Fiscal Buffers, Private Debt and Stagnation: The Good, the Bad and the Ugly

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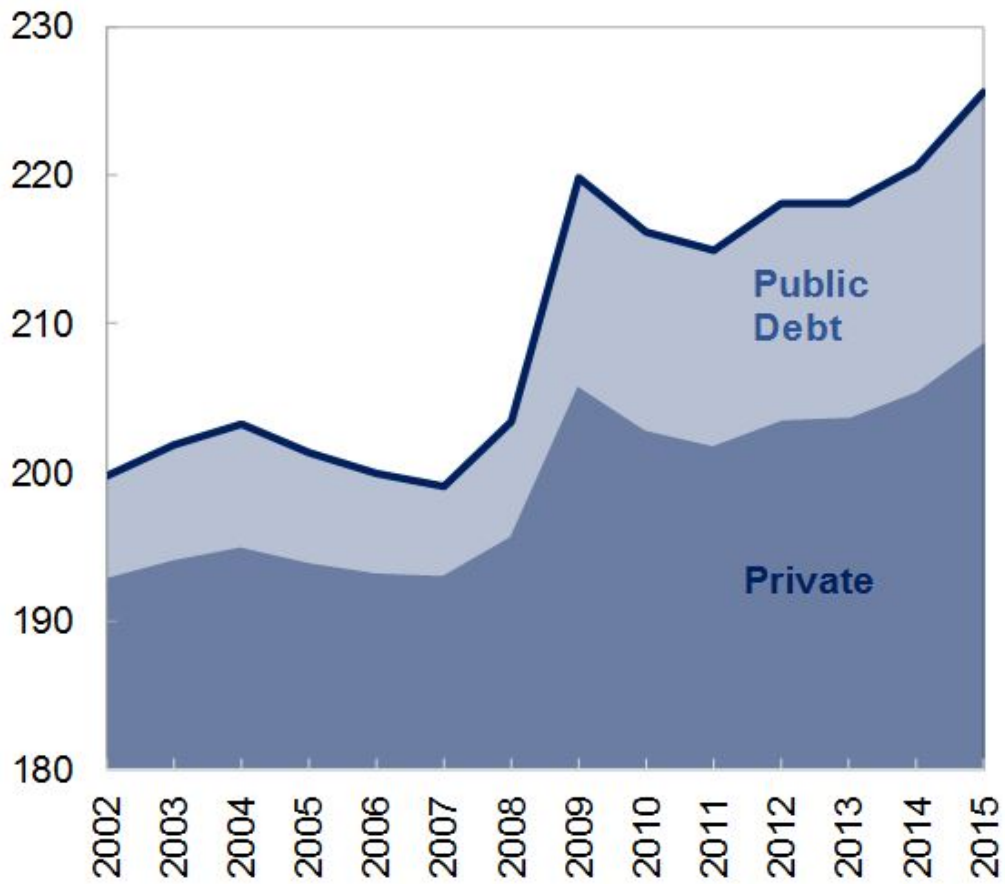
Global Gross Debt (percent of GDP) - Fiscal Monitor 2016



Sources: Abbas and others, 2010; Bank for International Settlements; Dealogic; IMF, *International Financial Statistics*; IMF, *Standardized Reporting Forms*; IMF, *World Economic Outlook*; Organisation for Economic Co-operation and Development; and IMF staff estimates.

Context

- The Global Financial Crisis followed an extraordinary **upward swing in the leverage cycle** (Geanakoplos et al., 2012, *AER*).
- Bust sparked typical **debt deflation dynamics** (Fisher, 1933, *Econometrica*; Minsky, 1982) that boosted public debt-to-GDP very rapidly:
  - recession-induced **decline in government revenues**;
  - governments **took over** private debt.
- We are left with both **high private and public debt**.

Research questions

1. Do the levels of **private and public debt** amplify swings in economic activity over the leverage cycle?

2. Should governments extend **financial assistance** to credit-constrained agents at times of financial stress?

In this paper:

- We first **empirically** revisit the interaction between private and public debt and economic growth.
- We then build a **DSGE** model that:
  - reproduces leverage cycles;
  - embeds explicit links between private and public debt dynamics;
  - stylizes the empirical relationships between private-public debt and output.
- We use the model to analyze **targeted government interventions** towards financially-constrained agents.

Empirics

- Similarly to Mian, Sufi and Verner (2017, *QJE*), we estimate

$$\Delta_3 y_{i,t+3} = \alpha_i + \beta_{prd} \Delta_3 \left(\frac{PRD}{Y} \right)_{it-1} + \beta_{pud} \Delta_3 \left(\frac{PUD}{Y} \right)_{it-1} + u_{it}, \tag{1}$$

  where $\Delta_3 y_{it+3}$ is **future output growth** over three years, while $\Delta_3 \left(\frac{PRD}{Y} \right)_{it-1}$ and $\Delta_3 \left(\frac{PUD}{Y} \right)_{it-1}$ are the **change in total private/public debt-to-GDP ratio** in the previous three years.

- We seek to capture **partial correlations** between past private and public debt growth and future GDP growth.

- Panel annual dataset of 30 advanced and emerging market countries from 1960 to 2014. ▸ More

Revisiting the link between private-public debt and output

Private and Public Debt and Subsequent Real GDP Growth

	Dependent variable: $\Delta_3 y_{it+3}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 (PRD/Y)_{it-1}$	-0.128***	-0.143***				
	(0.014)	(0.016)				
$\Delta_3 (PUD/Y)_{it-1}$		-0.014				
		(0.019)				
$(PRD/Y)_{it-1}$			-0.086***	-0.095***	-0.087***	-0.212***
			(0.005)	(-0.006)	(0.006)	(0.030)
$(PUD/Y)_{it-1}$				-0.008	0.057***	-0.119***
				(0.011)	(0.015)	(0.032)
$(PUD/Y)_{it-1} \leq 95\%$					✓	
$(PUD/Y)_{it-1} > 95\%$						✓
R^2	0.056	0.108	0.131	0.112	0.125	0.034
Country fixed effects	✓	✓	✓	✓	✓	✓
Observations	873	629	898	700	626	74

Notes: Estimates are obtained via panel regressions of real GDP growth from t to $t+3$ on either the change in private and public debt to GDP from $t-4$ to $t-1$ or the level of private and public debt in $t-1$. *,**,*** denote significance at the 0.1, 0.05, 0.01 level, respectively.

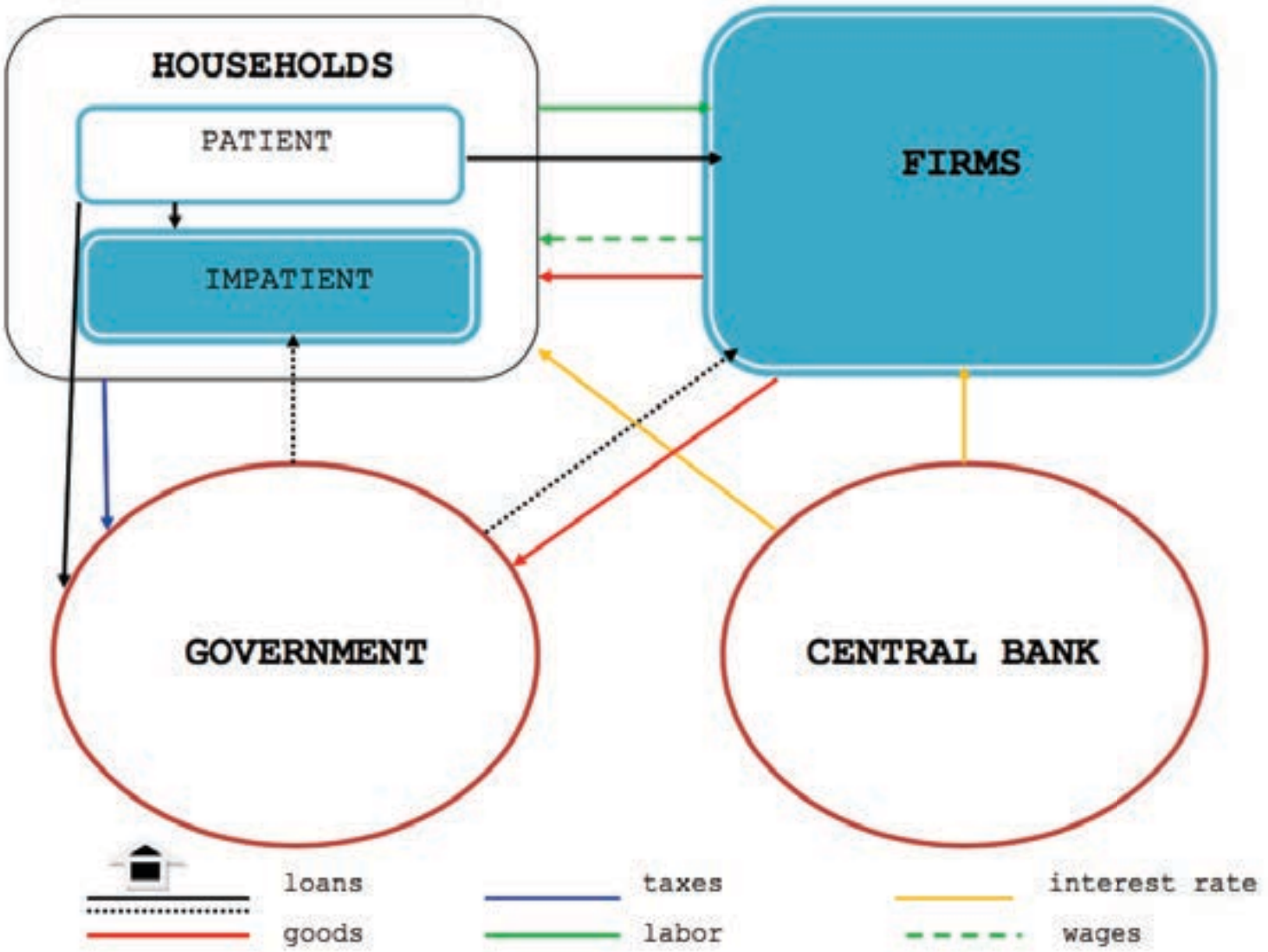
To sum up

- Surges in **private debt** are unambiguously followed by lower output growth.
- Surges in **public debt** do not generally exacerbate recessions.
- There are **nonlinearities** at play: when the level of public debt is high, further increases in public debt are associated to lower growth *and* the negative effects of excessive private debt on growth are harshened.
- Results are robust to detrended real GDP (consistent with the DSGE model). ▸ More

Theoretical framework

- Model that produces **leverage cycles** and embeds links between private and public debt dynamics:
  - Basic structure: Iacoviello (2005, *AER*);
  - Government debt and fiscal limits leading to sovereign risk premium (Corsetti et al., 2013, *EJ*; Bi and Traum, 2014, *JAE*);
  - Government financial intervention (in the spirit of Gertler and Karadi, 2011, *JME*).
- Two key **links** between private and public debt:
  - **Financial accelerator**: private deleveraging affects output which depresses government revenues;
  - **Government intervenes** to alleviate borrowing constraints and mitigate private deleveraging.

The model in a snapshot



Key model equations - Impatient households

Impatient households' budget constraint:

$$\left(1+\tau_t^C\right) C_t'' + q_t \Delta h_t'' + \frac{R_{t-1} B_{t-1}''}{\Pi_t} + \frac{R_{t-1} B_{g,t-1}''}{\Pi_t} \leq \left(1-\tau_t^W\right) \frac{W_t''}{P_t} L_t'' + B_t'' + B_{g,t}'' \quad (2)$$

Borrowing constraint:

$$B_t'' \leq m'' E_t \left[\frac{q_{t+1} h_t'' \Pi_{t+1}}{R_t} \right] \quad (3)$$

Key model equations - Firms

Firms' budget constraint:

$$\frac{P_{e,t}}{P_t} Y_{e,t} + B_{e,t} + B_{ge,t} = \left(1 + \tau_t^C\right) C_{e,t} + q_t \Delta h_{e,t} + \frac{R_{t-1} B_{e,t-1}}{\Pi_t} + \frac{R_{t-1} B_{ge,t-1}}{\Pi_t} + w_t' L_{e,t}' + w_t'' L_{e,t}'' + I_{e,t} + \xi_{K,t} + \xi_{P,t}, \tag{4}$$

Borrowing constraint:

$$B_{e,t} \leq m E_t \left[\frac{q_{t+1} h_{e,t} \Pi_{t+1}}{R_t} \right]. \tag{5}$$

Key model equations - Government

Rules for government financial intervention:

$$b''_{g,t} = -\epsilon b''_t \tag{6}$$

$$b_{g,t} = -\epsilon b_t \tag{7}$$

where $x_t = \frac{x_t - x}{y}$

Government's budget constraint:

$$B_t^G = \left(1 - \Delta_t^G\right) \frac{R_{t-1}^G B_{t-1}^G}{\Pi_t} + G_t + \frac{\left(R_{t-1}^G - R_{t-1}\right) B_{t-1}^{int}}{\Pi_t} + \kappa B_t^{int} - T_t + \Xi_t \tag{8}$$

where $B_t^{int} \equiv B''_{g,t} + B_{g,t}$.

Total government revenue:

$$T_t = \tau_t^C \left(C'_t + C''_t + C_t\right) + \tau_t^W \left(w'_t L'_t + w''_t L''_t\right) + \tau_t^L \tag{9}$$

Calibration

Parameter		Value
Patient households' discount factor	β	0.99
Impatient households' discount factor	β''	0.95
Entrepreneurs' discount factor	γ	0.98
Labor supply elasticity	η	1.01
Habits in consumption	θ	0.592
Capital depreciation rate	δ	0.03
Capital share	ω	0.30
Patient households' wage share	α	0.64
Capital adjustment costs	ψ_K	2.00
Elasticity of substitution in goods	χ	6.00
Price stickiness	ψ_P	41.667
Inflation -Taylor rule	ρ_π	1.5
Output -Taylor rule	ρ_y	0.1
SS stock of res. housing over annual y	$\bar{q}\left(\bar{h}' + \bar{h}''\right) / \left(4\bar{Y}\right)$	1.34
SS commercial real estate over annual y	$\bar{q}\bar{h} / \left(4\bar{Y}\right)$	0.65
SS share of gov. spending in GDP	$\bar{G} / \bar{Y}$	0.23

Calibration (cont'd)

SS consumption tax rate	$\bar{\tau}^C$	0.20
SS labor income tax rate	$\bar{\tau}^W$	0.45
Persistence of fiscal instruments	ρ	0.90
Fiscal responsiveness to government debt	ρ_B	0.01
Responsiveness of the fiscal stance to government debt	ϕ	1.4
Scaling factor in default probability	η_1	-8.5527
Slope parameter in default probability	η_2	1.8261
Government intervention	ϵ	0.10
Efficiency costs	κ	0.10
SS impatient households loan-to-value ratio	m''	0.80
SS entrepreneurs loan-to-value ratio	m	0.375
SS debt-to-GDP ratio	$\bar{\Gamma}/4$	0.68
Persistence of housing shock	ρ_H	0.9890
Persistence of inflation shock	ρ_P	0.8171
Persistence of technology shock	ρ_A	0.0421
Standard deviation of housing shock	σ^H	0.0098
Standard deviation of inflation shock	σ^P	0.0015
Standard deviation of technology shock	σ^A	0.0233

Properties of simulated data

Dynamic Correlations Between Private/Public Debt/GDP Ratios and the Output Gap in Simulated Data

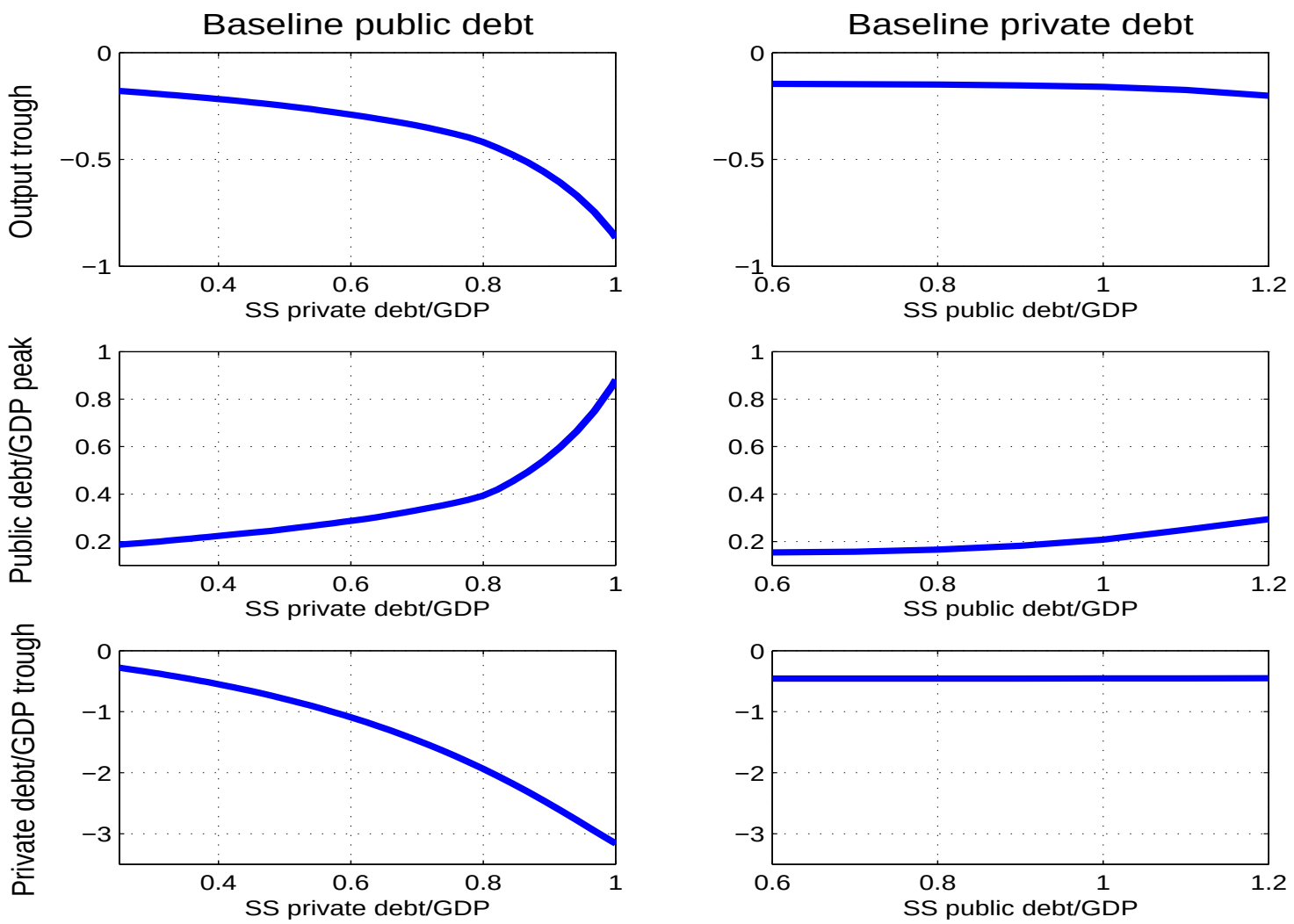
	$corr\left(\frac{B_t^{TOT}}{4Y_t}, Y_{t+i}\right)$		$corr\left(\frac{B_t^{G}}{4Y_t}, Y_{t+i}\right)$	
Quarters	Baseline	High private debt	Baseline	High public debt
$i = 0$	0.5421***	0.5039***	-0.2057***	-0.3363***
$i = 4$	0.3057***	0.2814***	-0.0632	-0.2044***
$i = 6$	0.1329***	0.0832*	0.0006	-0.1318***
$i = 8$	-0.0061	-0.0590	0.0422	-0.0744*
$i = 10$	-0.0714	-0.0986**	0.0588	-0.0383
$i = 12$	-0.1005**	-0.0917**	0.0635	-0.0063

Notes: Correlations are computed on simulated time series of length 500 quarters. B_t^{TOT} is total private debt. High private debt refers to LTV ratios in the high range of the distribution in the euro area experience, $m'' = 0.99$ and $m = 0.44$; high government debt refers to $\Gamma = 1$. *,**,*** denote significance at the 0.1, 0.05, 0.01 level, respectively.

Impulse responses to a negative 1 % house price shock

Notes: X-axes in quarters; Y-axes are in percent deviations from steady state, except for private and public debt to GDP ratios where deviations are absolute.

Effects of high private and public debt during deleveraging

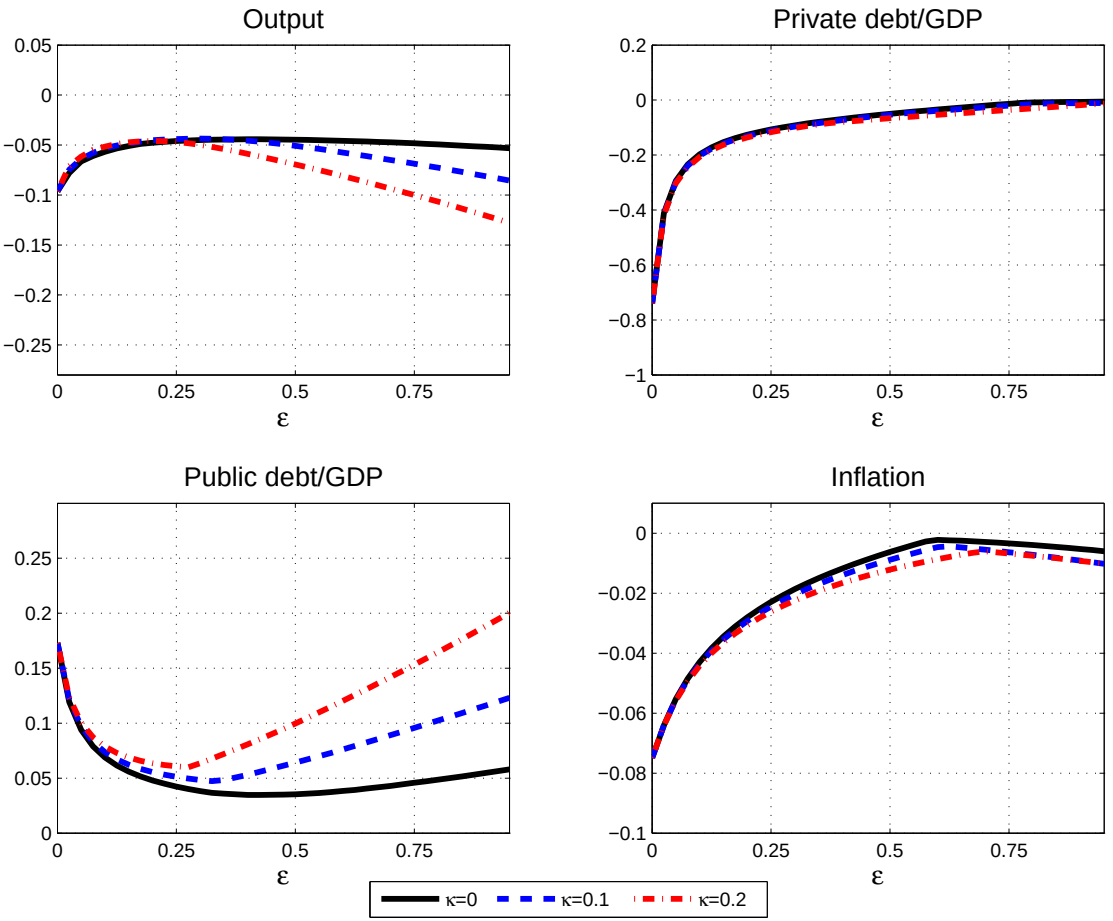


Should governments extend financial assistance to credit constrained agents in a deleveraging phase?

- Targeted interventions are a form of temporary financial assistance by the government to financially constrained households and firms.
- Since the government is not in the business of funds intermediation, the loan is not perfectly efficient.
- The fiscal cost of targeted intervention is given by: the interest rate differential between the lending and borrowing rate of the government + inefficiency costs.

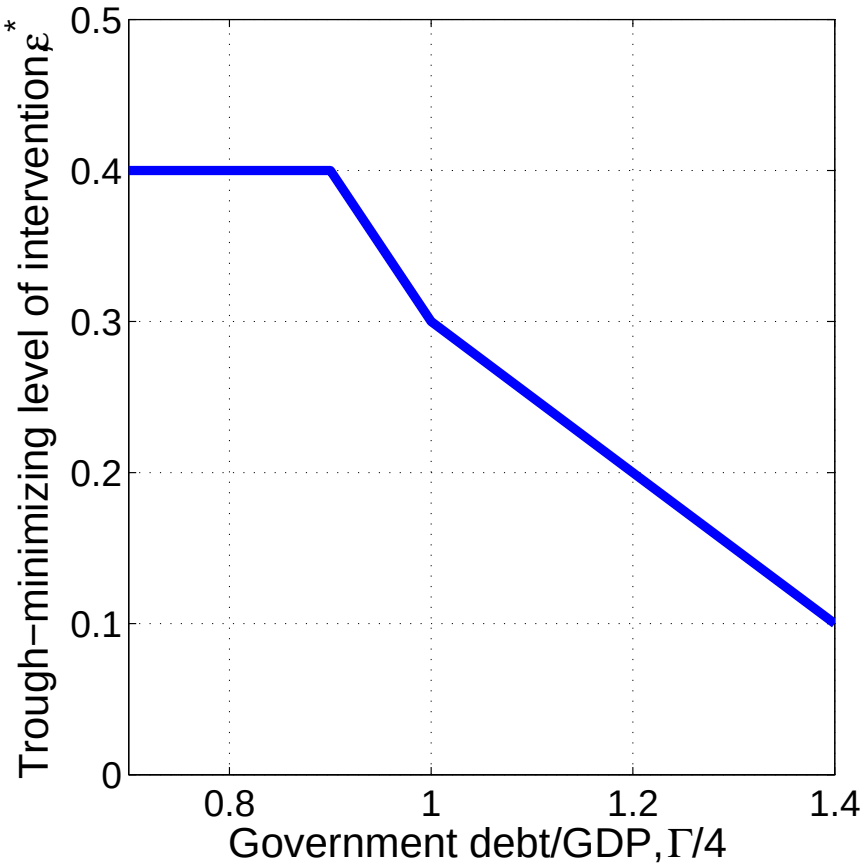
The effects of targeted interventions

Peak Responses to a Negative One-Per-Cent House Price Shock for Different Degrees of Government Intervention to Private Deleveraging, ϵ, and Alternative Levels of Inefficiency Created by Direct Government Intermediation of Funds, κ



"Optimal" level of intervention

Trough-Minimizing Government Intervention



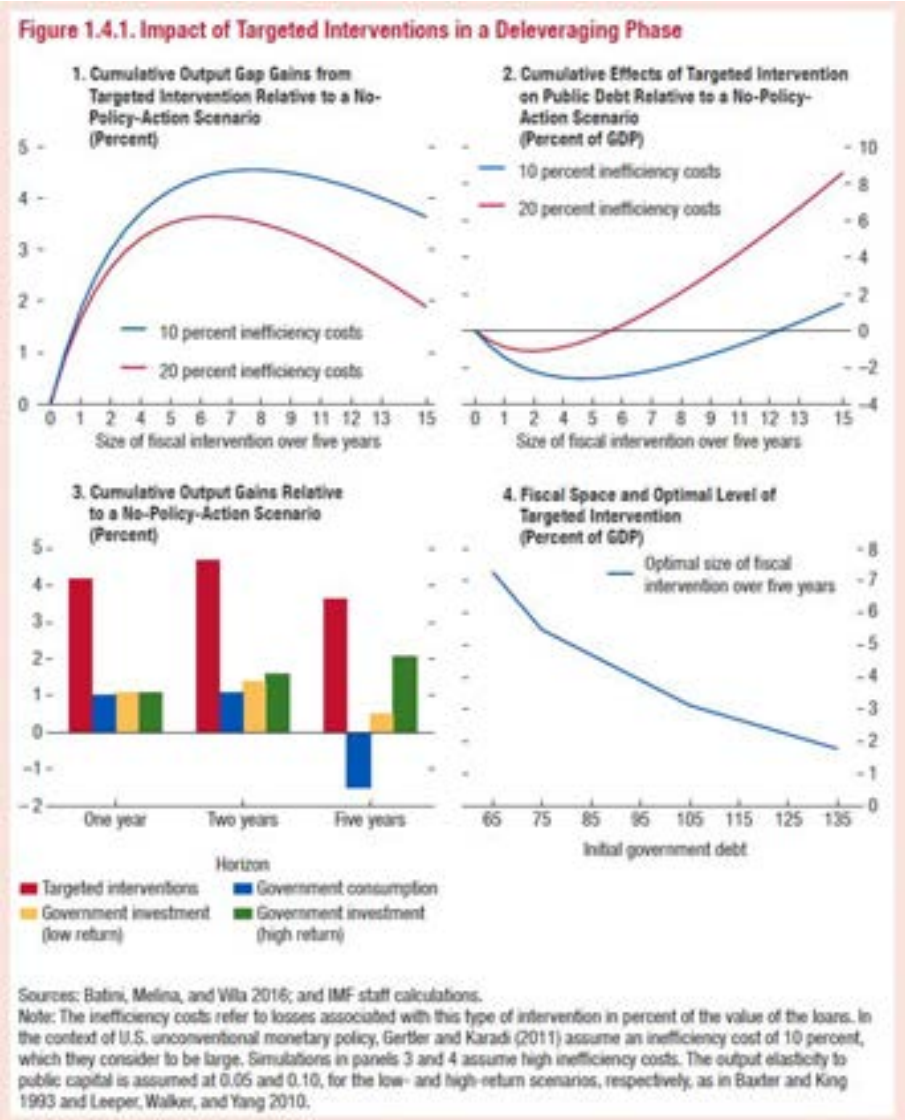
An application of the model in the IMF Fiscal Monitor 2016 "Debt: Use it Wisely"

Three types of stimuli are considered:

1. A targeted intervention in the form of a subsidized government loan to the private sector.
2. Government consumption.
3. Public investment.

The output benefits of targeted intervention are four times larger than those of more standard stimulus measures.

Impact of government interventions - FM box 1.4



Conclusion

- **Private debt booms** raise the **severity** of a recession.
- **Public debt** exacerbates a downturn **only if especially high**.
- There is a **positive "optimal" level of government intervention** targeted at financially constrained agents during a deleveraging phase.
- This is an increasing function of the size of **fiscal buffers**.

Ground rules and concepts

- What is a **leverage cycle**? An increase (decrease) in private indebtedness caused by an losening (tightening) of borrowing constraints when collaterals appreciate (depreciate) in value.
- What is **deleveraging**? A reduction in liabilities achieved through cuts to spending.
- What is a **crisis**? A phase of intensified financial stress, which occurs when a drop in the value of the collateral reduces the availability of credit to borrow out of future income.
- What is **public intervention**? It is credit extended to the private sector to alleviate borrowing constraints that originate in swings in the value of private debt collateral.

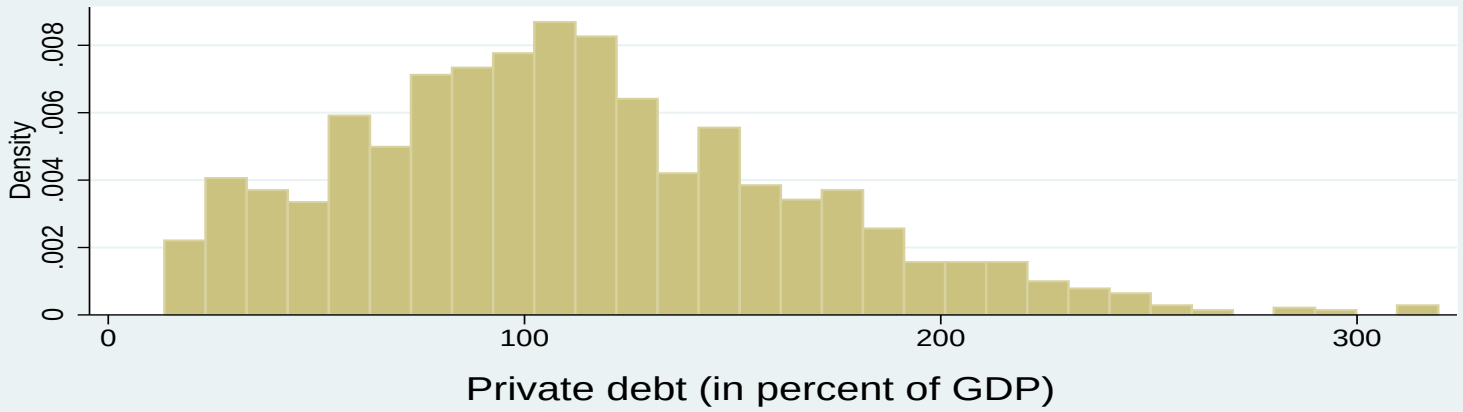
Countries in panel regressions and descriptive statistics

	Private debt (% of GDP)			Public debt (% of GDP)		
	Years	Average	Std. dev.	Years	Average	Std. dev.
Australia	1960-2014	110.62	47.21	1989-2014	21.75	8.03
Austria	1960-2014	92.29	38.36	1988-2014	68.27	9.28
Belgium	1970-2014	120.52	45.38	1980-2014	111.33	16.01
Canada	1955-2014	126.49	36.49	1980-2014	78.12	14.39
Czech Republic	1993-2014	77.25	10.07	1995-2014	27.92	11.11
Denmark	1966-2014	162.54	48.05	1992-2014	51.00	13.89
Finland	1970-2014	120.34	31.20	1980-2014	36.61	16.67
France	1969-2014	125.86	25.73	1980-2014	54.93	22.21
Germany	1960-2014	100.24	19.14	1991-2014	62.37	11.61
Greece	1970-2014	62.28	33.17	1980-2014	91.52	45.06
Hong Kong	1978-2014	163.28	48.74	2001-2014	1.18	1.00
Hungary	1989-2014	81.49	33.96	1997-2014	66.83	10.04
Indonesia	1976-2014	35.96	15.05	2000-2014	40.31	20.11
Ireland	1971-2014	135.17	85.22	1995-2014	61.43	33.97
Italy	1960-2014	79.55	21.70	1988-2014	109.02	11.61
Japan	1964-2014	169.53	30.98	1980-2014	132.25	66.72
Korea, Rep.	1962-2014	107.75	52.29	1990-2014	21.63	9.58

Countries in panel regressions and descriptive statistics (cont'd)

	Private debt (% of GDP)			Public debt (% of GDP)		
	Years	Average	Std. dev.	Years	Average	Std. dev.
Mexico	1980-2014	28.30	10.07	1980-2014	34.92	23.07
Netherlands	1961-2014	141.13	70.35	1980-2014	63.21	10.56
Norway	1960-2014	144.30	36.05	1980-2014	36.63	8.53
Poland	1992-2014	50.17	21.06	1995-2014	46.61	5.70
Portugal	1960-2014	124.69	49.46	1990-2014	72.27	28.40
Singapore	1970-2014	98.78	19.75	1963-2014	67.57	25.84
Spain	1970-2014	123.53	44.86	1980-2014	52.09	19.57
Sweden	1961-2014	138.07	44.74	1993-2014	50.70	12.56
Switzerland	1960-2014	156.31	33.05	1983-2014	48.33	11.11
Thailand	1970-2014	86.46	40.24	1996-2014	43.65	9.64
Turkey	1986-2014	31.74	18.82	1987-2014	40.45	12.38
United Kingdom	1963-2014	110.19	46.68	1980-2014	49.87	17.12
United States	1952-2014	110.83	29.93	1947-2014	85.54	15.25

Distributions of private and public debt/GDP ratios in the sample



Back

Detrended GDP as a dependent variable

Private and Public Debt and Subsequent Cyclical Fluctuations of Real GDP

	Dependent variable: $\hat{y}_{it+3}$			
	(1)	(2)	(3)	(4)
$\left(\frac{PRD}{Y}\right)_{it}$	-0.007***	-0.012***	-0.012***	-0.043***
	(0.003)	(0.003)	(0.003)	(0.013)
$\left(\frac{PUD}{Y}\right)_{it}$		0.006	0.003	-0.029**
		(0.005)	(0.008)	(0.013)
$\left(\frac{PUD}{Y}\right)_{it} \leq 95\%$			✓	
$\left(\frac{PUD}{Y}\right)_{it} > 95\%$				✓
R^2	0.003	0.005	0.003	0.003
Country fixed effects	✓	✓	✓	✓
Observations	972	743	659	84

Notes: Estimates are obtained via panel regressions of deviations of real GDP from HP(100) trend in $t+3$ on the level of private and public debt in t. All specifications include country fixed effects. *,**,*** denote significance at the 0.1, 0.05, 0.01 level, respectively.

▸ Back

Key model equations - Fiscal limit

Government's fiscal limit (default probability):

$$p_t^* = P\left(\Gamma_t^* \leq \Gamma_t\right) = \frac{\exp\left(\eta_1 + \eta_2 \Gamma_t\right)}{1 + \exp\left(\eta_1 + \eta_2 \Gamma_t\right)} \tag{10}$$

Expected haircut rate:

$$\Delta_t^G = \begin{cases} 0 & \text{with probability } 1 - p_t^* \\ \bar{\Delta}^G & \text{with probability } p_t^* \end{cases} \tag{11}$$

$$\Delta_t^G = p_t^* \bar{\Delta}^G \tag{12}$$

Sovereign default risk premium:

$$R_t^G = E_t\left[\left(1 - \Delta_{t+1}^G\right)^{-1}\right] R_t \tag{13}$$

Calibration of the CDF of the fiscal limit

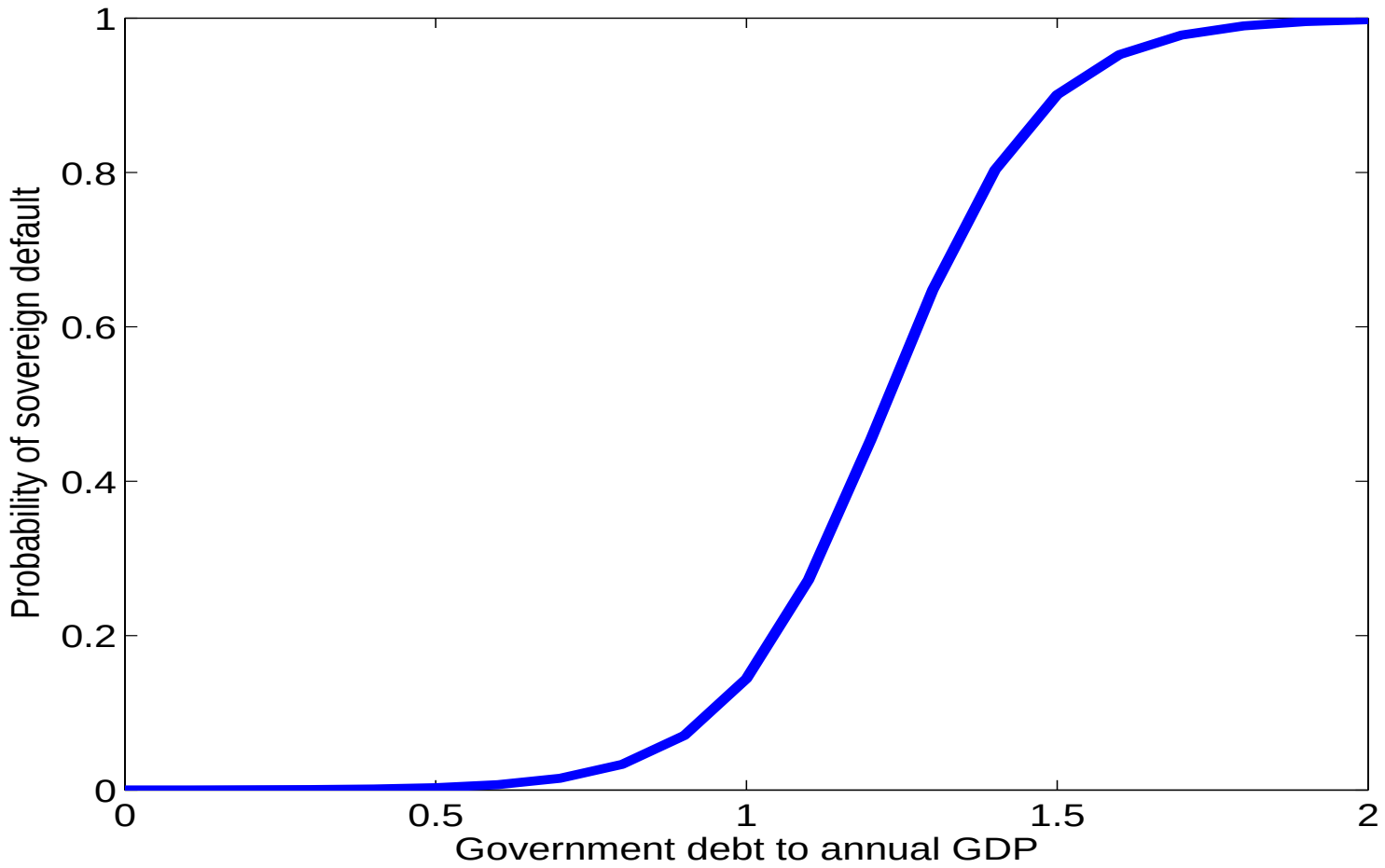
- We fix two points on the function in a way consistent with empirical evidence.
- Given two points (Γ_1, p_1^*) and (Γ_2, p_2^*), with $\Gamma_2 > \Gamma_1$, parameters η_1 and η_2 are uniquely determined by

$$\eta_2 = \frac{1}{\Gamma_1 - \Gamma_2} \log\left(\frac{p_1^*}{p_2^*}\frac{1-p_2^*}{1-p_1^*}\right), \tag{14}$$

$$\eta_1 = \log\left(\frac{p_1^*}{1-p_1^*}\right) - \eta_2\Gamma_1. \tag{15}$$

- We assume that at Γ_2 the probability of exceeding the fiscal limit is almost unity, i.e. $p_2^* = 0.99$.
- We can recover the haircut rate, $\bar{\Delta}$, consistent with ABP_2 and p_2^*.
- At this point, we can recover the probability of default p_1^*.

Cumulative density function of the fiscal limit



Policy rules

Fiscal rules

$$\log\left(\frac{\tau_t}{\tau}\right) = \rho \log\left(\frac{\tau_{t-1}}{\tau}\right) + (1-\rho)\left[e^{\phi \frac{B^G}{Y}} \rho_B \log\left(\frac{B^G_{t-1}}{B^G}\right)\right] \quad (16)$$

$$\log\left(\frac{G_t}{G}\right) = \rho \log\left(\frac{G_{t-1}}{G}\right) - (1-\rho)\left[e^{\phi \frac{B^G}{Y}} \rho_B \log\left(\frac{B^G_{t-1}}{B^G}\right)\right] \quad (17)$$

Monetary policy rule:

$$\log\left(\frac{R_t}{R}\right) = \rho_\pi \log\left(\frac{\Pi_t}{\Pi}\right) + \rho_y \log\left(\frac{Y_t}{Y}\right) \quad (18)$$

Fiscal space

In the case of higher and higher public indebtedness, intervention can still mitigate output losses, but the government has **much less room for maneuver**.