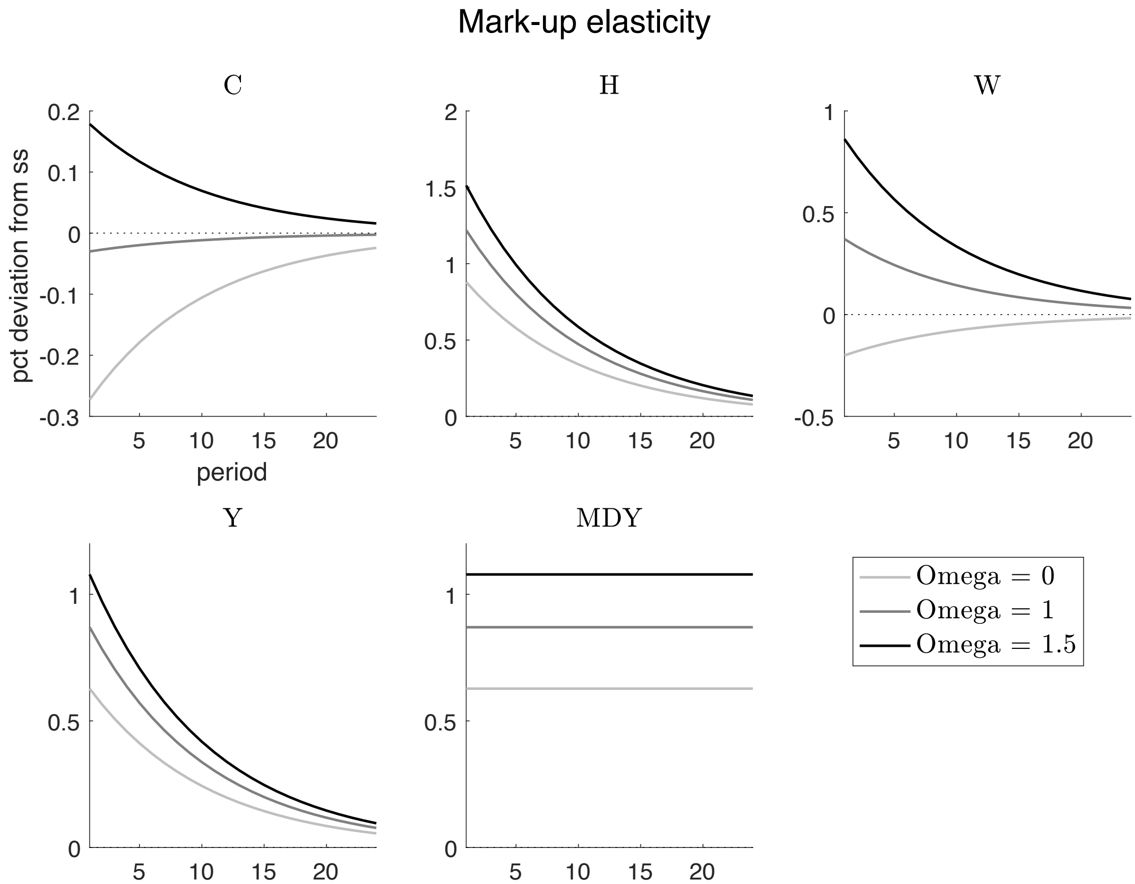


Figure 2.7: Impulse response to a government consumption shock in the closed economy

NO MARK UP

	C	H	W	Y	MYG
	CLOSED ECONOMY				
impact	-0.27	0.88	-0.20	0.63	0.63
t=12	-0.11	0.34	-0.08	0.24	0.63
t=24	-0.02	0.08	-0.02	0.06	0.63
	OPEN ECONOMY				
	C	**H**	**W**	**Y**	**MYG**
impact	-0.08	0.26	-0.06	0.19	0.19
t=12	-0.07	0.25	-0.06	0.18	0.28
t=24	-0.06	0.22	-0.05	0.15	0.45

Figure 2.8: Government consumption shock: closed versus open economy

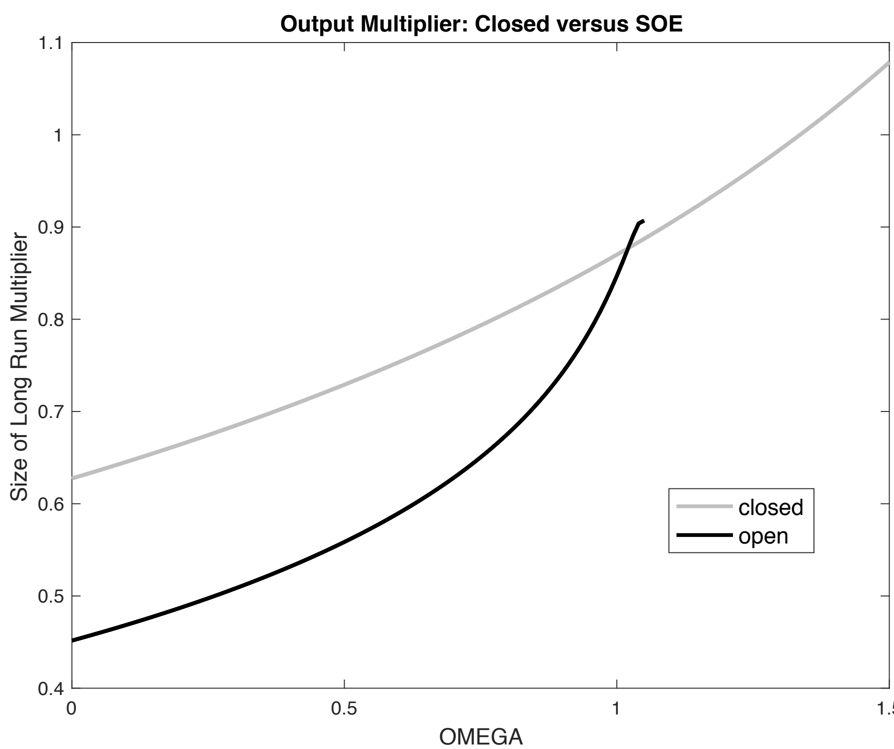


Figure 2.9: Introducing a working capital constraint

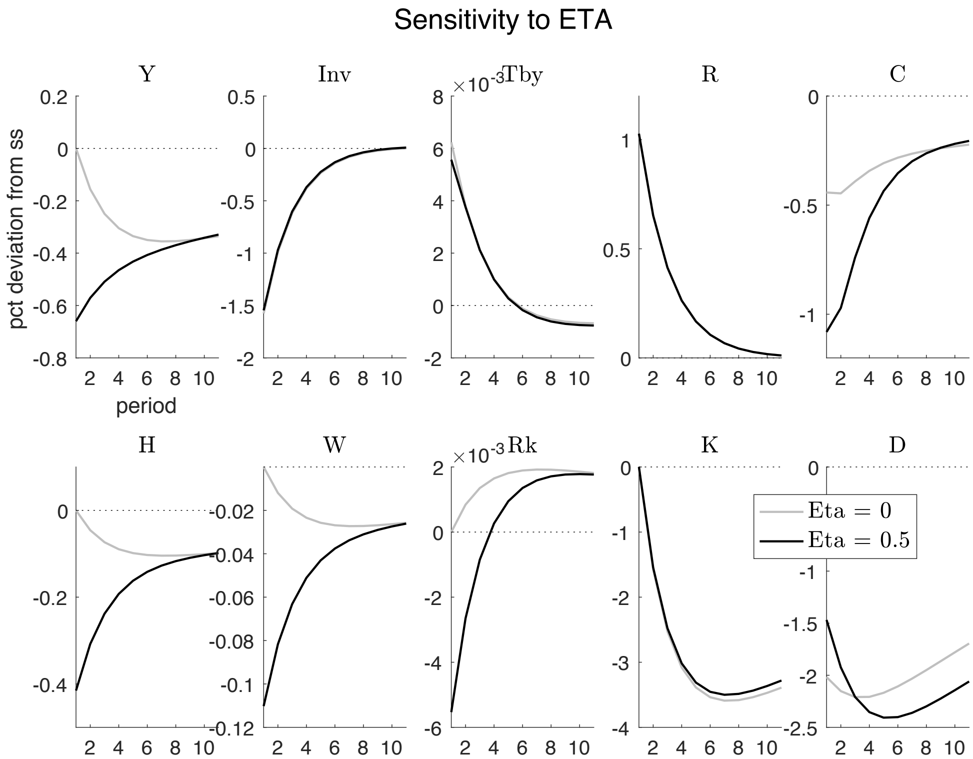


Figure 2.10: Sensitivity to η

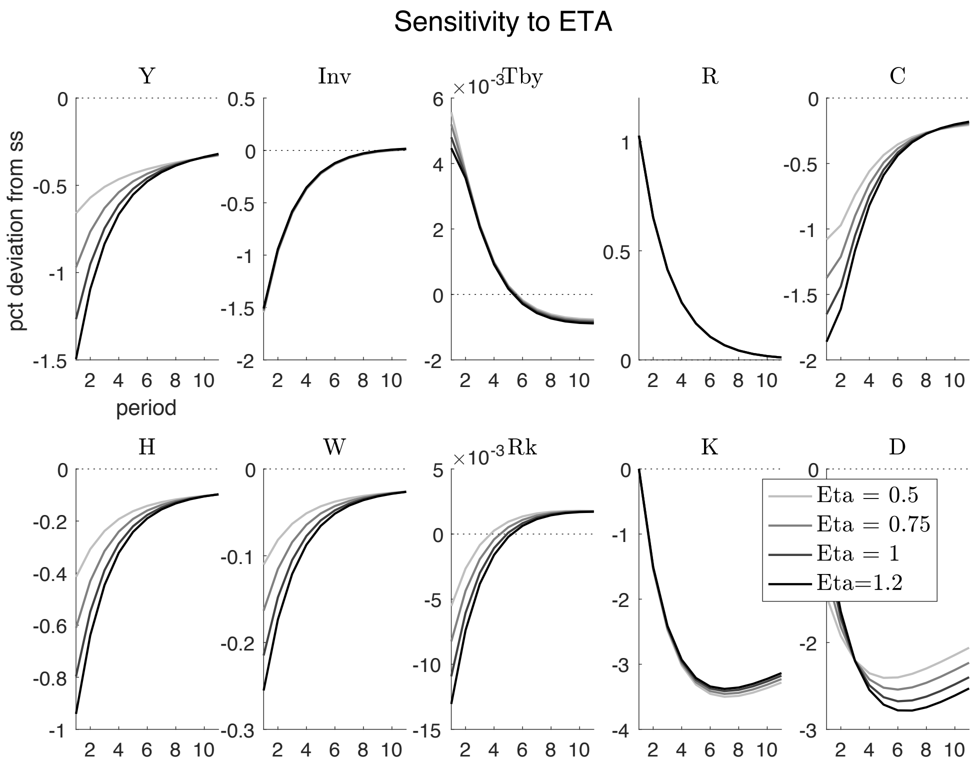


Figure 2.11: Sensitivity to the capital adjustment cost ϕ

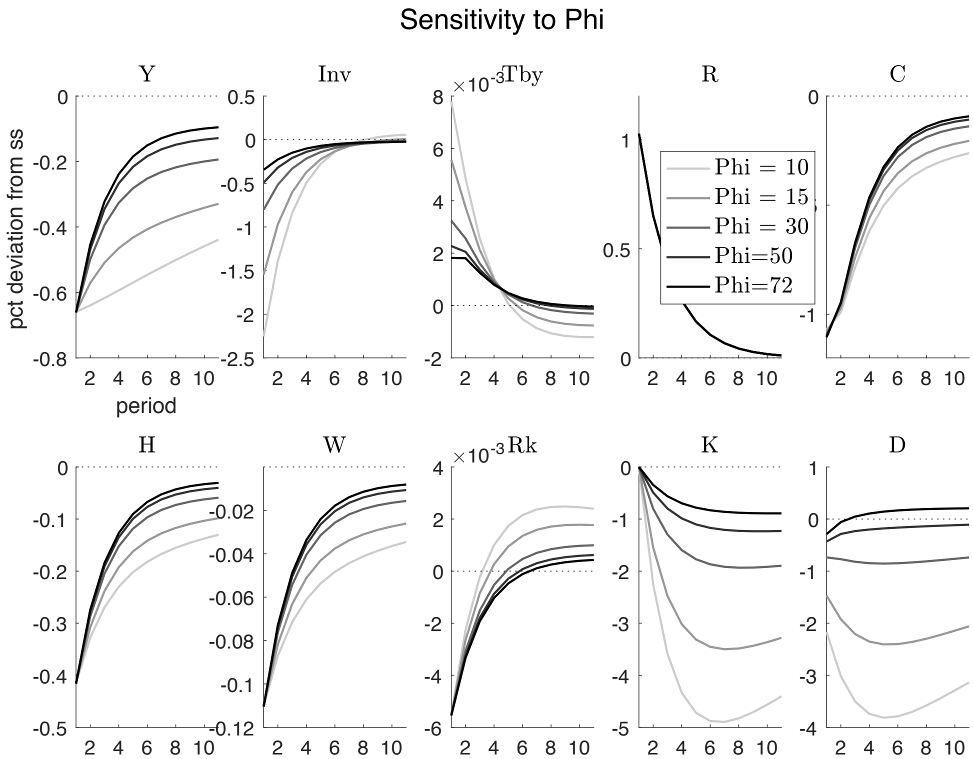


Figure 2.12: Sensitivity to habit formation μ

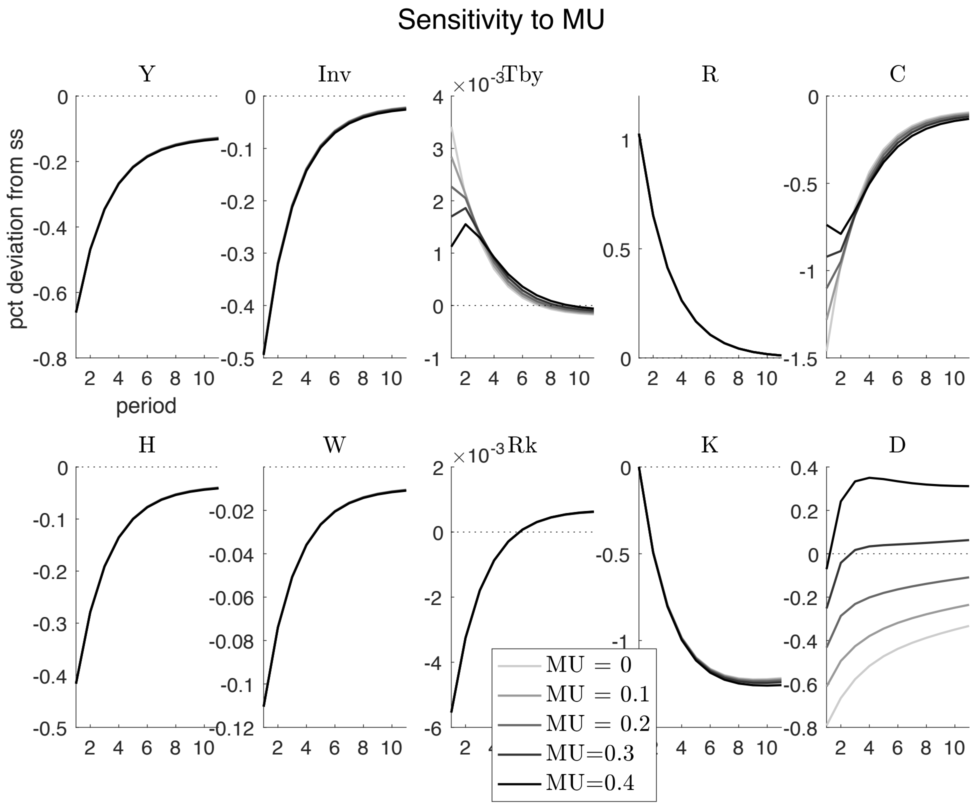
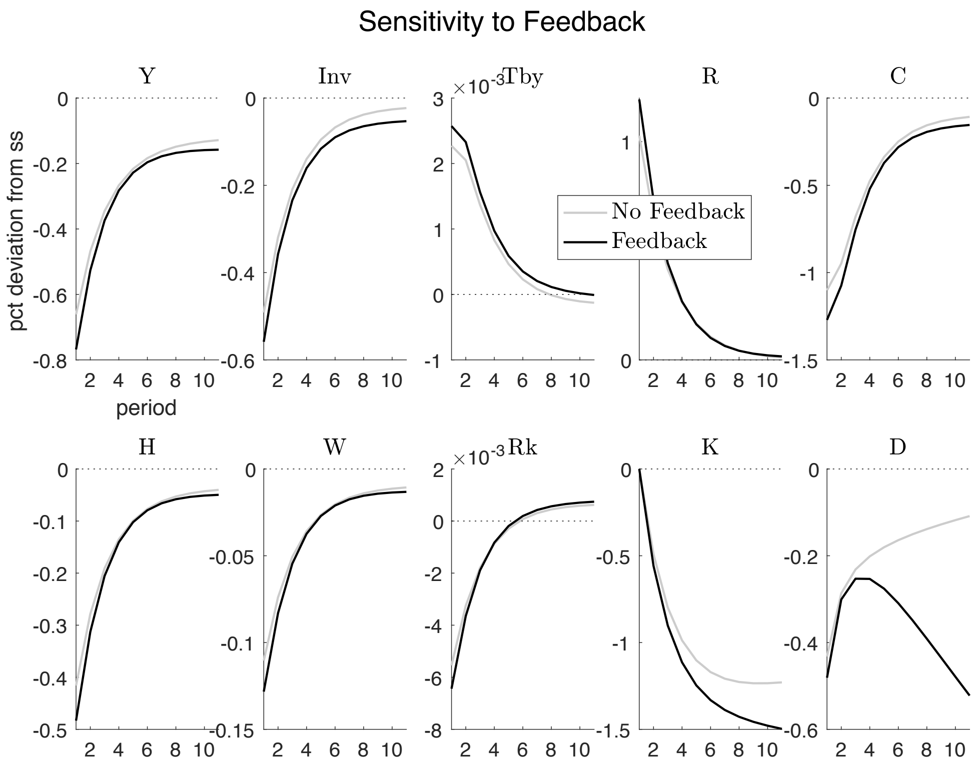


Figure 2.13: Sensitivity to feedback



Appendix A

Below I outline the model without non Ricardian consumers, but with habit formation instead:

$$maxE_0 \sum_{t=0}^{\infty} \beta^t u(c_t - \mu \tilde{c_{t-1}}, h_t)$$

such that

1.

$$w_t h_t + u_t k_t + d_t - R_{t-1} d_{t-1} - \Psi(d_t) = c_t + i_t$$

2.

$$k_{t+1} = (1-\delta)k_t + k_t \Psi(\frac{i_t}{k_t})$$

c_t

$$u_c(c_t - \mu \tilde{c_{t-1}}, h_{t+1}) - \lambda_t = 0$$

h_t

$$u_h(c_t - \mu \tilde{c_{t-1}}, h_t) + E_t \lambda_t w_t = 0$$

k_{t+1}

$$-\lambda_t q_t + \beta E_t \lambda_{t+1} \{u_{t+1} + q_{t+1}[1 - \delta + \Phi(\frac{s_{3t+1}}{k_{t+1}}) - \Phi_i(\frac{i_{t+1}}{k_{t+1}}) i_{t+1}]\} = 0$$

d_t

$$\lambda_t (1 - \Psi'(d_t)) = R_t \beta E_t \lambda_{t+1}$$

i_t

$$1 = q_t k_t \Phi_i(\frac{i_t}{k_t})$$

$q_t = 1$ if capital adjustment is 0. Writing out the condition explicitly: $1 = q_t(1 - \varphi(\frac{i_t}{k_t} - \delta))$. $q = 1$ evaluated at the steady state.

The firm FOC-s are the same.

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