The Macroeconomic Effects of Fiscal Adjustments Plans

Alesina, Barbiero, Favero, Giavazzi, Paradisi

IGIER, Bocconi University

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Road Map

1. Estimating Fiscal Multipliers
    - plans *vs* isolated shocks
2. Does the composition of a fiscal adjustment make a difference? How much of a difference?
    - cuts in current and capital spending
    - cuts in transfers
    - increases in taxes (direct and indirect)
3. Are these differences consistent with a theoretical macro model with tax distortions?
    - results from a new-keynesian DSGE model
4. Data: 16 OECD countries, 1978-2014
    - multipliers during fiscal consolidations: this paper has nothing to say about fiscal expansions

Multi-year plans

- Real-world fiscal adjustments adopted by a Parliament in a given year – say year t – consist of three components
  - unexpected shifts in fiscal variables (announced upon implementation at time t)
  - shifts implemented at time t that had been announced in previous years
  - future announced corrections (announced at time t for implementation in future years)
- Anticipations are an intrinsic element of plans and cannot be assumed orthogonal to unanticipated corrections (Leeper et al 2012, Ramey 2009)
- Corrections in T and G are also correlated
- Analysing isolated shocks when fiscal policy is conducted through plans is thus incorrect

Plans: an example

The multi-year plan introduced in **Belgium** (and then reivsed) in 1992 (% of GDP)

year	τ_t^u	$\tau_{t-1,t}^a$	$\tau_{t,t+1}^a$	$\tau_{t,t+2}^a$	$\tau_{t,t+3}^a$	g_t^u	$g_{t-1,t}^a$	$g_{t,t+1}^a$	$g_{t,t+2}^a$	$g_{t,t+3}^a$
1992	1.03	0	0.05	0	0	0.82	0	0.42	0	0
1993	0.40	0.05	0.55	0	0	0.12	0.42	0.28	0	0
1994	0	0.55	0	0	0	0.38	0.28	0	0	0

Plans: another example and classification by type of plan

Stabilization plans in Italy: 1991-1993 (% of GDP)												
year	τ_t^u	$\tau_{t-1,t}^a$	$\tau_{t,t+1}^a$	$\tau_{t,t+2}^a$	$\tau_{it,t+3}^a$	g_t^u	$g_{t-1,t}^a$	$g_{t,t+1}^a$	$g_{t,t+2}^a$	$g_{t,t+3}^a$	**TB**	**EB**
1991	1.69	0	-1.26	0	0	1.08	0	0	0	0	**0**	**1**
1992	2.85	-1.26	-1.2	0	0	1.92	0	0	0	0	**0**	**1**
1993	3.2	-1.2	-0.57	0	0	3.12	0	0	0	0	**0**	**1**

Reconstructing plans: TB and EB plans

The multi-year plans introduced in **Italy** in 2009-2013 (% of GDP)

year	τ_t^u	$\tau_{t-1,t}^a$	$\tau_{t,t+1}^a$	$\tau_{t,t+2}^a$	$\tau_{t,t+3}^a$	g_t^u	$g_{t-1,t}^a$	$g_{t,t+1}^a$	$g_{t,t+2}^a$	$g_{t,t+3}^a$	**EB**	**TB**
2009	0	0	0.11	-0.02	-0.02	0	0	0.01	0	0	**0**	**1**
2010	0.27	0.11	0.18	0.20	-0.12	0.02	0.01	0.68	0.39	0.14	**1**	**0**
2011	0.22	0.18	1.30	0.76	0.21	0.23	0.68	0.68	0.85	0.15	**0**	**1**
2012	0.97	1.30	0.75	0.09	0	0.37	0.68	1.28	0.48	0.04	**0**	**1**
2013	0.31	0.75	0.23	0.05	0	0.04	1.28	0.47	0.01	-0.03	**1**	**0**

- Main features of the 2010-2013 Italian budget laws
  - **2010**: one-off revenue increase form income tax pre-payments and combating tax evasion; reduction in current and capital expenditures of local government from 2011
  - **2011**: abolition of some tax reliefs in 2012; VAT increase from 20% to 21%; cuts to ministries current expenditures
  - **2012**: abolition of tax relief is cancelled; property tax; excise taxes on fuel; one year deferral of investments; pensions reform to be effective from 2013 and deindexation
  - **2013**: VAT increase from 21% to 22%; cuts to local government spending and effects of pension reform announced in 2012

Identification

- Plans, rather than isolated shifts in fiscal variables
  - plans include annnouncements $\Rightarrow$ VAR identification fails
- Narrative identification

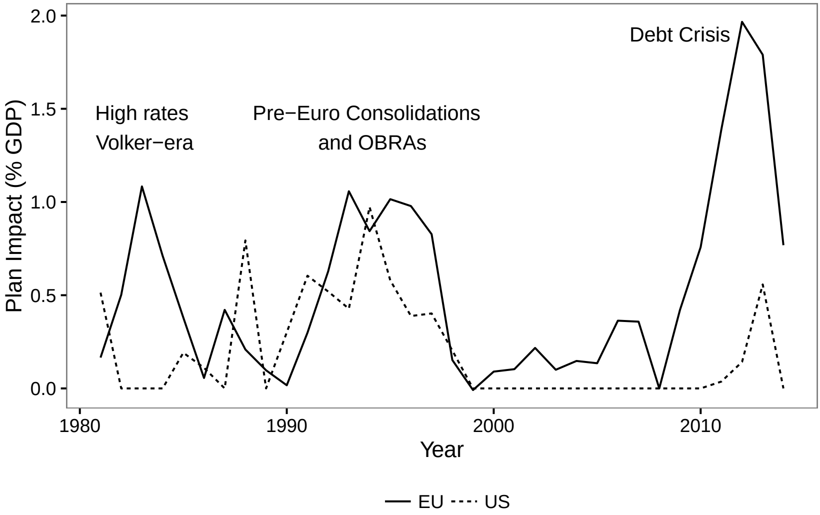
Data and narrative identification

- Starting point: exogenous fiscal consolidations identified by Devries&al (IMF 2011) using the Romer&Romer (2010) methodology
- 17 OECD countries, 1978-2009
- Consolidation episodes are classified as exogenous if
  - geared towards reducing an inherited budget deficit, a long run trend of it (e.g pensions, aging) or the inherited level of debt
- Adjustments motivated by short-run countercyclical concerns are excluded on the argument that they are endogenous in the estimation of their effect on output
- Individual shifts in fiscal variables identified à la R&R: Budget Reports, EU Stability Programs, IMF Reports, OECD Surveys, etc.
  - both shifts in G and T (general government except US, CAN, AUS)
    - shifts in G : relative to projections (as in the "Sequester")
    - shifts in T: estimated revenue effect (as in R&R)
  - unanticipated and anticipated shifts in G and T
    - 216 episodes of shifts in G or T (unanticipated and anticipated)

Constructing plans and extending the data

- We go back to the original Devries&al sources and
  - separate out unanticipated, anticipated and implemented (but previously announced) shifts in taxes and spending
  - organize the data into plans
  - extend the data to 2014 and construct plans: *172 plans* over the period 1978-2014
  - while doing this we double check the Devries&al identification
    - e.g. drop the Netherlands and a few other observations: Dutch government sets fiscal targets which can later be changed based on the cycle
- Data and their organization in plans available on the Igier website

Exogenous Fiscal Consolidation Plans in Europe and in the United States 1980-2014



Reconstructing plans

- A narratively identified adjustment occurring in year t, e_t, will have 3 components (consider plans with a forward horizon of 1 year)

$$e_t : \left\{ e^u_t,\ e^a_{t-1,t},\ e^a_{t,t+1} \right\}$$

$$e^u_t : \left\{ \tau^u_t,\ g^u_t \right\} \quad e^a_{t-1,t} : \left\{ \tau^a_{t-1,t},\ g^a_{t-1,t} \right\} \quad e^a_{t,t+1} : \left\{ \tau^a_{t,t+1},\ g^a_{t,t+1} \right\}$$

- e^u_t: unexpected shifts in fiscal variables (announced upon implementation at time t)
- $e^a_{t-1,t}$: shifts implemented at time t that had been **announced** in previous years $\Longrightarrow$predictable
- $e^a_{t,t+1}$: future announced corrections (announced at time t for implementation in future years)

Plans vs the existing literature

$$e_t : \left\{ e^u_t,\ e^a_{t-i,t},\ e^a_{t,t+i} \right\}$$

$$e^u_t : \left\{ \tau^u_t,\ g^u_t \right\} \quad e^a_{t-i,t} : \left\{ \tau^a_{t-i,t},\ g^a_{t-i,t} \right\} \quad e^a_{t,t+i} : \left\{ \tau^a_{t,t+i},\ g^a_{t,t+i} \right\}$$

Romer and Romer (2010)

$$e^{R\&R}_t = \tau^u_t + \tau^a_{t,t+i}$$

Mertens and Ravn (2011)

$$e^{M\&R}_t = \left\{ \tau^u_t,\ \tau^a_{t,t+i} \right\}$$

IMF (2011), Jordà and Taylor (2013)

$$e^{IMF}_t = e^u_t + e^a_{t-i,t}$$

⇒ i.e. e^{IMF}_t is predictable

Analyzing isolated shocks when fiscal policy is conducted through plans

- Suppose the data generating process is

$$y_t = \alpha + \beta_1 e_t^u + \beta_2 e_{t,t+1}^a + \beta_3 e_{t-1,t}^a + \epsilon_t$$
$$e_{t,t+1}^a = \varphi e_t^u + v_t$$

- If you overlook plans and estimate

$$y_t = \alpha + \beta e_t^u + \zeta_t$$

$$p\lim\left(\beta_{OLS}\right) = \left(\beta_1 + \varphi\beta_2\right)$$

- β_{OLS} captures the inter-temporal dimension of the plan, not only the effect of the innovation e_t^u

Analyzing isolated shocks when fiscal policy is conducted through plans (cont.)

- Suppose the data generating process is

$$
\begin{aligned}
y_t &= \alpha + \beta_1 e_t^u + \beta_2 e_{t,t+1}^a + \beta_3 e_{t-1,t}^a + \epsilon_t \\
e_{t,t+1}^a &= \varphi e_t^u + v_t
\end{aligned}
$$

- You estimate

$$y_t = \alpha + \beta_1 e_t^u + \beta_2 e_{t,t+1}^a + \zeta_t$$

$$p\lim\left(\beta_{1OLS}\right) = \beta_1$$

$$p\lim\left(\beta_{2OLS}\right) = \beta_2$$

- Using β_{1OLS} to simulate the output effect of an innovation e_t^u would be wrong: $\frac{dy_t}{de_t^u} = \beta_1 + \beta_2\varphi$ and φ cannot be set to 0 in simulation

Overlooking the correlation between shifts in G and T

- Suppose the data generating process is

$$y_t = \beta_1 \tau_t + \beta_2 g_t + \epsilon_t$$
$$g_t = \varphi \tau_t + v_t$$

- You estimate

$$y_t = \alpha + \beta \tau_t + \zeta_t$$

$$p\lim\left(\beta_{OLS}\right) = \left(\beta_1 + \varphi \beta_2\right)$$

- It would be wrong to interpret β_{OLS} as the effect of (e.g.) a tax cut: it is the effect of a tax cut paired with a coordinated change in g

Overlooking the correlation between shifts in G and T (cont.)

- Suppose the data generating process is

$$y_t = \beta_1 \tau_t + \beta_2 g_t + \epsilon_t$$
$$g_t = \varphi \tau_t + v_t$$

- You estimate

$$y_t = \alpha + \beta_1 \tau_t + \beta_2 g_t + \zeta_t$$
$$p\lim\left(\beta_{1OLS}\right) = \beta_1$$
$$p\lim\left(\beta_{2OLS}\right) = \beta_2$$

- Using β_{1OLS} to simulate the output effect of an innovation e_t^u would be wrong: $\frac{dy_t}{d\tau_t} = \beta_1 + \beta_2 \varphi$ and φ cannot be set to 0 in simulation

Predictability of the "IMF shocks"

$$e_t^{IMF} = e_t^u + e_{t-1,t}^a$$

"IMF Shocks" are predictable

$$\begin{aligned} Cov\left(e_t^{IMF}, e_{t-1}^{IMF}\right) &= Cov\left(\left(e_t^u + e_{t-1,t}^a\right), \left(e_{t-1}^u + e_{t-2,t-1}^a\right)\right) \\ &= \varphi Var\left(e_{t-1}^u\right) \end{aligned}$$

Jorda and Taylor (2013) propose a technique to "clean them up". But the fact that shocks are predictable does not necessarily imply that they are endogenous: in fact they are not. Not surprisingly, the J&T results are almost identical to IMF (2013)

Estimating and simulating plans: the truncated MA approach

- Romer and Romer (2010)

$$\Delta z_t = \alpha + B(L) f_t + \chi_t + u_t$$
$$f_t = e_t^u + e_{t,t+1}^a$$

here the effect of e_t^u and $e_{t,t+1}^a$ are assumed to be identical (e.g. no credit constraints) . Mertens and Ravn (2011) allow for announcements to have a different multiplier

Estimating and simulating plans: heterogeneity in composition and in persistence

- Estimation

$$\Delta y_{t,} = \alpha + \beta_1 e^u_t * TB_t + \beta_2 e^a_{t,t+1} * TB_t + \beta_3 e^a_{t-1,t} * TB_t$$
$$\gamma_1 e^u_t * EB_t + \gamma_2 e^a_{t,t+1} * EB_t + \gamma_3 e^a_{t-1,t} * EB_t + \epsilon_t$$

- Simulation
  - need to keep track of the correlation between "news innovations" and "current innovations"

$$e^a_{t,t+1} = \varphi_1 e^u_t * TB_t + \varphi_2 e^u_t * EB_t + v_{t,t+1}$$
$$where \quad e^u_t = \tau^u_t + g^u_t$$

- $\varphi' s$ can be plan-specific, as here, or country-specific

- Since TB and EB are mutually exclusive ($when \quad TB = 0, \quad EB = 1$)
  - $\frac{dy_t}{de^u_t * TB_t} = \beta_1 + \beta_2 \varphi_1, \quad \frac{dy_t}{de^u_t * EB_t} = \gamma_1 + \gamma_2 \varphi_2$
  - but g and t are not mutually exclusive: thus you could not compute $\frac{dy_t}{d\tau^u_t}|_{g^u}$ *or* $\frac{dy_t}{dg^u_t}|_{\tau^u}$

Estimating and simulating plans allowing for heterogeneity across plans. Step 1: composition

- Heterogeneity in the **composition of plans**
  - Three types of plans. *Mostly* based on
    - *increases in Taxes*
    - *cuts in Transfers*
    - *cuts in Government Spending*

    - (working on the disaggregation between plans based on direct and indirect taxes)

Estimating and simulating plans allowing for heterogeneity across plans. Step 2: persistence

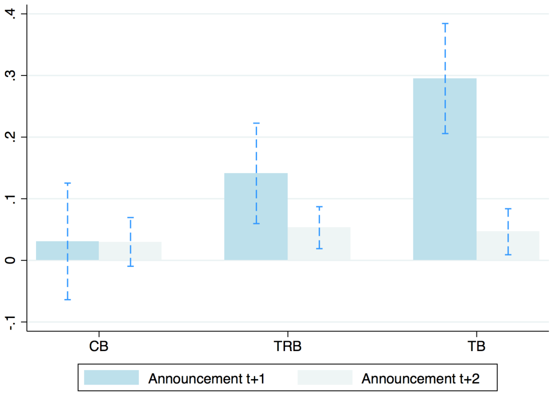
- Heterogeneity in **persistence**

$$
\begin{aligned}
e^{a}_{i,t,t+1} =& \varphi_{1,1}\ e^{u}_{i,t} * TB_{i,t} + \varphi_{2,1}\ e^{u}_{i,t} * CB_{i,t} \\
&+ \varphi_{3,1}\ e^{u}_{i,t} * TRB_{i,t} + v_{i,t,t+1} \\
e^{a}_{i,t,t+2} =& \varphi_{1,2}\ e^{u}_{i,t} * TB_{i,t} + \varphi_{2,2}\ e^{u}_{i,t} * CB_{i,t} \\
&+ \varphi_{3,2}\ e^{u}_{i,t} * TRB_{i,t} + \upsilon_{i,t,t+1}
\end{aligned}
$$

⇒ when the model contains announcements, the effect of an unanticipated shift in a fiscal variable can only be simulated using estimates of the $\varphi' s$

⇒ above $\varphi' s$ are plan-specific. Alternatively, country-specific $\varphi' s$

Persistence: correlations between unanticipated and anticipated components of plans



- Tax-based and transfers-based plans *not front-loaded*
- Consumption-based plans *frontloaded*

Disaggregation: definitions

Taxes

- **Direct Taxes**: taxes on net income of individuals, on profits of corporations and enterprises, on capital gains and taxes on individual and corporate properties
- **Indirect Taxes**: taxes on transactions, goods and services (e.g. VAT, excise duties, stamp duty, services tax)

Spending

- **Government consumption and investment**: current expenditures for consumption of goods and services, public sector salaries, costs of state provided services (e.g. public education and health) plus all government fixed capital formation expenditures
- **Transfers**: money transferred by the government to households (e.g. pensions and unemployment benefits) and corporations (without expecting an economic gain, e.g. subsidies)

Three types of plans: Tax-based, Transfers-based and Consumption and Investment-based

We label plans in two steps

- we evaluate whether the plan mainly consists of spending measures (EB) or tax measures (TB)
    - if the plan is EB, we further assess whether it consists mostly of consumption and investment or transfers measures
    - otherwise it is labelled TB

Plans Classification, 1981-2014

Country	TB	CB	TRB	
AUS	4	1	2	
AUT	3	0	4	
BEL	7	0	8	
CAN	8	9	2	
DEU	5	0	5	
DNK	4	1	3	
ESP	8	7	0	
FIN	3	1	5	
FRA	5	4	1	
GBR	6	1	3	
IRL	7	6	1	
ITA	8	6	4	
JPN	3	5	0	
PRT	6	5	0	
SWE	0	0	5	
USA	4	1	1	
Tot.	81	47	44	**172**

Note. Plans are classified according to the category that is most affected. The Table reports new plans only, excluding years when no new measures where introduced. Data on Germany restricted to the period 1992-2014.

Average composition of plans, 1981-2014

			Average composition (% of GDP)					
			Tax		Consumption		Transfer	
Type of plan	N	Total Plan	% GDP	% Plan	% GDP	% Plan	% GDP	% Plan
Tax Based	81	1.900	**1.123**	**0.591**	0.360	0.189	0.268	0.141
		(1.646)	(0.847)		(0.510)		(0.417)	
Consumption Based	47	1.588	0.274	0.173	**0.919**	**0.579**	0.240	0.151
		(1.638)	(0.670)		(0.721)		(0.348)	
Transfer Based	44	2.048	0.402	0.196	0.393	0.192	**1.001**	**0.489**
		(1.466)	(0.667)		(0.318)		(0.672)	

Note. Mean values computed in each category. Columns denoted by GDP report the size of the component with respect to the GDP in the previous year. Columns denoted by Plan show the average with respect to the total plan size. Standard Deviation in parenthesis. Data on Germany restricted to the period 1992-2014.

Estimating and simuating plans allowing for heterogeneity in composition and persistence

$$\Delta y_{i,t} = \alpha + \left[\sum_{j=0}^{2} \left(\overbrace{\overrightarrow{\beta_j} e^{u}_{i,t-j}}^{Unexpected} + \overbrace{\overrightarrow{\gamma_j} \underbrace{{}^{a}_{i,t-j,t}}_{Past} + \overrightarrow{\delta} \underbrace{e^{a}_{i,t,t+j}}_{Future}}^{Announced} \right) \right] \begin{bmatrix} CB_{i,t} \\ TRB_{i,t} \\ TB_{i,t} \end{bmatrix} + \lambda_i + \chi_t \tag{1}$$

$$\begin{aligned} e^{a}_{t,t+1} =& \varphi_1^{TB}\ e^{u}_{t} * TB_t + \varphi_1^{CB}\ e^{u}_{i,t} * CB_t + \varphi_1^{TRB}\ e^{u}_{t} * TRB_t + v_{t,t+1} \\ e^{a}_{t,t+2} =& \varphi_2^{TB}\ e^{u}_{t} * TB_t + \varphi_2^{CB}\ e^{u}_{t} * CB_{,t} + \varphi_{4,2}\ e^{u}_{t} * TRB_t + v_{t,t+2} \end{aligned}$$

Computing impulse responses

- Heterogeneity in styles implies that an initial correction of 1% of GDP will generate plans of different size
- We normalize plans, computing impulse responses to a *plan* of the size of 1% of GDP, while traditional impulse responses are computed with respect to a *shock* of 1% of GDP

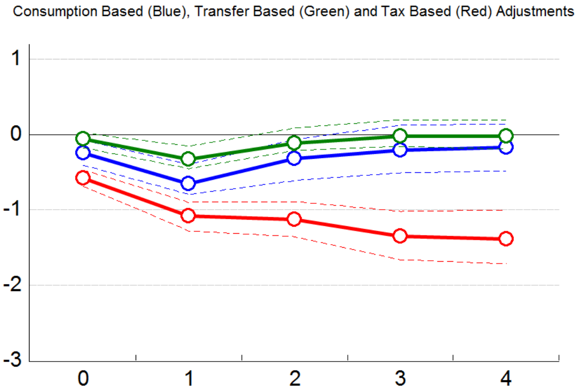
$$e^u_{i,t} + e^a_{i,t,t+1} + e^a_{i,t,t+2} = 1$$

$$e^{a}_{i,t,t+j} = \hat{\varphi}_{p,j} e^u_{i,t} \quad \text{for} \quad j = 1, 2 \; and \; p = TB, \; CB, \; TRB$$

$$e^u_{i,t} = \frac{1}{1 + \hat{\varphi}_{p,1} + \hat{\varphi}_{p,2}}$$

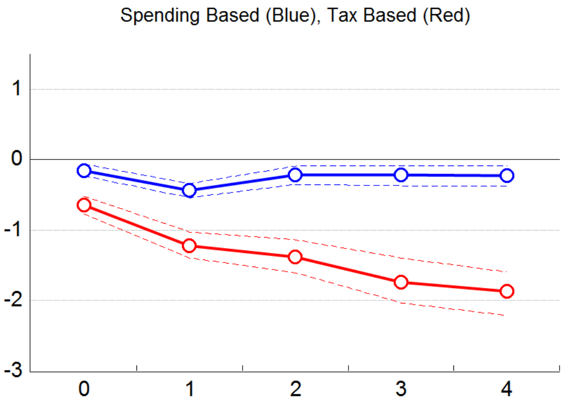
- As an example, in the case of a TB plan, $\hat{\varphi}_1 = 0.38$ and $\hat{\varphi}_2 = 0.06$. Hence we simulate $e^u_t = 0.69$, $e^a_{t,t+1} = 0.26$, $e^a_{t,t+2} = 0.05$

Results: output growth



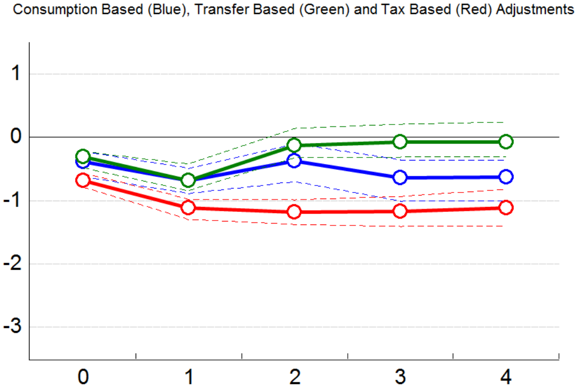
Alternative phi's

Restricting the two spending multipliers to be identical: output growth

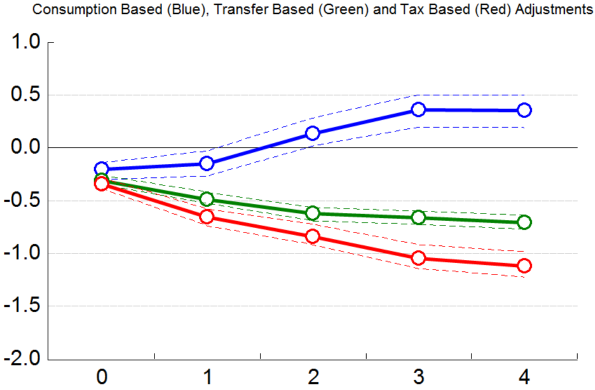


▸ Coefficients ▸ Phi's ▸ Alternative specification with Tax and Spending shocks

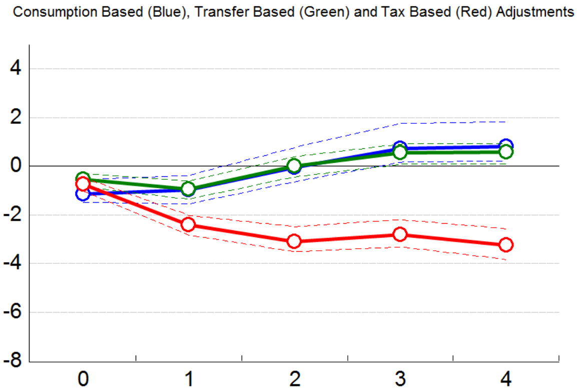
Private consumption growth



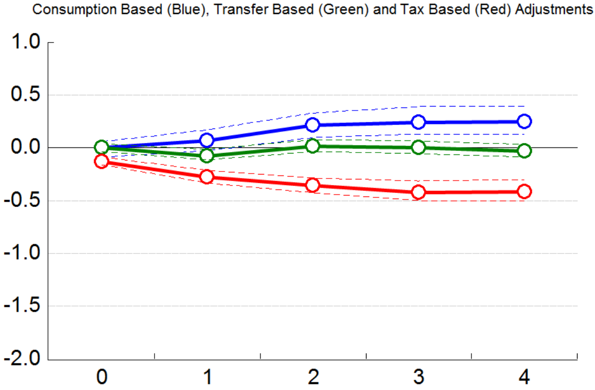
Consumer confidence



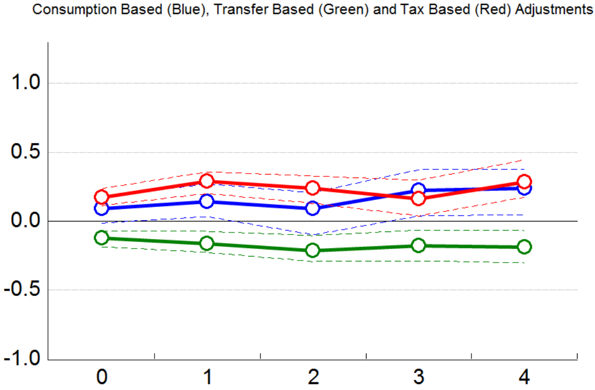
Fixed capital formation



Business confidence



Short term rate



Robustness: fiscal consolidations and structural reforms

1. Do accompanying reforms (e.g., labor and product markets liberalizations) influence the decision to implement a fiscal consolidation?
2. Is the choice between type of plans related to accompanying reforms?

- Check (with a probit specification) whether contemporaneous changes in the index of Product Market Reforms and in the index of Labor Market Reforms (OECD) affect:
  - the probability of introducing a fiscal consolidation plan
  - the type of the plan (given that a new plan is announced)

An increase in the index denotes an increase in regulation in the product and labor markets

	New plan	TB	EB	DB	IB	CB	TRB
Product Market Reforms	-0.247	0.564	-0.564	0.850	0.00405	0.309	-0.832
	(0.381)	(0.625)	(0.625)	(0.786)	(0.709)	(0.635)	(0.603)
Observations	484	157	157	157	157	157	157
Labor Market Reforms	-0.514	0.606	-0.606	1.077	-0.393	0.405	-0.927
	(0.544)	(1.061)	(1.061)	(1.267)	(1.243)	(0.911)	(0.913)
Observations	415	135	135	135	135	135	135

Cycle

Mechanisms

- Start extending Chistiano, Eichenbaum and Rebelo 2011 (CER)
- Representative household: infinitely lived with

$$U_t(C_t, G_t, N_t) = \frac{\left[C_t^{\gamma}(1-N_t)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma} + \nu(G_t)$$

$\Rightarrow$ *consumption separable in G but not in N*

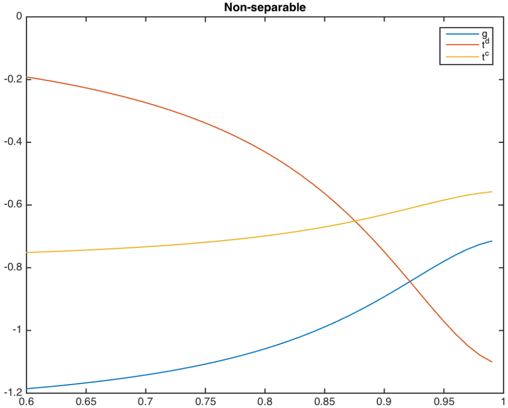
  - Invests in two assets: capital K_t and risk free government bonds B_t
  - Subject to adjustment costs on investment
  - Receives lump sum transfer T_t and pays payroll tax τ_t^d and private consumption tax τ_t^c
- Production side: monopolistic competition among intermediate goods producers with Calvo price rigidity, flexible wages and constant returns to scale
- Government: 5 instruments: τ^d, τ^c, T, G, B

$$G_t + T_t + (1 + i_t)\frac{B_t}{P_t} = \tau_t^d w_t N_t + \tau_t^c C_t + \frac{B_{t+1}}{P_t}$$

- Monetary policy: Taylor rule

Fiscal multipliers and the persistence of fiscal shocks

Istantaneous output multipliers to shifts in G and τ_n in CER for varying level of shocks persistence. No capital, no debt: budget is balanced using transfers



Analytical multipliers

Multipliers and persistence

AD and AS curves derived from the log-linearized the model

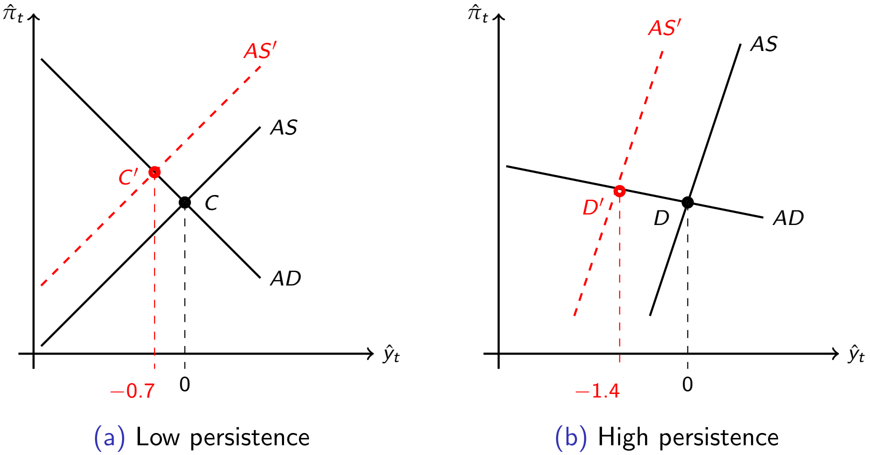
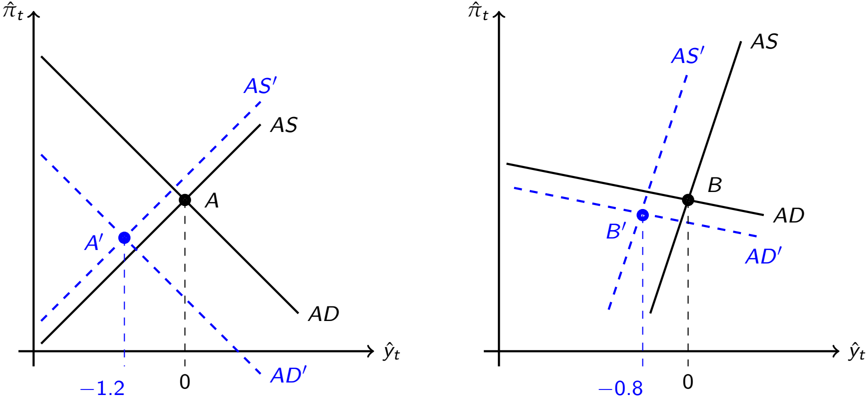


Figure: The output effect of a wage tax increase

Multipliers and persistence

AD and AS curves derived from the log-linearized the model



(a) Low persistence (b) High persistence

Figure: The output effect of a cut in government spending

A richer model: debt, capital and 4 types of plans

$$G_t = (1-\rho_G)G_{ss} + \rho_G G_{t-1} + e_t^{u,G} + \sum_{s=1}^{3} e_{t-s,t}^{a,G}$$

$$T_t = (1-\rho_T)T_{ss} + \rho_T T_{t-1} + e_t^{u,T} + \sum_{s=1}^{3} e_{t-s,t}^{a,T}$$

$$\tau_t^d = (1-\rho_{\tau^d})\tau_{ss}^d + \rho_{\tau^d}\tau_{t-1}^d + e_t^{u,\tau^d} + \sum_{s=1}^{3} e_{t-s,t}^{a,\tau^d}$$

$$\tau_t^c = (1-\rho_{\tau^c})\tau_{ss}^c + \rho_{\tau^c}\tau_{t-1}^c + e_t^{u,\tau^c} + \sum_{s=1}^{3} e_{t-s,t}^{a,\tau^c}$$

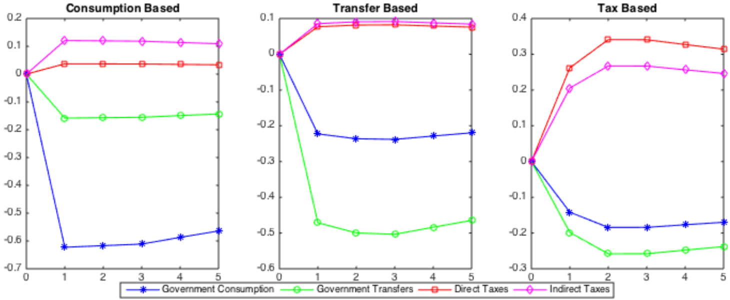
Note that each movement in $e_t^{u,f}$, $f \in \{G, T, \tau^d, \tau^c\}$, is accompanied by

- **announcements**: $e_{t,t+s}^{a,f} = \varphi_s e_t^{u,f}$, $s \in \{1, 2, 3\}$
- **contemporaneous changes in fiscal variables other than** f
  - e.g. the composition of the average *CB plan* is 50% G, 17%, T and 12% each τ_t^d and τ_t^c

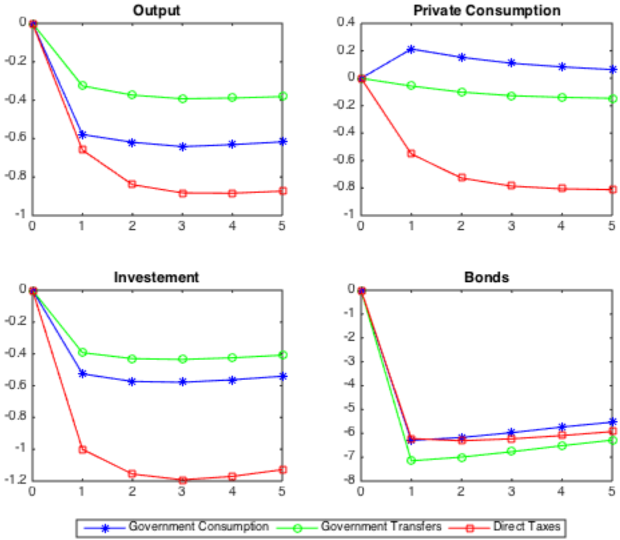
Calibration

Composition of Plans

Plan-specific phi's



Simulation results (Calibration as in CER, phi's as in our plans)



Separability in leisure, C and G non separable

- Representative household: infinitely lived with

$$U_t(C_t, G_t, N_t) = \frac{C_{agg}^{(1-\sigma)}}{(1-\sigma)} + \frac{N^{(1+\psi)}}{(1+\psi)} \text{ where}$$

$$C_{agg} = \left[\omega C_t^{(\nu-1)/\nu} + (1-\omega)\, G_t^{(\nu-1)/\nu}\right]^{\nu/(\nu-1)}$$

$\Rightarrow$ *consumption separable in N but not in G*

- The other features of the model remain unchanged

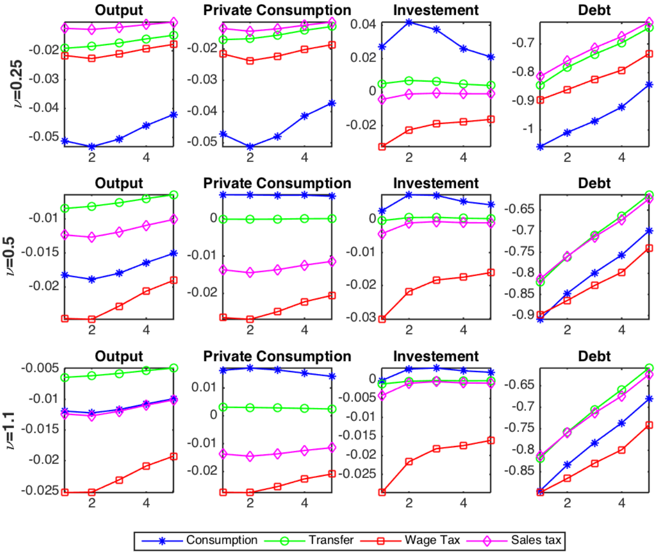
- The value of ν determines the relation between C and G
  - low ν: C and G are **complements**
  - high ν: C and G are **substitutes**

$\Longrightarrow$ As C and G become more substitutes the multiplier of G overtakes that of τ^d

$\Longrightarrow$ When v is high CB consolidations are less harmful than DB ones, a result more consistent with our empirical evidence

Calibration

CER calibration. Plan-specific phi's. Varying values of ν



Conclusions

- Empirical results
  - Tax-based plans are the most recessionary
  - Plans based on cuts in Spending are the least recessionary
  - Transfers-based plans are not very different from Spending-based plans, except for their effect on investment
- This heterogeneity is consistent with the predictions of a simple NK model with tax distortions and standard calibration provided
  - preference separable in G
  - C and G sufficiently substitutes

Exogeneity and predictability

- Predictability of f_t^{IMF} by their own past does not necessarily imply violation of exogeneity. Consider, for the sake of illustration, this simple representation

$$\Delta y_t = \beta_0 + \beta_1 f_t^{IMF} + u_{1t}$$
$$f_t^{IMF} = \rho_1 f_{t-1}^{IMF} + \rho_2 \Delta y_{t-1} + u_{2t}$$
$$\begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{12} & \sigma_{22} \end{pmatrix}\right]$$

- The condition required for f_t^{IMF} to be weakly exogenous for the estimation of β_1 is $\sigma_{12} = 0$,
- The condition(s) required for strong exogeneity is weak exogeneity and $\rho_2 = 0$. They can be both verified even if $\rho_1 \neq 0$.

Back

An alternative specification for phi's: country-specific

- Allow phi's to be different across countries, but renounce to the heterogeneity across types of plans (not enough observations to keep both), estimating

$$\begin{aligned} e^a_{i,t,t+1} &= \varphi_{i,1} e^u_{i,t} + \nu_{i,t,t+1} \\ e^a_{i,t,t+2} &= \varphi_{i,2} e^u_{i,t} + \nu_{i,t,t+2} \end{aligned} \quad \textit{for each } i \in \{\textit{countries}\}$$

- **Pro's:** emphasizes different country-specific styles of doing fiscal policy
- **Con's:** overlooks the possibility that governents' styles might depend on the fiscal instrument they use (an assumption less coherent with the specification for Δz)

$\Longrightarrow$ As the effect of consolidations on macro-variables is estimated **pooling** from different **countries** but **separating** among **DB, IB, CB and TRB plans**, it is preferable to use for simulation a **plan-specific framework**, more similar to that employed at the estimation stage

Back

Specification with four types of plans: heterogeneity in the impact on Δz and in style

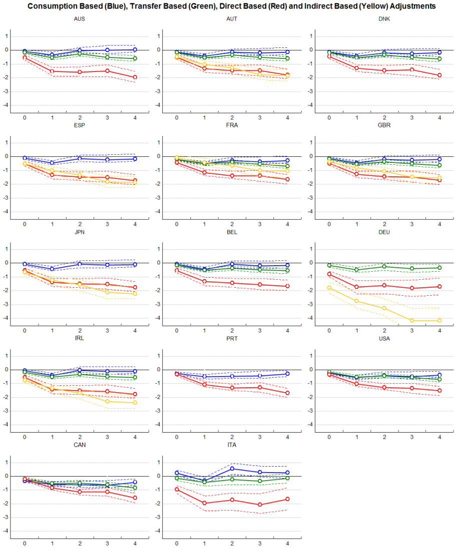
$$
\begin{aligned}
\Delta z_{i,t} = & \alpha + B_1(L) e^{u}_{i,t} * DB_{i,t} + B_2(L) e^{a}_{i,t-1,t} * DB_{i,t} \\
& + C_1(L) e^{u}_{i,t} * IB_{i,t} + C_2(L) e^{a}_{i,t-1,t} * IB_{i,t} \\
& + D_1(L) e^{u}_{i,t} * CB_{i,t} + D_2(L) e^{a}_{i,t-1,t} * CB_{i,t} \\
& + E_1(L) e^{u}_{i,t} * TRB_{i,t} + E_2(L) e^{a}_{i,t-1,t} * TRB_{i,t} \\
& + \beta_1 e^{a}_{i,t,t+1} * DB_{i,t} + \gamma_1 e^{a}_{i,t,t+1} * IB_{i,t} \\
& + \delta_1 e^{a}_{i,t,t+1} * CB_{i,t} + \zeta_1 e^{a}_{i,t,t+1} * TRB_{i,t} \\
& + \lambda_i + \chi_t + u_{i,t}
\end{aligned}
$$

$$
\begin{aligned}
e^{a}_{i,t,t+1} = & \varphi_{1,1} \; e^{u}_{i,t} * DB_{i,t} + \varphi_{2,1} \; e^{u}_{i,t} * IB_{i,t} \\
& + \varphi_{3,1} \; e^{u}_{i,t} * CB_{i,t} + \varphi_{4,1} \; e^{u}_{i,t} * TRB_{i,t} + v_{i,t,t+1}
\end{aligned}
$$

$$
\begin{aligned}
e^{a}_{i,t,t+2} = & \varphi_{1,2} \; e^{u}_{i,t} * DB_{i,t} + \varphi_{2,2} \; e^{u}_{i,t} * IB_{i,t} \\
& + \varphi_{3,2} \; e^{u}_{i,t} * CB_{i,t} + \varphi_{4,2} \; e^{u}_{i,t} * TRB_{i,t} + v_{i,t,t+1}
\end{aligned}
$$

Back

4-component disaggregation and country-specific phi's: output growth



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Country-specific phi's

	AUS	AUT	BEL	CAN	DEU	DNK	ESP
φ_1	0.48	0.36	0.14	1.34	-0.10	0.48	0.27
	(0.19)	(0.08)	(0.14)	(0.17)	(0.12)	(0.13)	(0.06)
φ_2	-0.23	0	0.11	0.51	-0.03	-0.02	0.06
	(0.14)	(0.04)	(0.03)	(0.11)	(0.07)	(0.08)	(0.02)

	FRA	GBR	IRL	ITA	JPN	PRT	USA
φ_1	0.46	0.35	0.21	-0.26	0.25	0.89	0.47
	(0.09)	(0.22)	(0.04)	(0.07)	(0.03)	(0.29)	(0.35)
φ_2	0.14	0.07	0	-0.02	0	0.12	0.34
	(0.05)	(0.18)	(0.00)	(0.04)	(0.00)	(0.10)	(0.28)

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EB-TB disaggregation: coefficients

EB-TB - Sample: 1981-2014

	Coefficient	Std. Error	t-Statistic	p-value
$e^u_{i,t} * TB_{i,t}$	-0.907425***	0.132946	-6.825502	0.0000
$e^u_{i,t} * EB_{i,t}$	-0.129351*	0.067739	-1.909556	0.0569
$e^a_{i,t-1,t} * TB_{i,t}$	-0.688698***	0.176473	-3.902578	0.0001
$e^a_{i,t-1,t} * EB_{i,t}$	-0.439236***	0.113745	-3.861578	0.0001
$e^u_{i,t-1} * TB_{i,t-1}$	-0.602757***	0.127808	-4.716098	0.0000
$e^u_{i,t-1} * EB_{i,t-1}$	-0.265282***	0.074072	-3.581403	0.0004
$e^a_{i,t-2,t-1} * TB_{i,t-1}$	-0.224191	0.166291	-1.348178	0.1784
$e^a_{i,t-2,t-1} * EB_{i,t-1}$	-0.052200	0.119031	-0.438542	0.6612
$e^u_{i,t-2} * TB_{i,t-2}$	-0.145537	0.126743	-1.148288	0.2515
$e^u_{i,t-2} * EB_{i,t-2}$	0.270165***	0.075761	3.565995	0.0004
$e^a_{i,t-3,t-2} * TB_{i,t-2}$	-0.021279	0.226958	-0.093760	0.9253
$e^a_{i,t-3,t-2} * EB_{i,t-2}$	-0.053604	0.120602	-0.444470	0.6569
$e^u_{i,t-3} * TB_{i,t-3}$	-0.418563***	0.136427	-3.068046	0.0023
$e^u_{i,t-3} * EB_{i,t-3}$	-0.015573	0.071601	-0.217501	0.8279
$e^a_{i,t-4,t-3} * TB_{i,t-3}$	-0.858703**	0.355697	-2.414144	0.0162
$e^a_{i,t-4,t-3} * EB_{i,t-3}$	0.002897	0.127668	0.022693	0.9819
$e^a_{i,t,t+1} * TB_{i,t}$, $e^a_{i,t,t+2} * TB_{i,t}$	0.270701**	0.125074	2.164331	0.0310
$e^a_{i,t,t+1} * EB_{i,t}$, $e^a_{i,t,t+2} * EB_{i,t}$	-0.293998***	0.090577	-3.245847	0.0013

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EB-TB disaggregation: phi's

Styles of plans	*TB*	*EB*
φ_1	0.328	0.09
	(0.05)	(0.03)
φ_2	0.05	0.03
	(0.02)	(0.01)

SE in parentheses

Back

Alternative specification with Tax & Spending shocks: coefficients on output growth

Tax & Spending shocks - Sample: 1981-2014

	Coefficient	Std. Error	t-Statistic	p-value
$\tau^u_{i,t}$	-0.413328***	0.136253	-3.033521	0.0026
$g^u_{i,t}$	-0.416138***	0.144148	-2.886885	0.0041
$\tau^a_{i,t-1,t}$	-0.815328***	0.206099	-3.956002	0.0001
$g^a_{i,t-1,t}$	-0.489651***	0.196757	-2.488603	0.0132
$\tau^u_{i,t-1}$	-0.141179	0.137547	-1.026407	0.3053
$g^u_{i,t-1}$	-0.399863**	0.156602	-2.553377	0.0110
$\tau^a_{i,t-2,t-1}$	-0.229159	0.206652	-1.108914	0.2681
$g^a_{i,t-2,t-1}$	0.190424	0.205321	0.927445	0.3543
$\tau^u_{i,t-2}$	-0.159379	0.144566	-1.102462	0.2709
$g^u_{i,t-2}$	0.612319***	0.158631	3.860011	0.0001
$\tau^a_{i,t-3,t-2}$	-0.227896	0.225910	-1.008791	0.3137
$g^a_{i,t-3,t-2}$	0.066819	0.206060	0.324271	0.7459
$\tau^u_{i,t-3}$	-0.507586***	0.148842	-3.410231	0.0007
$g^u_{i,t-3}$	0.214471	0.150792	1.422293	0.1557
$\tau^a_{i,t-4,t-3}$	0.036030	0.237232	0.151876	0.8794
$g^a_{i,t-4,t-3}$	-0.174760	0.227581	-0.767902	0.4430
$\tau^a_{i,t,t+1}$, $\tau^a_{i,t,t+2}$	-0.425569***	0.162627	-2.616847	0.0092
$g^a_{i,t,t+1}$, $g^a_{i,t,t+2}$	-0.155765	0.135077	-1.153159	0.2495

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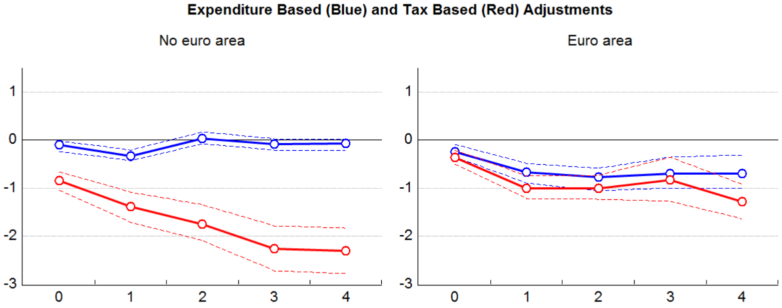
Robustness: fiscal policy when monetary policy does not respond: different phi's in euro vs. non-euro countries

- As in the previous specification but allowing the phi's to be different in euro vs. non-euro countries



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Robustness: fiscal policy when monetary policy does not respond: different phi's in euro vs. non-euro countries (Cont.)

	EUR		No-EUR	
Styles of plans	TB	EB	TB	EB
φ_1	0.46	0.47	0.10	-0.06
	(0.07)	(0.06)	(0.07)	(0.04)
φ_2	0.07	0.11	0.02	0.00
	(0.03)	(0.03)	(0.03)	(0.02)

SE in parentheses

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Fiscal policy when monetary policy does not respond: econometric specification

$$\Delta z_{i,t} = \alpha + \sum_{k=1}^{2} D_{i,t}^{k} * B_{1k}(L) e_{i,t}^{u} * TB_{i,t} + \sum_{k=1}^{2} D_{i,t}^{k} * B_{2k}(L) e_{i,t-1,t}^{a} * TB_{i,t} + \sum_{k=1}^{2} D_{i,t}^{k} * C_{1k}(L) e_{i,t}^{u} * EB_{i,t} + \sum_{k=1}^{2} D_{i,t}^{k} * C_{2k}(L) e_{i,t-1,t}^{a} * EB_{i,t} + \sum_{k=1}^{2} \gamma_{1k} e_{i,t,t+1}^{a} * EB_{i,t} * D_{i,t}^{k} + \sum_{k=1}^{2} \delta_{1k} e_{i,t,t+1}^{a} * TB_{i,t} * D_{i,t}^{k} + \lambda_i + \chi_t + u_{i,t}$$

- $D_{i,t}^{1} = 1$ if EMU (i.e. AUT, BEL, FRA, DEU, ESP, PRT, IRL, ITA from 1999)
- $D_{i,t}^{2} = 1$ if Non-EMU (i.e. AUS GBR, DNK, JPN, USA, CAN and AUT, BEL, FRA, DEU, ESP, PRT, IRL, ITA before 1999)
- $D_{i,t}^{2} = 1 - D_{i,t}^{1}$

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Robustness: fiscal consolidations and the cycle

1. Do the economic conditions prevailing at the beginning of the period (i.e. in $t-1$) influence the decision to implement a fiscal consolidation?
2. Is the choice between type of plans related to the cycle?

- Check (with a probit specification) whether bad economic conditions in $t-1$ affect:
  - the probability of introducing a fiscal consolidation plan in t
  - the type of the plan in t (given that a new plan is announced)
- Proxy for negative cycle: a dummy $= 1$ if output growth was negative in $t-1$

	New plan	TB	EB	DB	IB	CB	TRB
Dummy=1 if $growth_{t-1} < 0$	0.724***	0.148	-0.148	0.261	-0.138	0.0684	-0.257
	(0.155)	(0.221)	(0.221)	(0.234)	(0.287)	(0.222)	(0.241)
Observations	462	159	159	159	159	159	159

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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Calibration (as in Christiano, Eichembaum and Rebelo, 2011)

Parameter	Value	Description
β	0.99	Discount factor (quarterly)
σ	2	Inverse intertemporal elasticity of substitution
γ	0.29	Utility Parameter
σ_I	17	Investment adjustment cost parameter
G_{ss} / Y_{ss}	0.2	Government consumption (% of GDP)
T_{ss} / Y_{ss}	0.2	Transfers (% of GDP)
τ^d_{SS}	0.3	Income tax rate
τ^c_{SS}	0.2	Indirect tax rate
α	0.3	Capital share
θ	0.85	Degree of price stickiness (quarterly)
A	1	Total factor productivity

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Fiscal multipliers and the persistence of fiscal shocks

Analytical multipliers

$$\Omega_G = \frac{(\rho - \phi_\pi)\kappa - [\gamma(\sigma - 1) + 1](1 - \rho)(1 - \beta\rho)}{(1 - \beta\rho)[\rho - 1 - (1 - g)\phi_Y] + (1 - g)(\rho - \phi_\pi)\kappa(\frac{1}{1-g} + \frac{N}{1-N})}$$

$$\Omega_{\tau^d} = \frac{(\phi_\pi - \rho)\frac{1}{1-\tau^d}\frac{\kappa}{1-\beta\rho}}{[(1 - \sigma)\gamma\tau^d - 1](1 - \sigma) - \phi_Y - (\phi_\pi - \rho)\frac{\kappa}{1-\beta\rho}(1 + \frac{N}{1-N})}$$

$$\Omega_{\tau^c} = \frac{(\phi_\pi - \rho)\frac{\kappa}{1-\beta\rho} - (\rho - 1)}{\gamma(1 - \sigma)\tau^c - (1 + \tau^c) - (1 + \tau^c)(\phi_Y + (\phi_\pi - \rho)\frac{\kappa}{1-\beta\rho}\frac{1}{1-N})}$$

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Calibration

Parameter	Value	Description
β	0.99	Discount factor (quarterly)
σ	2	Inverse intertemporal elasticity of substitution
ω	0.8	Utility share in private consumption
ψ	0.30	Inverse of Frisch Elasticity
σ_I	17	Investment adjustment cost parameter
G_{ss}/Y_{ss}	0.2	Government consumption (% of GDP)
T_{ss}/Y_{ss}	0.2	Transfers (% of GDP)
τ^d_{SS}	0.3	Income tax rate
τ^c_{SS}	0.2	Indirect tax rate
α	0.3	Capital share
θ	0.85	Degree of price stickiness (quarterly)
A	1	Total factor productivity

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