The Macroeconomic Effects of Fiscal Adjustments Plans

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based on papers with
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Road Map

1. Estimating Fiscal Multipliers
   - plans *vs* isolated shoks
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
   - hikes in direct taxes
   - hikes in indirect taxes
3. Is the effect of a fiscal adjustment different in booms and recessions?

Multi-year plans

- Real-world fiscal adjustments adopted by parliament in a 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 (1)

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: an example (2)

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: distinction between TB and EB

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

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

$$e_t : \left\{ e_t^u,\ e_{t-i,t}^a,\ e_{t,t+i}^a \right\}$$

$$e_t^u : \left\{ \tau_t^u,\ g_t^u \right\} \quad e_{t-i,t}^a : \left\{ \tau_{t-i,t}^a,\ g_{t-i,t}^a \right\} \quad e_{t,t+i}^a : \left\{ \tau_{t,t+i}^a,\ g_{t,t+i}^a \right\}$$

Romer and Romer (2010)

$$e_t^{R\&R} = \tau_t^u + \tau_{t,t+i}^a$$

Mertens and Ravn (2011)

$$e_t^{M\&R} = \left\{ \tau_t^u,\ \tau_{t,t+i}^a \right\}$$

IMF (2011), Jordà and Taylor (2013)

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

⇒ i.e. e_t^{IMF} is predictable

▸ Plans vs isolated shocks ▸ Predictability

Estimating and simulating plans: step 0

- Start from the Romer and Romer (2010) regression (a truncated MA representation)

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

where the effect of e_t^u and $e_{t,t+1}^a$ assumed to be identical (e.g. no credit constraints)

Pooling data from different countries allowing for heterogeneity across plans (1)

- Heterogeneity in the **composition of plans**
  - plans mostly based on
    - *hikes in Direct Taxes*
    - *hikes in Indirect Taxes*
    - *cuts in Transfers*
    - *cuts in Government Spending*

Pooling data from different countries allowing for heterogeneity across plans (2)

- Heterogeneity in **persistence**

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

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

Styles of fiscal adjustments (persistence of plans)

Styles of plans	*DB*	*IB*	*CB*	*TRB*
φ_1	0.38	0.16	0.09	0.14
	(0.07)	(0.08)	(0.05)	(0.04)
φ_2	0.06	0.03	0.04	0.05
	(0.03)	(0.03)	(0.02)	(0.02)

SE in parentheses

Step 1: a model to estimate and simulate plans

one-year horizon

- Estimation for a panel of countries

$$\Delta z_{i,t} = \alpha + B_1(L)e^{u}_{i,t} + B_2(L)e^{a}_{i,t-1,t} + \\ + \gamma_1 e^{a}_{i,t,t+1} + \lambda_i + \chi_t + u_{i,t}$$

$$e^{a}_{i,t,t+1} = \varphi_1 \; e^{u}_{i,t} + v_{i,t,t+1}$$

- The R&R specification is modified to allow flexibility in the effect of plans upon announcement and implementation (as in Mertens and Ravn, 2011)
  - No distributed lag for the effect of future announced plans because the effect over time of announcements is followed through the plan
  - Simulations constructed using the estimated $\varphi' s$

Step 2: heterogeneity between EB and TB plans

$$\Delta z_{i,t} = \alpha + B_1(L)e^u_{i,t} * TB_{i,t} + B_2(L)e^a_{i,t-1,t} * TB_{i,t} + \\ C_1(L)e^u_{i,t} * EB_{i,t} + C_2(L)e^a_{i,t-1,t} * EB_{i,t} + \\ + \gamma_1 e^a_{i,t,t+1} * EB_{i,t} + \delta_1 e^a_{i,t,t+1} * TB_{i,t} + \lambda_i + \chi_t + u_{i,t}$$

$$if \ \left(\tau^u_t + \tau^a_{t-1,t} + \tau^a_{t,t+1}\right) > \left(g^u_t + g^a_{t-1,t} + g^a_{t,t+1}\right) \Longrightarrow TB_t = 1 \\ otherwise \ TB_t = 0 \\ EB_t = 1 - TB_t$$

$$e^a_{i,t,t+1} = \varphi_{1,1} \ e^u_{i,t} * TB_{i,t} + \varphi_{2,1} \ e^u_{i,t} * EB_{i,t} + v_{i,t,t+1}$$

- EB and TB plans are allowed to have an heterogeneous effect on the dependent variable
- We estimate two sets of φ: style of EB plans and style of TB plans

Step 3: cross-country heterogeneity and four-level disaggregation of plans

- $TB_{i,t}$ plans disaggregated into:
  - $DB_{i,t}$ plans based on direct taxes
  - $IB_{i,t}$ plans based on indirect taxes
- $EB_{i,t}$ plans disaggregated into:
  - $CB_{i,t}$ plans based on govt consumption and investment
  - $TRB_{i,t}$ plans based on transfers
- Four sets of φ: DB-style, IB-style, CB-style and TRB-syle

▸ Full econometric specification ▸ Alternative phi's

Identification

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

Data and narrative identification

Starting point: exogenous fiscal consolidations identified by Devries&al (IMF, 2011) using the Romer&Romer methodology

- 17 OECD countries, 1978-2009 (we only use 16 - we drop the Netherlands as its adjustments are perfectly predicted by the cycle - this may be explained by a feature of Dutch fiscal rules)
- Only stabilization episodes designed to reduce a budget deficit and put the public debt on a sustainable path $\Longrightarrow$ unlikely to be systematically correlated with other developments affecting output, and can be considered as exogenous for the estimation of the short-term output effects of fiscal consolidation
- "If the motivation of the fiscal consolidation is primarily to contract domestic demand, we do not include it in our database"
- Isolated shifts in fiscal variables identified à la R&R. Data sources: 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
    - 227 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 and construct plans that cover the period 2010-2014
  - disaggregate expenditure in government consumption and investments and transfers, and revenues in direct and indirect taxes
  - while doing this we double check the Devries&al identification

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)

Labelling of plans

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 assess whether it consists mostly of consumption and investment or transfers measures
  - If TB whether direct or indirect taxes prevail

Average plans

4 components - (1981-2014)

	Number of plans	**Average composition (% of GDP)**				
		Plan	*Direct*	*Indirect*	*Consumption*	*Transfer*
Direct Tax Based	38	1.67	**0.73**	0.22	0.31	0.18
		(0.22)	(0.06)	(0.05)	(0.08)	(0.06)
Indirect Tax Based	21	1.48	0.26	**0.80**	0.15	0.04
		(0.30)	(0.09)	(0.05)	(0.10)	(0.09)
Consumption Based	60	1.81	0.20	0.20	**0.89**	0.31
		(0.17)	(0.05)	(0.04)	(0.04)	(0.05)
Transfer Based	53	2.15	0.29	0.17	0.40	**0.96**
		(0.17)	(0.06)	(0.04)	(0.06)	(0.04)

Robustness of plans classification

	Share of principal component			
Type of plan	$\geq 50\%$	$< 50\%$	$< 35\%$	$< 25\%$
Direct Tax Based	19	19	7	0
Indirect Tax Based	15	6	2	1
Consumption Based	33	27	12	6
Transfer Based	21	32	11	3
Tot.	88	84	32	10

Total Plans: 172

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

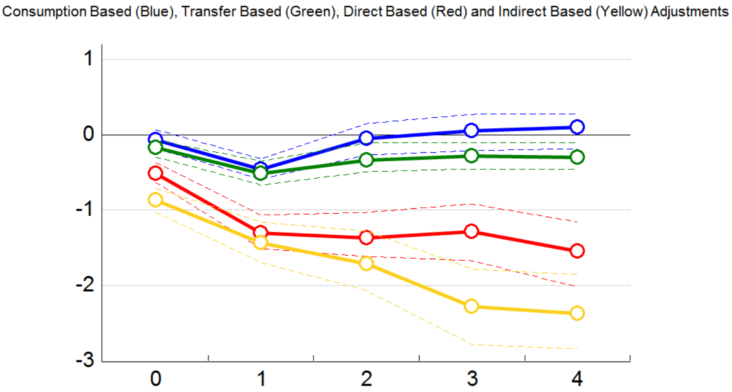
$$e^u_{i,t} + e^a_{i,t,t+1} + e^a_{i,t,t+2} = 1$$

$$\overset{\wedge}{e^a_{i,t,t+j}} = \overset{\wedge}{\varphi_{p,j}} e^u_{i,t} \quad \text{for} \quad j = 1, 2 \, and \, p = DB, \; IB \; CB \; TRB$$

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

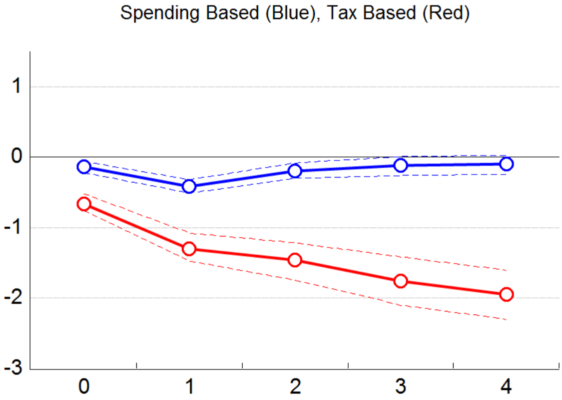
- As an example, in the case of a DB plan, $\overset{\wedge}{\varphi}_1 = 0.38$ and $\overset{\wedge}{\varphi}_2 = 0.06$. Hence we simulate $e^u_t = 0.69$, $e^a_{t,t+1} = 0.26$, $e^a_{t,t+2} = 0.05$

4-level disaggregation: output growth



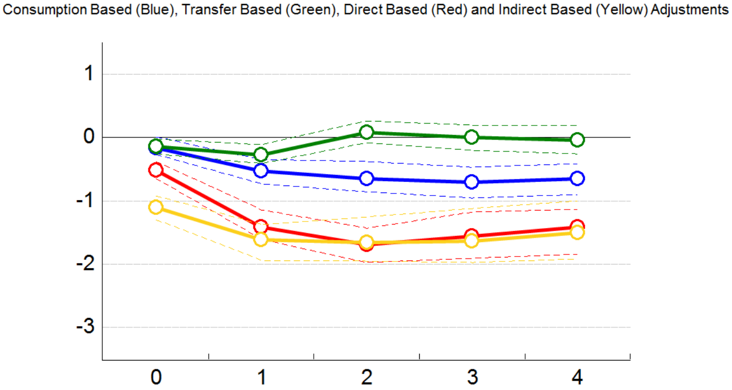
Alternative phi's

Restricting the two tax and the two spending multipliers to be identical: output growth

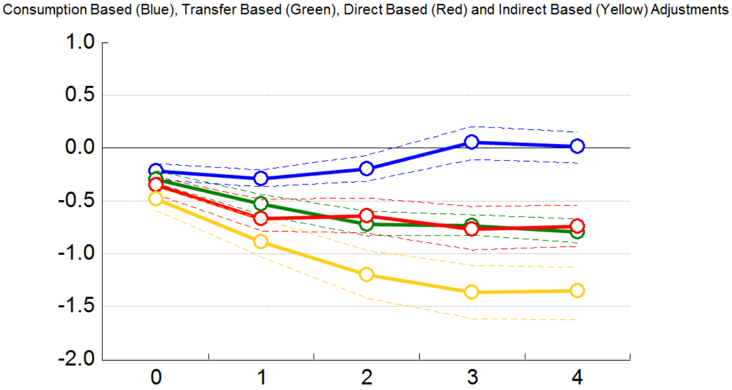


▸ Coefficients ▸ Phi's ▸ Alternative specification with Tax and Spending shocks

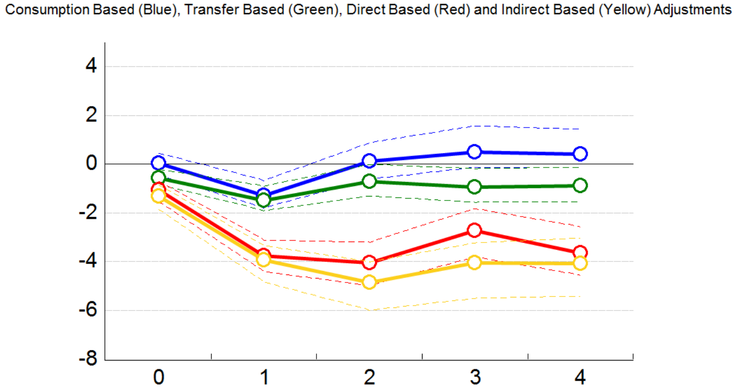
4-level disaggregation: private consumption growth



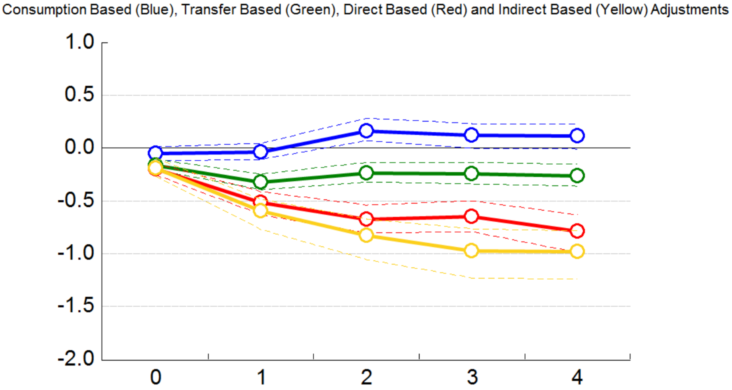
4-level disaggregation: ESI consumer confidence



4-level disaggregation: fixed capital formation

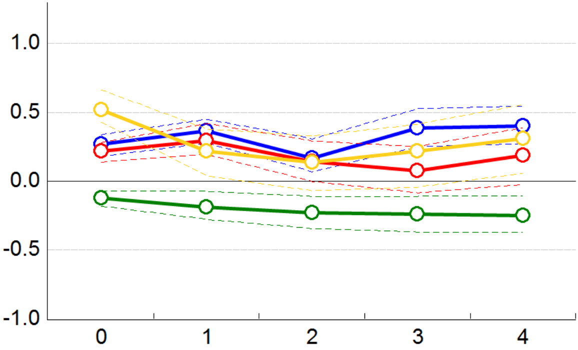


4-level disaggregation: ESI business confidence



4-level disaggregation: short term rate

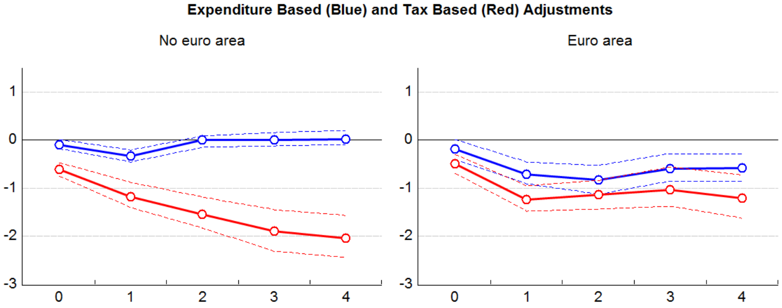
Consumption Based (Blue), Transfer Based (Green), Direct Based (Red) and Indirect Based (Yellow) Adjustments



Theoretical Model

Robustness: fiscal policy when monetary policy does not respond

- Restricting tax and spending but allowing for heterogeneity between Non-EMU and EMU countries (where monetary policy cannot respond to national fiscal policy)



▸ Econometric specification

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)

A negative change in the index signals liberalizations 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

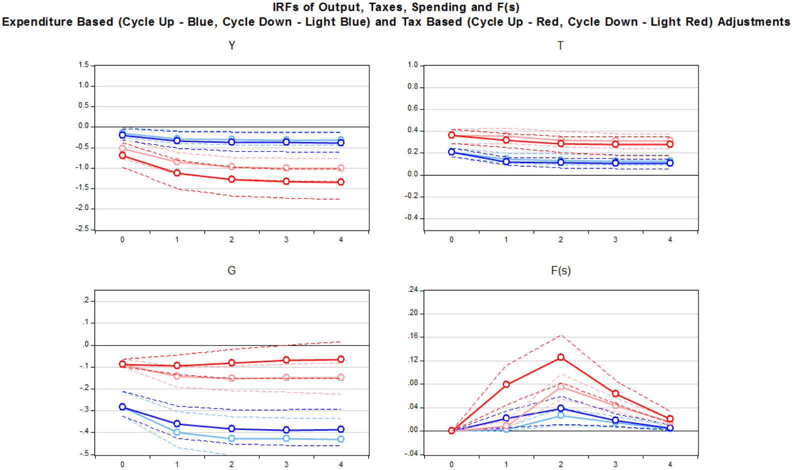
Consolidations in booms and recessions

- Recent empirical literature (Auerbach and Gorodnichenko 2012, 2013, Ramey and Zubairy 2014, Caggiano et al. 2015) finds that fiscal multipliers depend on the state of the economy: it makes a difference whether a fiscal shock happens during an expansion or a recession
- Which is the relevant non-linearity: the *when* or the *how*?

Consolidations in booms and recessions: our framework

- We build a framework that allows for two non-linearities at a time: state of the cycle at the beginning of the adjustment (boom vs recession) and composition of the plan (EB vs TB)
- The state indicator for the cycle is $F(s)$, a country-specific logistic function measuring the probability that the economy is in a recession F(s)
- We estimate a state-dependent SVAR including output, taxes and spending Full econometric specification
- In simulation we allow for a two-way feedback: not only the response of output is influenced by $F(s)$ but also $F(s)$ is free to evolve as output responds to the shift in fiscal variables

Consolidations in booms and recessions: results



Conclusions

- Empirical results
  - Tax-based plans (both based on Direct and Indirect Taxes) 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
- The composition is more important than the timing
  - It does not matter much whether a consolidation starts in recession or expansion
  - TB plans are more recessionary than EB ones regardless of the state of the cycle

Predictability

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

"Shocks" become 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)

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

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

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

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

- 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

Estimating and simulating plans

- Estimating

$$
\begin{aligned}
y_t = &\alpha + \beta_1 e^u_t * TB_t + \beta_2 e^a_{t,t+1} * TB_t + \beta_3 e^a_{t-1,t} * TB_t \\
&\gamma_1 e^u_t * EB_t + \gamma_2 e^a_{t,t+1} * EB_t + \gamma_3 e^a_{t-1,t} * EB_t + \epsilon_t
\end{aligned}
$$

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

$$
where\ e^u_t = \tau^u_t + g^u_t
$$

$\Rightarrow$ This specification does not require to estimate all the intra-temporal and inter-temporal cross correlations between τ and g, but only the inter-temporal correlation between the aggregate shocks e^u and e^a

$\Rightarrow$ As when $TB = 1$, $EB = 0$ and vice-versa *by construction*

- $\frac{dy_t}{de^u_t * TB_t} = \beta_1 + \beta_2 \varphi_1$
- $\frac{dy_t}{de^u_t * EB_t} = \gamma_1 + \gamma_2 \varphi_2$

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

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

- **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

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

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

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

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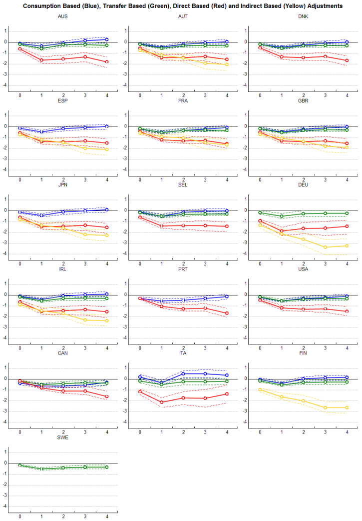
4-component disaggregation and country-specific phi's: output growth



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Country-specific phi's

	AUS	AUT	BEL	CAN	DEU	DNK	ESP	FIN
φ_1	0.48	0.36	0.14	1.34	-0.10	0.48	0.27	0.09
	(0.19)	(0.08)	(0.14)	(0.17)	(0.12)	(0.13)	(0.06)	(0.12)
φ_2	-0.23	0	0.11	0.51	-0.03	-0.02	0.06	-0.01
	(0.14)	(0.04)	(0.03)	(0.11)	(0.07)	(0.08)	(0.02)	(0.02)

	FRA	GBR	IRL	ITA	JPN	PRT	USA	SWE
φ_1	0.46	0.35	0.21	-0.26	0.25	0.89	0.47	0.57
	(0.09)	(0.22)	(0.04)	(0.07)	(0.03)	(0.29)	(0.35)	(0.11)
φ_2	0.14	0.07	0	-0.02	0	0.12	0.34	0.34
	(0.05)	(0.18)	(0.00)	(0.04)	(0.00)	(0.10)	(0.28)	(0.08)

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EB-TB disaggregation: coefficients

EB-TB - Sample: 1981-2014

	Coefficient	Std. Error	t-Statistic	p-value
$e^u_{i,t} * TB_{i,t}$	-0.949799***	0.125233	-7.584267	0.0000
$e^u_{i,t} * EB_{i,t}$	-0.094089	0.059393	-1.584181	0.1138
$e^a_{i,t-1,t} * TB_{i,t}$	-0.733702***	0.159449	-4.601474	0.0000
$e^a_{i,t-1,t} * EB_{i,t}$	-0.371942***	0.101001	-3.682555	0.0003
$e^u_{i,t-1} * TB_{i,t-1}$	-0.628784***	0.120869	-5.202196	0.0000
$e^u_{i,t-1} * EB_{i,t-1}$	-0.249209***	0.064568	-3.859634	0.0001
$e^a_{i,t-2,t-1} * TB_{i,t-1}$	-0.287714*	0.149457	-1.925059	0.0548
$e^a_{i,t-2,t-1} * EB_{i,t-1}$	0.060870	0.103290	0.589316	0.5559
$e^u_{i,t-2} * TB_{i,t-2}$	-0.105233	0.119698	-0.879156	0.3798
$e^u_{i,t-2} * EB_{i,t-2}$	0.265000***	0.066475	3.986447	0.0001
$e^a_{i,t-3,t-2} * TB_{i,t-2}$	-0.171947	0.207754	-0.827646	0.4083
$e^a_{i,t-3,t-2} * EB_{i,t-2}$	0.089771	0.104005	0.863138	0.3885
$e^u_{i,t-3} * TB_{i,t-3}$	-0.331351**	0.129430	-2.560074	0.0108
$e^u_{i,t-3} * EB_{i,t-3}$	0.073684	0.062918	1.171119	0.2422
$e^a_{i,t-4,t-3} * TB_{i,t-3}$	-0.829834**	0.334179	-2.483200	0.0134
$e^a_{i,t-4,t-3} * EB_{i,t-3}$	0.107686	0.109019	0.987768	0.3238
$e^a_{i,t,t+1} * TB_{i,t}$, $e^a_{i,t,t+2} * TB_{i,t}$	0.267816**	0.112263	2.385614	0.0175
$e^a_{i,t,t+1} * EB_{i,t}$, $e^a_{i,t,t+2} * EB_{i,t}$	-0.348291***	0.078104	-4.459310	0.0000

EB-TB disaggregation: phi's

Styles of plans	*TB*	*EB*
φ_1	0.28	0.11
	(0.05)	(0.03)
φ_2	0.05	0.04
	(0.02)	(0.01)

SE in parentheses

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

Tax & Spending shocks - Sample: 1981-2014

	Coefficient	Std. Error	t-Statistic	p-value
$\tau^u_{i,t}$	-0.495994***	0.122127	-4.061289	0.0001
$g^u_{i,t}$	-0.405841***	0.128105	-3.168036	0.0016
$\tau^a_{i,t-1,t}$	-0.864720***	0.182199	-4.746008	0.0000
$g^a_{i,t-1,t}$	-0.348672**	0.160364	-2.174262	0.0302
$\tau^u_{i,t-1}$	-0.235163*	0.123533	-1.903636	0.0576
$g^u_{i,t-1}$	-0.458218***	0.135375	-3.384820	0.0008
$\tau^a_{i,t-2,t-1}$	-0.432061**	0.186349	-2.318560	0.0209
$g^a_{i,t-2,t-1}$	0.376504**	0.167767	2.244214	0.0253
$\tau^u_{i,t-2}$	-0.263732**	0.129703	-2.033348	0.0426
$g^u_{i,t-2}$	0.694599***	0.136117	5.102956	0.0000
$\tau^a_{i,t-3,t-2}$	-0.312234	0.206196	-1.514256	0.1306
$g^a_{i,t-3,t-2}$	0.260049	0.167913	1.548708	0.1221
$\tau^u_{i,t-3}$	-0.418055***	0.133359	-3.134819	0.0018
$g^u_{i,t-3}$	0.280307**	0.131676	2.128765	0.0338
$\tau^a_{i,t-4,t-3}$	0.100652	0.216779	0.464306	0.6426
$g^a_{i,t-4,t-3}$	-0.141484	0.177044	-0.799145	0.4246
$\tau^a_{i,t,t+1}$, $\tau^a_{i,t,t+2}$	-0.499966***	0.143745	-3.478137	0.0006
$g^a_{i,t,t+1}$, $g^a_{i,t,t+2}$	-0.178579	0.117367	-1.521540	0.1288

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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, FIN from 1999)
- $D_{i,t}^{2} = 1$ if Non-EMU (i.e. AUS GBR, DNK, JPN, USA, CAN, SWE 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 $growth_{t-1} < 0$	0.763***	0.108	-0.108	0.184	-0.0805	0.0844	-0.207
	(0.144)	(0.211)	(0.211)	(0.226)	(0.270)	(0.211)	(0.220)
Observations	529	172	172	172	172	172	172

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

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Fiscal plans in a NK framework: extending Chistiano, Eichenbaum and Rebelo (2011)

- Representative household: infinitely lived with

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

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

  - Invests in two types of assets: capital K_t and risk free government bonds B_t
  - Subject to adjustment costs on investments
  - Receives lump sum transfer T_t and pays payroll tax τ_t^d and private consumption tax τ_t^c

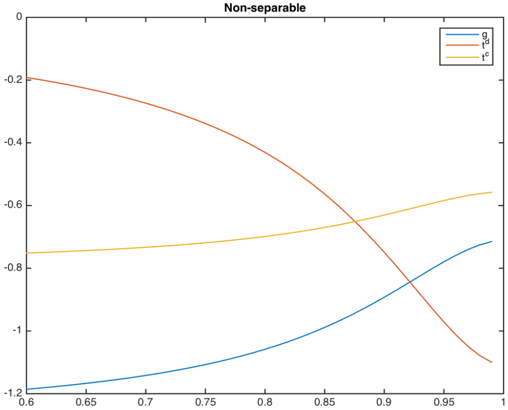
- Production side: monopolistic competition among intermediary firms with Calvo price rigidity, flexible wages and constant returns to scale
- Government: 5 instruments: τ^d, τ^c, T, G, B

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

- Monetary policy: Taylor rule

Fiscal multipliers and the persistence of fiscal shocks

Istantaneous output multipliers to shifts in G and τ_n in the model by Christiano, Eichenbaum and Rebelo (2011) for varying level of shocks persistence. No capital and government debt. GBC is balanced using transfers.



Analytical multipliers

Introducing plans

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

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

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

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

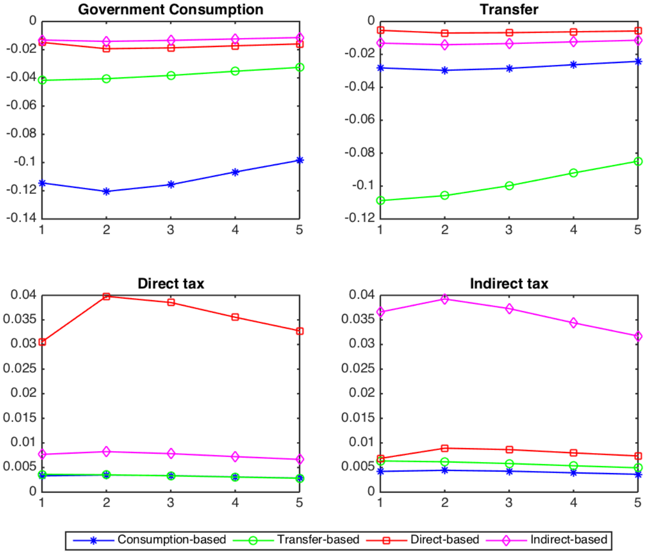
Note that each movement in $e_t^{u,f}$, $f \in \{G, T, \tau^d, \tau^c\}$, is accompanied by

- **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 (see slide 21)

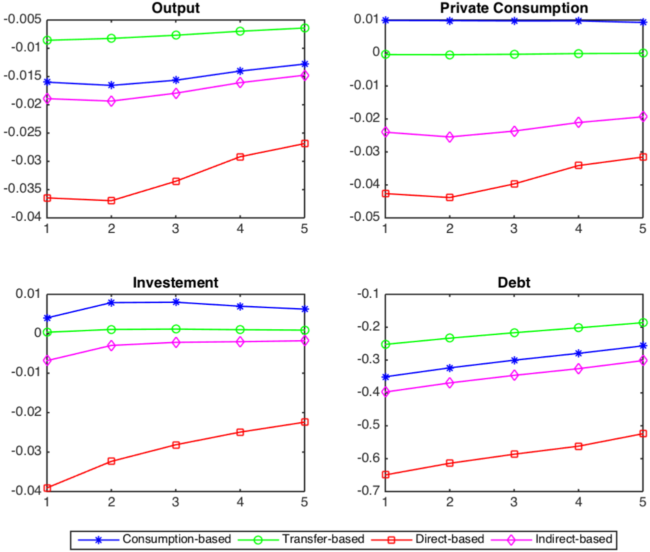
▸ Calibration

Illustrating plans

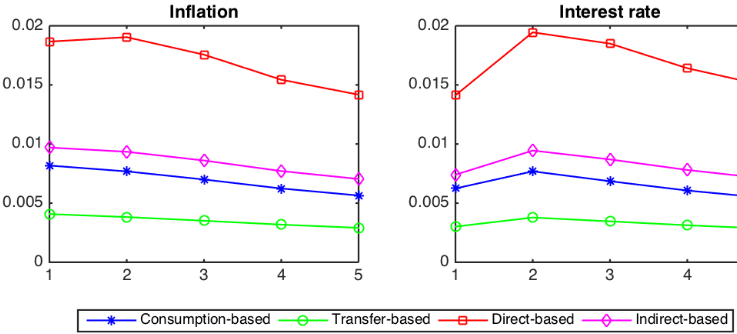
Plan-specific phi's as in slide 12



Calibration as in CER. Plan-specific phi's as in slide 12



Calibration as in CER. Plan-specific phi's as in slide 12 (Cont.)



Fiscal plans in a NK framework: introducing preferences with 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*

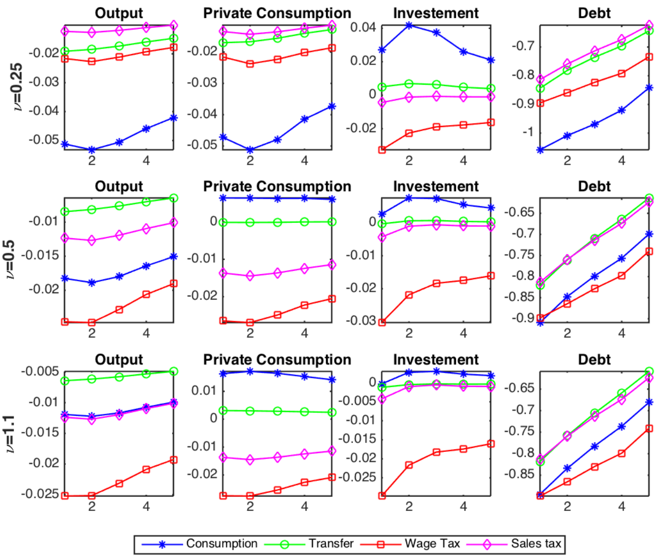
- The other features of the model remain unchanged
- The value of ν determines the relation between C and G
  - low ν: C and G are **complements**
  - high ν: C and G are **substitutes**

$\Longrightarrow$ 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



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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

Back

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

Back

$F(s)$

$$
\begin{aligned}
F(s_{i,t}) &= \frac{\exp(-\gamma_i s_{i,t})}{1+\exp(-\gamma_i s_{i,t})}, \gamma_i > 0, \\
s_{i,t} &= \left(\mu_{i,t} - E\left(\mu_{i,t}\right)\right) / \sigma\left(\mu_{i,t}\right) \\
\mu_{i,t} &= \frac{\Delta y_{i,t-1} + \Delta y_{i,t-2}}{2}
\end{aligned}
$$

Back

Full econometric framework

$$
\begin{aligned}
\Delta y_{i,t} &= (1-F(s_{i,t}))A_1^E(L)\,\mathbf{z}_{i,t-1} + F(s_{i,t})A_1^R(L)\,\mathbf{z}_{i,t-1} + \\
&\left[\begin{array}{c} 1-F(s_{i,t}) \\ F(s_{i,t}) \end{array}\right]' \left[\begin{array}{cc} \mathbf{a}'\mathbf{e}_{i,t} & \mathbf{b}'\mathbf{e}_{i,t} \\ \mathbf{c}'\mathbf{e}_{i,t} & \mathbf{d}'\mathbf{e}_{i,t} \end{array}\right] \left[\begin{array}{c} TB_{i,t} \\ EB_{i,t} \end{array}\right] \\
&+\lambda_{1,i} + \chi_{1,t} + u_{1,i,t} \\
\Delta g_{i,t} &= (1-F(s_{i,t}))A_2^E(L)\,\mathbf{z}_{i,t-1} + F(s_{i,t})A_2^R(L)\,\mathbf{z}_{i,t-1} + \\
&+\beta_{21}g_{i,t}^u + \beta_{22}g_{i,t-1,t}^a + \lambda_{2,i} + \chi_{2,t} + u_{2,i,t} \\
\Delta \tau_{i,t} &= (1-F(s_{i,t}))A_3^E(L)\,\mathbf{z}_{i,t-1} + F(s_{i,t})A_3^R(L)\,\mathbf{z}_{i,t-1} + \\
&+\beta_{31}\tau_{i,t}^u + \beta_{32}\tau_{i,t-1,t}^a + \lambda_{3,i} + \chi_{3,t} + u_{3,i,t}
\end{aligned}
$$

- $\Delta y_{i,t}$ is the growth rate of per capita output
- $\Delta \tau_{i,t}$ and $\Delta g_{i,t}$ are the percentage change of tax revenues and of primary government spending as a fraction of GDP
- $z_t = [\Delta y_{i,t}, \Delta \tau_{i,t}, \Delta g_{i,t}]$ and $e_{i,t} = [e_{i,t}^u, e_{i,t-1,t}^a, e_{i,t,t+1}^a]$

Full econometric framework (cont.)

$$
\begin{aligned}
\tau^u_{i,t} &= \varphi_0^{TB} e^u_{i,t} * TB_{i,t} + \varphi_0^{EB} e^u_{i,t} * EB_{i,t} + v_{0,i,t} \\
g^u_{i,t} &= \vartheta_0^{TB} e^u_{i,t} * TB_{i,t} + \vartheta_0^{EB} e^u_{i,t} * EB_{i,t} + \upsilon_{0,i,t} \\
\tau^a_{i,t,t+j} &= \varphi_j^{TB} e^u_{i,t} * TB_{i,t} + \varphi_j^{EB} e^u_{i,t} * EB_{i,t} + v_{j,i,t} \quad j = 1,2 \\
g^a_{i,t,t+j} &= \vartheta_j^{TB} e^u_{i,t} * TB_{i,t} + \vartheta_j^{EB} e^u_{i,t} * EB_{i,t} + \upsilon_{j,i,t} \quad j = 1,2 \\
e^a_{i,t,t+j} &= e^a_{i,t-1,t+j+1} + \left(e^a_{i,t,t+j} - e^a_{i,t-1,t+j+1} \right) \quad j \geqslant 1
\end{aligned}
$$

◂ Back