

Fiscal Multipliers in India*

March, 2010

Roberto Guimarães
International Monetary Fund

*The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

Motivation

- India has embarked on large fiscal stimulus in 2008/09 and 2009/10
- Debate on effectiveness of fiscal policy continues; evidence mostly from advanced countries.
- Eventual exit from accommodative stance would have to be done in a calibrated way, *knowledge of multipliers could be useful.*
- Shedding light on fiscal multipliers could also help understand other features of the economy and assess the extent of crowding-out going forward.

This Paper

- Briefly reviews cross-country evidence on fiscal multipliers
- Discusses alternative methodologies used to gauge the effect of fiscal policy
 - In light of “problems/failure(?)” of macroeconomic models, eclectic approach should be pursued
- Estimates tax and spending multiplier for India using structural VAR models
- Presents other fiscal multiplier estimates using states data and a estimated DSGE model (work in progress)

Evidence on Fiscal Multipliers

- Event-studies (ES) of fiscal stimulus provides mixed evidence on effectiveness; difficult to apply without institutional knowledge; harder to generalize.
 - Defense spending increases stimulates output but leads to decline in private C (war time multipliers?)
- VAR methods show both G and T multipliers are at work, results suggest multipliers may have declined (advanced economies), tax multipliers are generally large.
 - Positive spending and tax cut, spending between 0-1
 - Large VAR models show private C increase, crowding out effects on I
- Estimates from structural macro models generally show stronger multiplier effects
 - but findings depend non-trivially on several assumptions and parameters: labor supply elasticity, percentage of credit constrained households, monetary policy response, etc.

Cross-country Evidence on Fiscal Multipliers

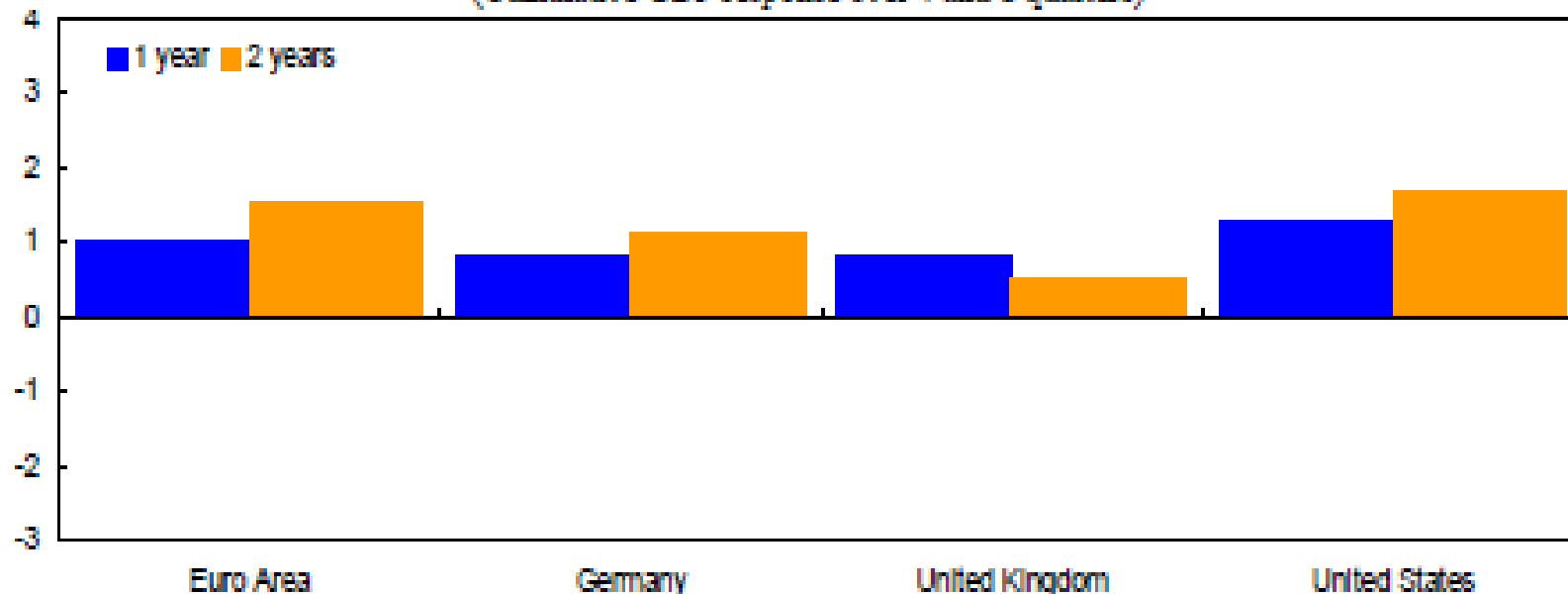
- Evidence from influential Romer-Bernstein has multipliers in the 0.9 to 1.6 range (larger for spending)
- But Romer and Romer (2008) find a much larger tax multiplier for the U.S.:

"tax changes have very large effects on output. Our baseline specification suggests that an exogenous tax increase of one percent of GDP lowers real GDP by roughly three percent. Our many robustness checks for the most part point to a slightly smaller decline, but one that is still well over two percent."

- Generally, evidence suggest that the success is contingent on: (i) timing; (ii) targeting; and strong economic fundamentals (especially for large fiscal adjustments)

Cross-country Evidence on Fiscal Multipliers

Fiscal Multipliers from Macroeconometric Models: 1 Percent of GDP Increase in Government Spending
(Cumulative GDP response over 4 and 8 quarters)



Source: Perotti (2005).

Cross-country Evidence on Fiscal Multipliers WEO Oct. 2008

Assessment of Impacts of Discretionary Fiscal Policy Stimulus by Empirical Method

	Output	Private Consumption	Private Investment in Durables	Private Capital Investment
VAR studies	Neutral to positive	Neutral to positive	Negative to positive	Negative to positive
Narrative studies	Positive	Negative	Negative	...
Case studies	Positive	Positive

Note: Studies placed in the vector autoregression (VAR) category include Fatás and Mihov (2001); Mountford and Uhlig (2002); Blanchard and Perotti (2002); and Galí, López-Salido, and Vallés (2007). Studies placed in the narrative category include Ramey and Shapiro (1998) and Edelberg, Eichenbaum, and Fisher (1999). Case studies include Johnson, Parker, and Souleles (2006).

Cross-country Evidence on Fiscal Multipliers

WEO Oct. 2008

Table 5.4. Responses of Real GDP to Discretionary Fiscal Policy Changes

Effect in:	Real GDP Response			
	Elasticity-based fiscal impulse measure		Regression-based fiscal impulse measure	
	Year zero	Year three	Year zero	Year three
	<i>(with respect to positive fiscal impulse by 1 percentage point of GDP)</i>			
Baseline specification	0.15	-0.16	0.08	-0.02
Country differences				
Advanced economies only	0.12	0.13	0.11	0.51
Emerging economies only	0.21	-0.03	0.10	-0.09
Composition				
Revenue-based policy changes	0.21	0.12	0.10	0.14
Expenditure-based policy changes	0.13	-0.21	0.06	-0.06
Composition: advanced economies only				
Revenue-based policy changes	0.35	0.59	0.01	0.40
Expenditure-based policy changes	-0.09	-0.26	0.15	0.52
Composition: emerging economies only				
Revenue-based policy changes	0.23	0.23	0.13	0.17
Expenditure-based policy changes	0.20	-0.18	0.08	-0.23
Downturns	0.29	0.00	0.10	0.04
Fiscal stimulus only	-1.30	-0.88	-0.87	-0.29
Fiscal stimulus only, high initial debt	-1.75	-2.05	-1.05	-0.80
Fiscal stimulus only, low initial debt	-0.96	-0.36	-0.65	0.13

Estimating Fiscal Multipliers: Event Studies

- Identify exogenous changes in G and T
 - For the U.S.: increases in defense spending
 - Korean War, Vietnam War, Reagan cold-war buildup, Bush 9/11 buildup
 - Create dummies: case above $D = 1$ if time=1950:Q3, ...
 - Run regressions:

$$Y_t = A(L)Y_{t-1} + B(L)D_t + u_t$$

- Compute impact of D on Y (given by $B(L)(I-A(L))^{-1}$)

Analytics of Fiscal Multipliers

- In a simple DSGE model with flexible prices, the representative agent maximizes:

$$U = E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} + \phi_m \frac{m_t^{1-\chi}}{1-\chi} - \phi_n \frac{N_t^{1+\xi}}{1+\xi} \right), \sigma, \chi > 1; \xi \geq 0; \phi_m, \phi_n > 0$$

- subject to the usual budget constraints:

$$C_t = \left[\int_0^1 C_t(i)^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}}, \theta > 1$$

- and

$$\int_0^1 P_t(i) C_t(i) di + B_t + M_t \leq W_t N_t + (1 + i_{t-1}) B_{t-1} + M_{t-1} + T_t + Q_t$$

Analytics of Fiscal Multipliers

- The government's budget constraint is given by:

$$M_t - M_{t-1} + B_t = T_t + (1 + i_{t-1})B_t + P_t G_t$$

- and government spending is assumed to follow the following stochastic process:

$$G_t = \bar{G}e^{g_t}$$

$$g_t = \rho_g g_{t-1} + \epsilon_t^g, 0 < \rho_g < 1$$

Analytics of Fiscal Multipliers

- In this model, the solution for output and inflation are given by:

$$\hat{y}_t = \underbrace{\frac{s_g}{1 + \frac{\xi}{\sigma}(1 - s_g)}}_{\geq 0} g_t$$

$$\hat{\pi}_t = \hat{m}_{t-1} + \underbrace{\frac{\xi(1 - \rho_g\beta)}{\chi(1 - \beta) + \beta(1 - \rho_g)}}_{\geq 0} \left(\frac{s_g}{1 + \frac{\xi}{\sigma}(1 - s_g)} \right) g_t$$

- The equation for output shows that the multiplier is positive and a function of the parameters described in the text (share of government spending, curvature of the utility function, and elasticity of labor supply).

Estimating Fiscal Multipliers: VARs

- System of equations that accounts for dynamic relationship between endogenous variables

$$Y_t = C(L)Y_{t-1} + u_t$$

where Vector $Y = [G \ Y \ T]$ -> **small VAR**

- In small VAR, reduced form errors are a combination of
 - automatic response of T , G to Y shocks (automatic stabilizers)
 - Systematic discretionary response of T , G to Y shocks (e.g. tax cuts typically implemented during recessions)
 - Discretionary (or structural) fiscal shock -> **what we really want to measure!**

Estimating Fiscal Multipliers: VARs

Reduced form VAR is estimated

$$(1) \quad Y_t = C(L)Y_{t-1} + u_t$$

v_t is a $N \times 1$ vector of reduced form innovations

Posited linear structural model of the economy is given by:

$$AY_t = C(L)Y_{t-1} + Bv_t$$

v_t is a $N \times 1$ vector of structural innovations (shocks)

Note: I've been omitting deterministic terms

Easy to show that structural shock can be mapped from reduced form shock, i.e. u_t are used to "identify" v_t :

$$(2) \quad Au_t = Bv_t,$$

Estimating Fiscal Multipliers in India

- Data:
 - Seasonally adjusted quarterly data for real macro economic and fiscal variables.
 - Expenditure data cover current and development spending (CGA whenever possible).
- Main Methodology Used:
 - Recursive and Structural VARs
 - Fiscal policy shocks are identified from VAR and impulse response functions (IRFs) are computed
 - Multipliers are based on scaled IRFs.
 - The *small* VAR system includes real government spending, real GDP, and real tax revenue;
 - The “large” VAR adds inflation and the interest rate to the small VAR
 - In some estimations exogenous dummies are used to address non-normality in the reduced form residuals

Estimating Fiscal Multipliers in India

- In recursive VAR, variables are ordered from most exogenous to most endogenous (**small-VAR ordering is G, Y, T**)
- In the structural/identified VAR we have:

$$\begin{bmatrix} 1 & -\alpha_{G}^Y & \alpha_{T}^Y \\ -\alpha_{Y}^G & 1 & 0 \\ -\alpha_{Y}^T & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^Y \\ u_t^G \\ u_t^T \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & \beta_G^T & 1 \end{bmatrix} \begin{bmatrix} v_t^Y \\ v_t^G \\ v_t^T \end{bmatrix}$$

- Timing is key to identification: it takes longer than a quarter for discretionary fiscal policy to respond to an output shock
- T still responds to G shocks contemporaneously
- **Important: there are no restrictions on dynamics beyond one quarter**

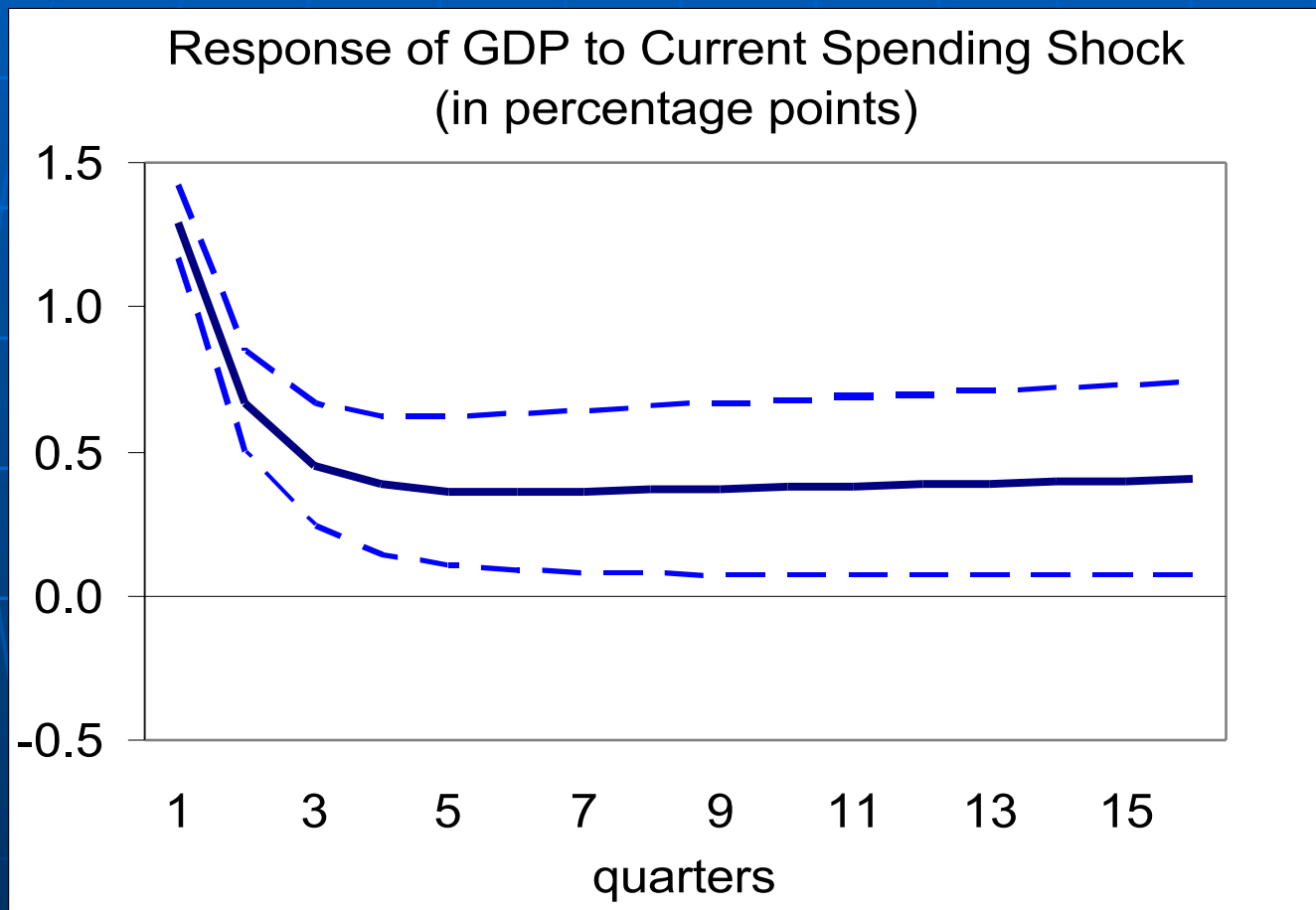
Selected VAR Results

- Preliminary findings for India show that discretionary fiscal policy shocks have economically significant effects on activity
- Current Spending multiplier is one on impact, and declines to around 0.5 after 4-5 quarters, suggesting partial crowding out of some private demand component
 - G multiplier not robust to specification of reduced form VAR
 - Effect loses statistical significance if 95 percent confidence bands are used
- Development spending multiplier is greater than 1, suggesting that composition of spending matters (consistent with cross country evidence),
 - effect persistent even at 16 quarters
 - IRF uncertainty is high
- Tax revenue multiplier is about twice as large as current spending (same order of magnitude of development spending), and remains significant after 8 quarters.

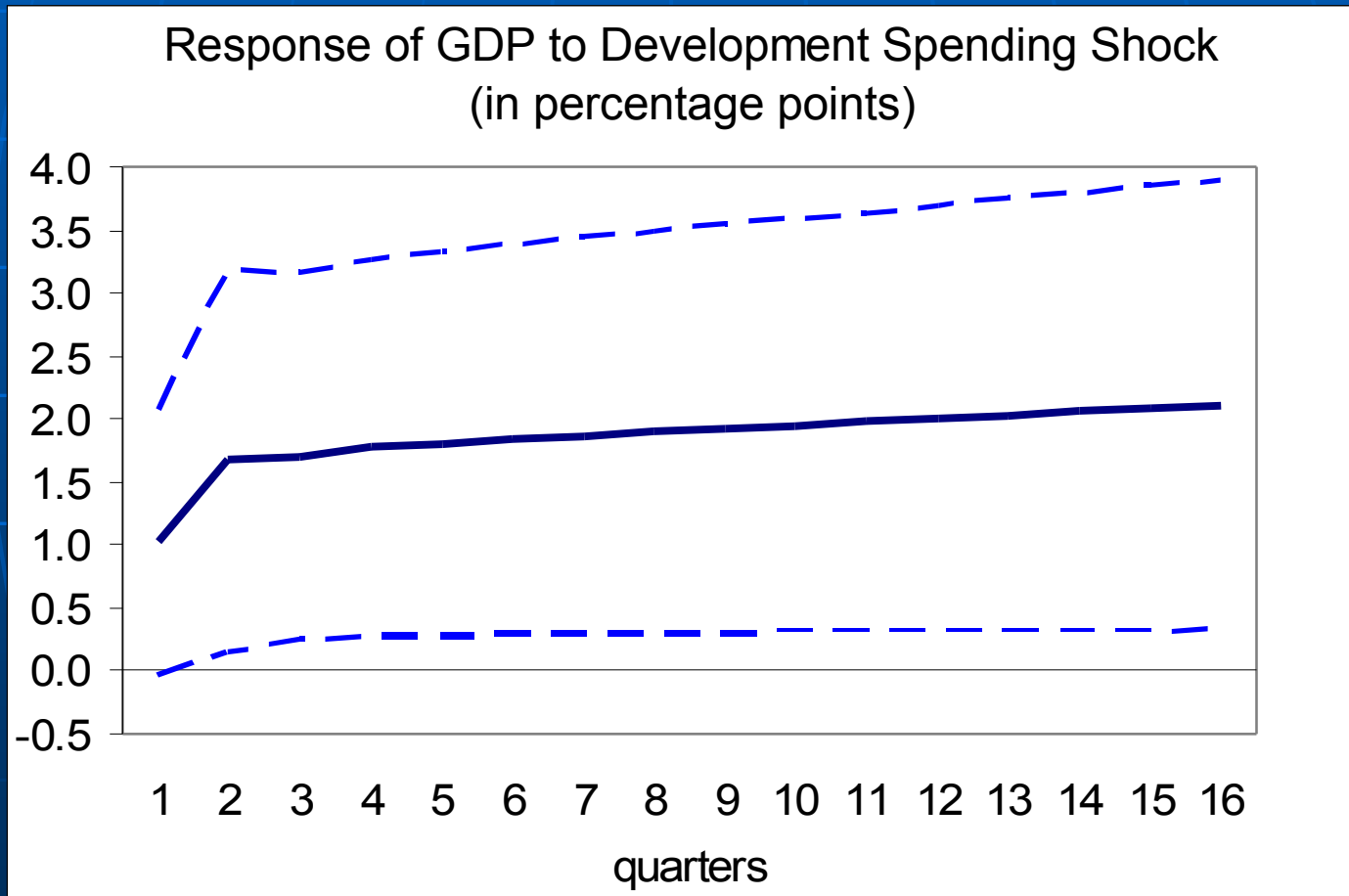
Other implications of main estimates

- Current Spending shocks have a positive impact on inflation, with the effect peaking at 6 quarters. This is also consistent with some form crowding out.
- The results above suggest that crowding out might dull the effects of fiscal policy.
 - First, the current spending multiplier is well below one after a few quarters, suggesting that the increased spending reduces the availability of resources for the private sector
 - The effect on growth over the longer term depends on which component of demand declines, but given that consumption of credit-constrained households is not interest sensitive, it is likely that investment may decline following a deficit-financed increase in spending
- Effect of taxes suggest that dynamic scoring of fiscal plans is crucial, particularly in medium term fiscal plan scenarios

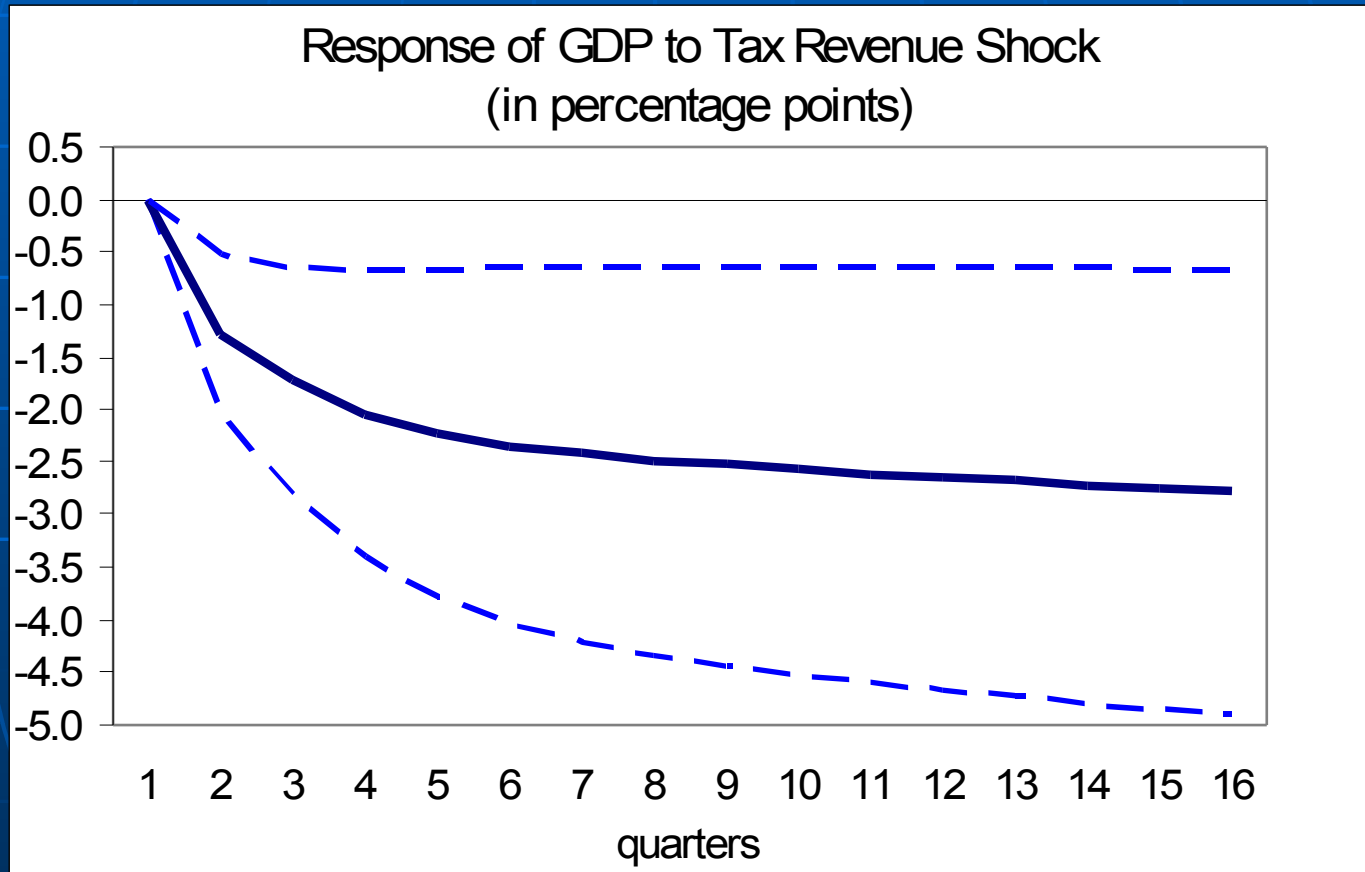
Current Spending Multiplier



Development Spending Multiplier



Tax Revenue Multiplier



Crowding Out: a brief detour

- Results suggest that crowding out (CO) may be at work
 - Current Spending multiplier < 1 after 5 quarters
 - Crowding out of private demand
- But model with interest rates indicates that CO might not operate via interest rates
 - Not inconsistent with evidence found elsewhere
 - Measurement issue: how representative are interest rates anyway?
- Credibility of fiscal framework (measured by credit spreads) may be the proximate causal link
 - Agca and Celasun show that public debt levels affect corporate loan spreads

Multiplier on government spending: Evidence from India's states

- Use Indian state data to assess the size of the fiscal multiplier
- Follow cross-country empirical literature (IMF WEO 2009, Gupta et al. (2004))
- Hard to find credible instruments for government spending (f.ex. election cycles)
- Instead, use GMM dynamic panel techniques to try to identify the causal impact
- Still, results should be interpreted with caution

Multiplier on government spending: Evidence from India's states

- Data on India's 15 major states over 1985/86-2007/08 period
- All variables are in real per capita terms
- Year fixed effect control for shocks that affect all states equally (i.e. monetary policy, strength of central government revenue etc)
- State fixed effects control for time-invariant state characteristics that may affect both growth and state fiscal policy

Multiplier on government spending: Evidence from India's states

	Log (real per capita GSDP)			Growth (Real per capita GSDP)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (real per capita primary spending)	0.206** [0.093]	0.222*** [0.080]	0.158** [0.070]					
Growth (real per capita primary spending)				0.175 [0.109]	0.189* [0.112]	0.165 [0.111]	0.187 [0.115]	0.187* [0.113]
N	313	313	312	312	298	312	298	283
Lag Dependent Variable	yes	yes	yes	yes	yes	yes	yes	yes
Lag Spending	yes	yes	no	no	yes	no	yes	yes
State Fixed Effect	yes	yes	no	no	no	yes	yes	no
Year Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
State time trend	no	yes	no	no	no	no	no	no
XTABOND	no	no	yes	no	no	no	no	yes
Implied multiplier	1.2	1.3	0.9	1.1	1.1	1.0	1.1	1.1

Concluding Remarks

- Fiscal policy can be an effective tool to counter shocks
 - composition of spending matters; development spending providing more “bang for the buck”, perhaps because of crowding in?
 - effects of revenue shocks are sizable and persistent
 - composition of fiscal packages is also important for growth
- Results are broadly in line with cross-country evidence, including SVAR evidence on relatively large tax multiplier
- Results are consistent with existence of crowding out, but not traditional crowding out via interest rates

Selected References

- Blanchard and Perotti, QJE 2002
- Perotti, Macroeconomics Annual 2008
- IMF WEO, October 2008
- Mountford and Uhlig, NBER WP 14551, 2008
- Romer and Bernstein, available at http://otrans.3cdn.net/45593e8ecbd339d074_l3m6bt1te.pdf