

# Country Heterogeneity and the International Evidence on the Effects of Fiscal Policy

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# The Research question

Figure 4

Estimated Impact of an Exogenous Tax Increase of 1% of GDP on GDP

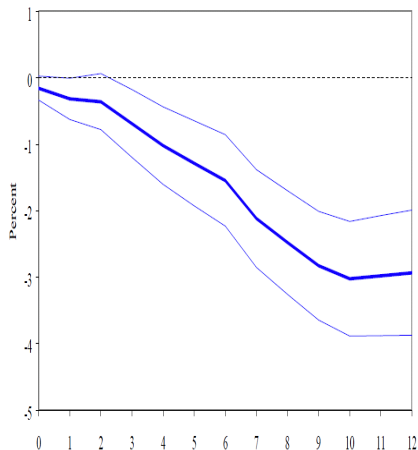
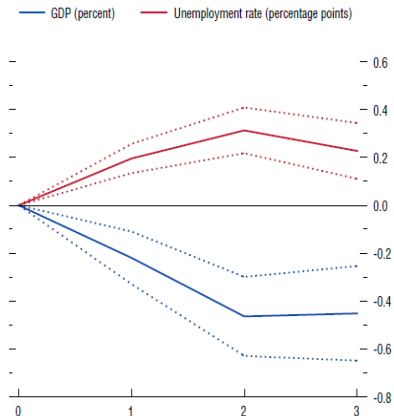


Figure 3.2. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP and Unemployment

Fiscal consolidation is normally contractionary. A fiscal consolidation equal to 1 percent of GDP typically reduces real GDP by about 0.5 percent and raises the unemployment rate by about 0.3 percentage point.



Source: IMF staff calculations.

# Introduction

- We reconsider the international evidence on fiscal multipliers based on a panel of countries.
- “What is the fiscal policy multiplier” is an ill-posed question. There is no unconditional fiscal policy multiplier.
- The effect of fiscal policy on output is different depending on the different debt dynamics, the different degree of openness and the different fiscal reaction functions in different countries. (Leeper (2010), Corsetti, Meier and Mueller(2009) and Favero and Giavazzi (2007))
- It is tempting to pool fiscal shocks from different countries and to study their effects in the context of an international panel. (IMF, Alesina-Ardagna(2010))
- Resist the temptation and specify a non-linear GVAR (Pesaran, M. H., Schuermann, T. and Weiner, S. M. [2004]) with endogenous debt dynamics and minimal cross-country restrictions.

# The Benchmark Model

IMF (2010) estimates, on a sample of fifteen OECD countries the following model

$$\Delta y_{i,t} = \alpha + A_1(L, 1)\Delta y_{i,t-1} + B(L, 2)\varepsilon_{i,t}^g + C(L, 2)\varepsilon_{i,t}^\tau + \lambda_i + v_t + \mu_{i,t}$$

The unique source of heterogeneity in this model is  $\lambda_i$ .

# Our empirical specification

$$\begin{aligned}\tilde{X}_{i,t} &= C_{i,1} + C_2 \tilde{X}_{i,t-1} + \boldsymbol{\varphi}_i Z_{i,t-1} + \gamma_i^g \varepsilon_{i,t}^g + \gamma_i^\tau \varepsilon_{i,t}^\tau + \mu_{i,t} & \text{if } i \neq US \\ X_{i,t} &= C_{i,1} + C_{i,2} X_{i,t-1} + \boldsymbol{\varphi}_i B_{i,t-1} + \gamma_i^g \varepsilon_{i,t}^g + \gamma_i^\tau \varepsilon_{i,t}^\tau + \mu_{i,t} & \text{if } i = US\end{aligned}$$

$$B_{i,t} = B_{i,t-1} \left( \frac{1+r_{i,t}}{1+gr_{i,t}} \right) + \frac{e^{\delta_{i,t}} - e^{\tau_{i,t}}}{e^{y_{i,t}}} + \zeta_{i,t}$$

$$y_{i,t}^* = \sum_{j=1}^n w_t^{ij} y_{j,t}$$

$$s_{i,t}^* = \sum_{j=1}^n w_t^{ij} s_{j,t}$$

$$Y_{i,t} = e^{y_{i,t} + p_{i,t}}$$

$$gr_{i,t} = (Y_{i,t} - Y_{i,t-1}) / Y_{i,t-1}$$

$$\tilde{B}_{i,t} = Y_{i,t} B_{i,t}$$

$$r_{i,t} = e^{i_{i,t} + p_{i,t}} / \tilde{B}_{i,t-1}$$

$$\tilde{X}_{i,t} = [y_{i,t}, g_{i,t}, \tau_{i,t}, i_{i,t}, p_{i,t}, s_{i,t}]$$

$$Z_{i,t} = [B_{i,t}, y_{i,t}^*, s_{i,t}^*]$$

$$X_{i,t} = [y_{i,t}, g_{i,t}, \tau_{i,t}, i_{i,t}, p_{i,t}]$$

$$\boldsymbol{\varphi}_i = [\varphi_{i,1}, \varphi_{i,2}, \varphi_{i,3}]$$

# The Sources of Heterogeneity

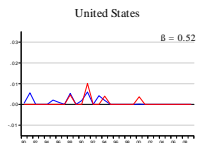
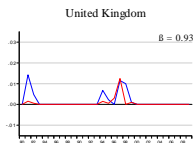
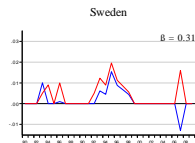
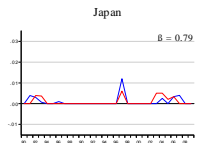
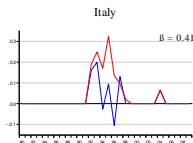
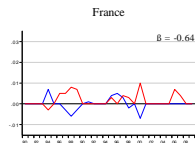
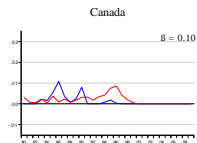
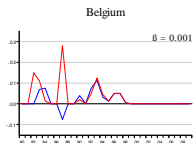
- Style of fiscal corrections
- Debt deficit dynamics
- Degree of openness

# Heterogeneity in the style of fiscal corrections

- We base our investigation on international fiscal shocks identified in IMF (2010). The international shifts in fiscal policy identified are *tax increases* and *spending cuts* implemented to reduce the budget deficit and to put the public finances on a sustainable path.
- 8 countries out of the 15 used in the IMF sample.
- Revenue shocks and expenditure shocks are correlated, and the fiscal mix historically used to achieve a correction in the budget is heterogeneous across countries.

# IMF Narrative Shocks

## Correlation Between Tax Hikes and Spending Cuts



— Tax Hikes  
— Spending Cuts



# Heterogeneity in the style of fiscal corrections

- The simulation of the effects of a shock to government spending, assuming no contemporaneous shift in taxes, would in general violate the historical pattern.
- When studying the international evidence of the effects of a fiscal correction, one should allow for different styles of such corrections across countries. A shift in the primary surplus equivalent to one per cent of GDP is not achieved with the same mix in all countries.

# The implications

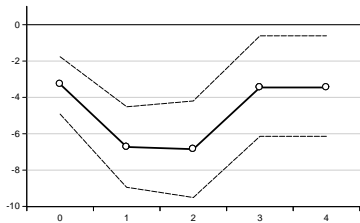
Overlooking the correlation between spending and revenue shocks produces biased multipliers.

To evaluate the importance of the problem, consider the case of US. We have estimated the following two models:

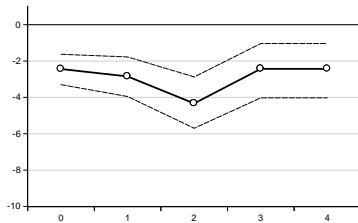
$$\Delta y_{i,t} = \alpha + A(L, 1)\Delta y_{i,t-1} + B(L, 2)\varepsilon_{i,t}^{\tau} + \mu_{i,t}$$

$$\Delta y_{i,t} = \alpha + A_1(L, 1)\Delta y_{i,t-1} + B(L, 2)\varepsilon_{i,t}^g + C(L, 2)\varepsilon_{i,t}^{\tau} + \mu_{i,t}$$

# IR to IMF Consolidation Shocks



(b): Tax Hikes only



(b): Tax and Spending (Balanced)

# Is there a truncation problem?

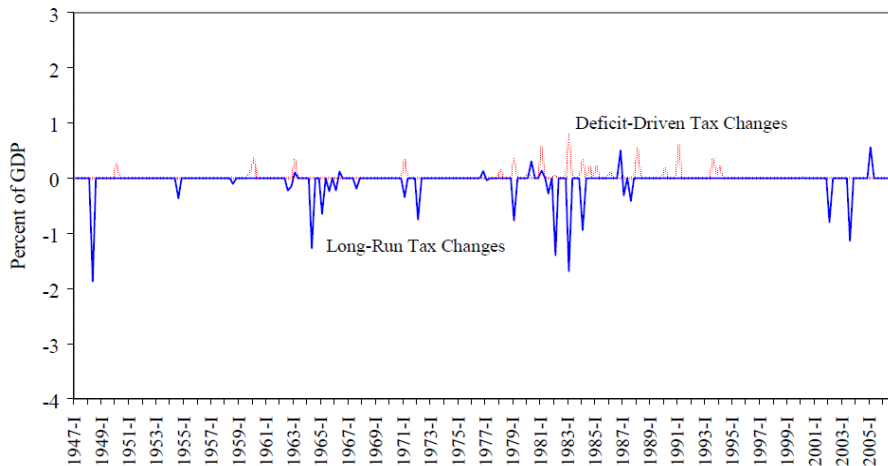
- IMF (2010) considers instead both expenditure and revenue shocks and focuses only on fiscal actions motivated by the objective of reducing the budget deficit. Thus, in the IMF sample, fiscal shocks only refer to fiscal consolidations episodes.
- A truncation problem would arise if there were deficit-driven fiscal expansions.

# Is there a truncation problem?

- R&R focus only on revenue shocks and identify two main types of legislated exogenous tax changes:
  - those driven by long-run motives, such as to foster long-run growth,
  - those aiming to deal with an inherited budget deficit.
- Deficit-driven fiscal expansions never occur in the R&R sample, where virtually all tax shocks driven by the long-run motive are expansionary (i.e. negative tax shocks) and all the deficit-driven tax shocks are contractionary (i.e. positive tax shocks). Moreover in the R&R identification, deficit-driven tax shocks and long-run tax shocks are virtually orthogonal (their correlation is  $-0.08$ ).
- Still, the fact that the multiplier computed using only deficit-driven fiscal shocks is unbiased doesn't make it directly comparable with the one computed using the R&R's series.

# Illustrating the point

## b. Long-Run and Deficit-Driven Tax Changes



# Heterogeneity in the debt-deficit dynamics

Traditional VAR models of the fiscal transmission mechanism are linearized around an equilibrium for the debt to GDP ratio:

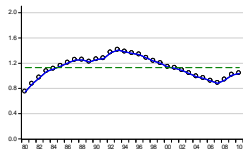
$$\begin{cases} X_t = C_1 + C_2 X_{t-1} + \boldsymbol{\varphi}(B_{t-1} - B_{t-1}^*) + \mu_t \\ B_t = \left( \frac{1+i_t}{1+\Delta y_t + \Delta p_t} \right) B_{t-1} + \frac{e^{g_t} - e^{\tau_t}}{e^{y_t}} \end{cases} \quad (1)$$

with  $X_{i,t} = [y_{i,t}, g_{i,t}, \tau_{i,t}, i_{i,t}, p_{i,t}]$

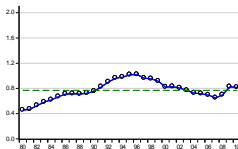
- If  $B_{t-1} = B^*$ , then debt dynamics is not relevant.
- In a panel VAR,  $\boldsymbol{\varphi}$  will differ across countries.
- You could only assume  $\boldsymbol{\varphi}$  constant if  $B_{t-1} = B^*$  for all countries

# Heterogeneity in the debt-deficit dynamics

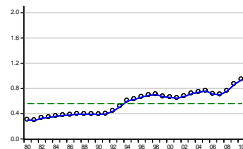
Belgium



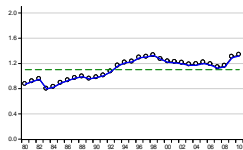
Canada



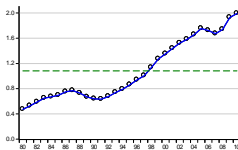
France



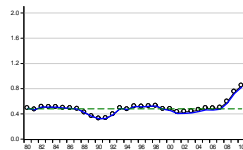
Italy



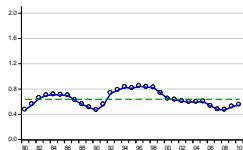
Japan



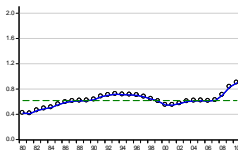
United Kingdom



Sweden



United States



—○— Tracked Debt  
— Actual Debt  
- - - Sample Mean



# Modelling heterogeneity in openness

Our sample of countries consists of one closed economy, the U.S., and 7 open economies.

To specify parsimoniously an open economy VAR we adopt the GVAR approach proposed by Schuerman et al (2004).

- International Business Cycles:

$$y_{i,t}^* = \sum_{j=1}^n w_t^{ij} y_{j,t}$$

- Global real exchange rate:

$$s_{i,t}^* = \sum_{j=1}^n w_t^{ij} s_{j,t}$$

where the weights  $w_t^{ij}$  are based on trade shares — the share of country  $j$  in the total trade of country  $i$  measured in U.S. dollars with  $w_t^{ii} = 0$ .

- International fiscal multipliers that do not allow for heterogeneity are not robust.
- The importance of tracking the debt dynamics.
- The effects of fiscal policy allowing for heterogeneity.

# On the importance of tracking the debt dynamics

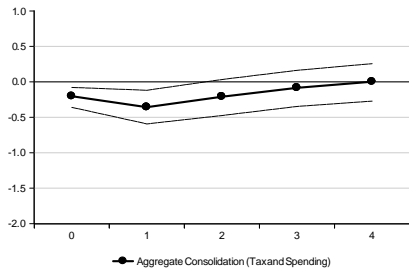
- We estimate the following VAR which overlook debt feedback.

$$X_{i,t} = C_{i,1} + C_{i,2}X_{i,t-1} + \gamma_i^g \varepsilon_{i,t}^g + \gamma_i^\tau \varepsilon_{i,t}^\tau + \mu_{i,t}$$

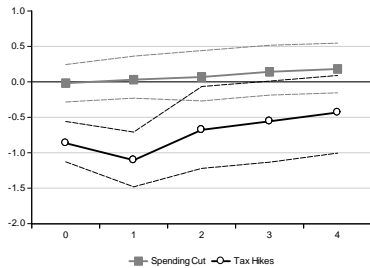
We append the usual set of identities needed to track debt dynamics endogenously.

- The model can be interpreted as a set of stacked closed economy VARs
- No exchange rate is included and no common fluctuations among different components of  $X_{i,t}$  across countries is allowed for.
- If panel restrictions are imposed, such that, for every country  $i$ ,  $C_{i,1} = C_1$ ,  $C_{i,2} = C_2$ ,  $\gamma_i^g = \gamma^g$  and  $\gamma_i^\tau = \gamma^\tau$ , the model can be re-interpreted as an approximation of the truncated MA representation .

# Output responses in the Restricted VAR



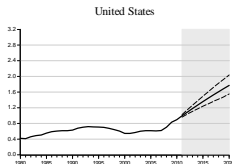
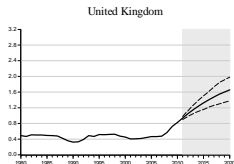
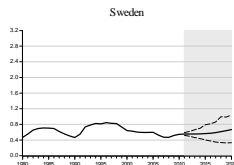
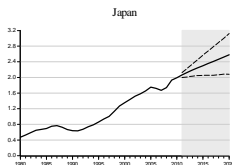
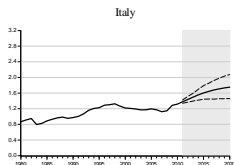
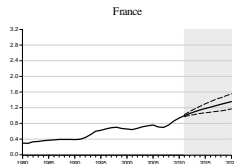
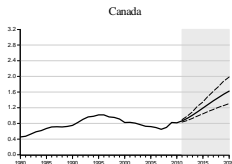
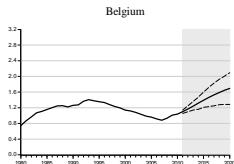
Aggregate (8 OECD countries)



Disaggregate (8 OECD countries)

# Debt Dynamics in the Restricted VAR

## Out of Sample Simulations



# The effects of overlooking the debt feedback: a case study of the U.S.

We consider the following system of equations for the US economy

$$X_t = C_0 + C_1 t + C_{i,2} X_{t-1} + \varphi B_{t-1} + \gamma^g \varepsilon_t^g + \gamma^\tau \varepsilon_t^\tau + \mu_t$$

$\varphi$  captures the feedback from the lagged debt-GDP ratio to the variables in  $X_t$ .

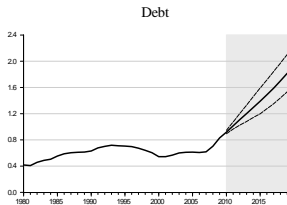
We consider two alternative specifications of this model.

- VAR *without* feedback: we impose the restriction  $\varphi = 0$ .
- VAR *with* feedback: we let  $\varphi$  unconstrained.

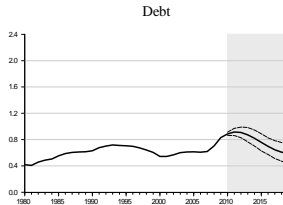
# The effects of overlooking the debt feedback

## Out of Sample Simulations (1)

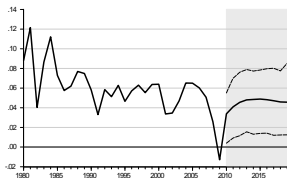
### No Debt Feedback



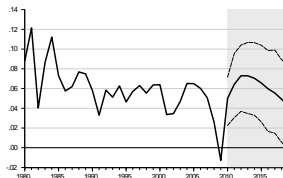
### Debt Feedback



### Real Output Growth



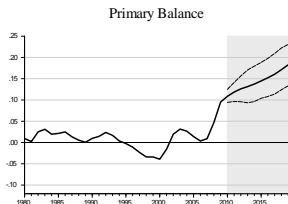
### Real Output Growth



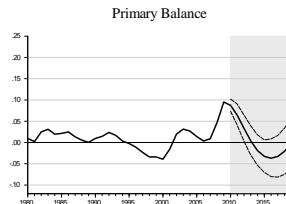
# The effects of overlooking the debt feedback

## Out of Sample Simulations (2)

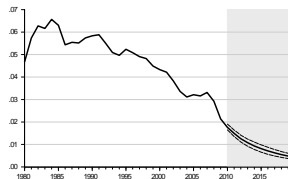
### No Debt Feedback



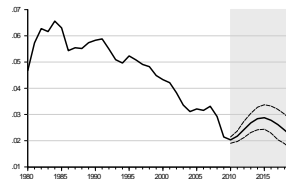
### Debt Feedback



### Cost of Financing the Debt



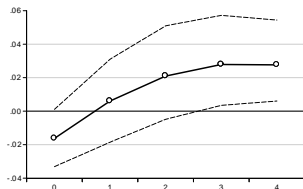
### Cost of Financing the Debt





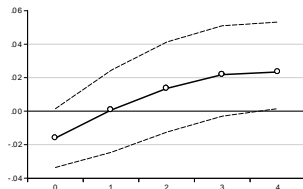
# The effects of overlooking the debt feedback

Without Debt Feedback

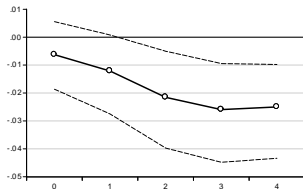


Output

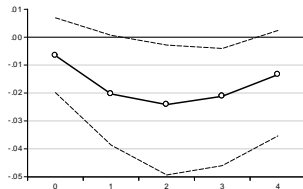
With Debt Feedback



Output



Primary Deficit



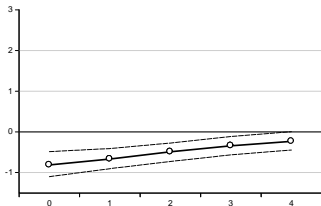
Primary Deficit

# Computing IR allowing for heterogeneity

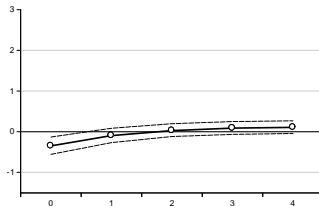
- We compute the effects of a fiscal adjustment of 1% of GDP obtained with a mix of tax increase and expenditure reduction that reflects, country by country, the historical pattern of fiscal policy.
- The model allows for:
  - different policy styles across countries
  - different debt-deficit dynamics
  - different degrees of exposure to the international cycle.

# Computing IR allowing for heterogeneity

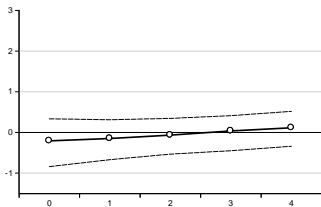
## Belgium



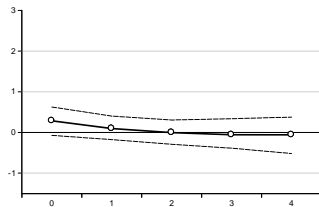
## Italy



## United Kingdom

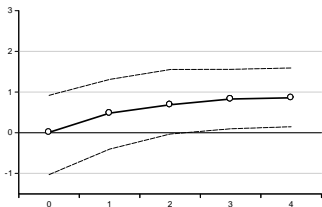


## Sweden

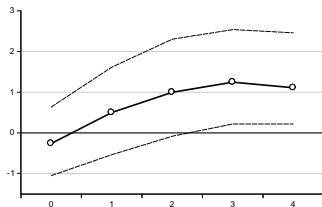


# Computing IR allowing for heterogeneity

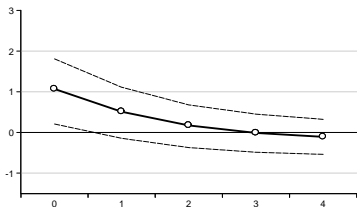
## Canada



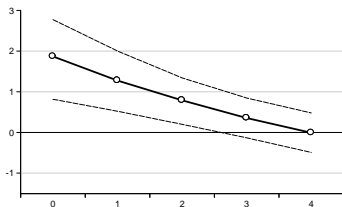
## United States



## Japan



## France



# Computing the effects of fiscal policy allowing for heterogeneity

- The question “what is the fiscal policy multiplier” asked unconditionally is impossible to answer empirically and makes little sense theoretically.
- There is no unconditional fiscal policy multiplier.
- The effect of fiscal policy on output is different according to the different debt dynamics, the different degree of openness and the different fiscal reaction functions in different countries.