

Fiscal Devaluations

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Motivation

- **Currency devaluation:** response to loss of competitiveness
 - New relevance: crisis in the Euro Area [▶ Quotes](#)
- **Fiscal devaluation:** *set of fiscal policies that lead to the same real outcomes but keeping exchange rate fixed*
 - Old idea (Keynes, 1931): *Uniform tariff cum export subsidy*
 - More recently: *VAT–payroll tax swap*
 - Cavallo and Cottani (2010), IMF Fiscal Monitor (2011)
 - No longer a theoretic curiosity:
 - Germany 2007, France 2012, discussed in Portugal, Spain

What we do

- Formal analysis of fiscal devaluations
 - New Keynesian open economy model (DSGE)
 - conventional fiscal instruments
 - wage and price stickiness (in local or producer currency)
 - alternative asset market structures
- Numerical example: approximate fiscal devaluations

What we do

- Formal analysis of fiscal devaluations
 - New Keynesian open economy model (DSGE)
 - conventional fiscal instruments
 - wage and price stickiness (in local or producer currency)
 - alternative asset market structures
- Numerical example: approximate fiscal devaluations
- Relate literature
 - ① Partial equilibrium: Staiger and Sykes (2010), Berglas (1974)
 - ② Fiscal implementation: Adao, Correia and Teles (2009) ▶ cf
 - ③ Quantitative studies of the VAT effects
 - ④ Taxes under sticky prices: Poterba, Rotemberg, Summers (1986)

Main Findings

① Robust Policies

- *Small set of conventional* fiscal instruments suffices for exact equivalence across a variety of economic environments

② Simple Sufficient Statistic

- Size of tax adjustments depends only on the size of desired devaluation and is independent of details of environment

③ Government Revenue Neutrality

- Exact if all tax instruments are used
- Long-run; proportional to trade deficit in the short run

Main Findings

- ① Two **Fiscal Devaluation** policies:

(FD') Uniform increase in import tariff and export subsidy

OR

(FD'') Uniform increase in value-added tax (with border adjustment) and reduction in payroll tax

- ② In general, (FD') and (FD'') need to be complemented with a reduction in consumption tax and increase in income tax
 - may be dispensed with if devaluation is unanticipated
- ③ If debt denominated in home currency, equivalence requires partial default (forgiveness)

Outline

- ① Static (one-period) model
- ② Full dynamic model
- ③ Numerical example
- ④ Implementation issues
 - non-zero initial taxes
 - differential short-run tax pass-through
 - non-uniform VAT and multiple variable inputs
 - labor mobility
 - quantitative assessment
 - the case of monetary union

Static Model Setup I

- Two countries:
 - nominal or fiscal devaluation at Home
 - passive policy in Foreign
- Households:
 - Preferences:

$$U(C, N), \quad C = C_H^\gamma C_F^{1-\gamma}, \quad \gamma \geq 1/2$$

- Budget constraint

$$\frac{PC}{1 + \varsigma^c} + M + T \leq \frac{WN}{1 + \tau^n} + \frac{\Pi}{1 + \tau^d} + B$$

- Cash in advance:

$$\frac{PC}{1 + \varsigma^c} \leq M$$

Setup II

- Firms: $Y = AN$

$$\Pi = (1 - \tau^v)P_H C_H + (1 + \zeta^x)\mathcal{E}P_H^* C_H^* - (1 - \zeta^p)WN$$

- Government: balanced budget

$$M + T + TR = 0,$$

$$TR = \left(\frac{\tau^n}{1 + \tau^n} WN + \frac{\tau^d}{1 + \tau^d} \Pi - \frac{\zeta^c}{1 + \zeta^c} PC \right) \\ + (\tau^v P_H C_H - \zeta^p WN) + \left(\frac{\tau^v + \tau^m}{1 + \tau^m} P_F C_F - \zeta^x \mathcal{E}P_H^* C_H^* \right)$$

Equilibrium relationships I

PCP case

① International relative prices:

$$P_H^* = P_H \frac{1}{\mathcal{E}} \frac{1 - \tau^v}{1 + \zeta^x}$$
$$P_F = P_F^* \mathcal{E} \frac{1 + \tau^m}{1 - \tau^v} \quad \Rightarrow \quad S = \frac{P_F^*}{P_H^*} = \frac{P_F^*}{P_H} \mathcal{E} \frac{1 + \zeta^x}{1 - \tau^v}$$

② Wage and Price setting:

$$W = \bar{W}^{\theta_w} \left[\mu_w \frac{1 + \tau^n}{1 + \zeta^c} PC^\sigma N^\varphi \right]^{1 - \theta_w},$$
$$P_H = \bar{P}_H^{\theta_p} \left[\mu_p \frac{1 - \zeta^p}{1 - \tau^v} \frac{W}{A} \right]^{1 - \theta_p}$$

③ Demand — cash in advance:

$$PC \leq M(1 + \zeta^c)$$

Equilibrium relationships II

④ Goods market clearing: $Y = C_H + C_H^*$

⑤ Exchange rate determination:

- Budget constraint (allowing for partial default)

$$P^* C^* = P_F^* Y^* - \frac{1 - \tau^h}{\mathcal{E}} B^h - B^{f*} \quad \Rightarrow \quad \mathcal{E} = \frac{\frac{1 - \tau^v}{1 + \tau^m} M(1 + \varsigma^c) - \frac{1 - \tau^h}{1 - \gamma} B^h}{M^* + \frac{1}{1 - \gamma} B^{f*}}$$

- Perfect risk-sharing:

$$\left(\frac{C}{C^*}\right)^\sigma = \frac{P^* \mathcal{E}}{P/(1 + \varsigma^c)} \equiv Q \quad \Rightarrow \quad \mathcal{E} = \frac{M}{M^*} Q^{\frac{\sigma - 1}{\sigma}}$$

Results I

Proposition

The following policies constitute a *fiscal δ -devaluation*

- ① *under balanced trade or foreign-currency debt:*

$$\left. \begin{array}{l} \text{(FD')} \quad \tau^m = \zeta^x = \delta \\ \text{(FD'')} \quad \tau^v = \zeta^p = \frac{\delta}{1+\delta} \end{array} \right] \quad \text{and} \quad \zeta^c = \tau^n = \epsilon, \quad \frac{\Delta M}{M} = \frac{\delta - \epsilon}{1 + \epsilon} \quad \forall \epsilon$$

- ② *under home-currency debt supplement with partial default:*

$$\tau^h = \delta / (1 + \delta)$$

- ③ *under complete international risk-sharing need to set:*

$$\epsilon = \delta \quad \text{and} \quad \frac{\Delta M}{M} = -\frac{\sigma - 1}{\sigma} \frac{\Delta Q}{Q}$$

4 Local currency pricing

- Result: *Same as under PCP.*

— Law of one price does not hold [▶ details](#)

$$P_H^* = \bar{P}_H^{*\theta_p} \left[\mu_p \frac{1 - \zeta^p}{1 + \zeta^x} \frac{1}{\mathcal{E}} \frac{W}{A} \right]^{1 - \theta_p}$$

— Real effects differ under PCP and LCP

Results III

5 Revenue neutrality

- Result: (FD') and (FD'') are fiscal revenue-neutral.
- When $\zeta^c = \tau^n = \epsilon$, revenue neutrality holds in the long run

$$TR = \left[\frac{\delta}{1 + \delta} - \frac{\epsilon}{1 + \epsilon} \right] \underbrace{(PC - WN)}_{=-NX + \Pi}$$

- Fiscal surplus in periods of trade deficit
- Revenue neutrality is relative to the fiscal effect of a nominal devaluation

Dynamic model

- Dynamic Calvo price and wage setting [▶ show](#)
- Endogenous savings and portfolio decisions
- Dynamic (interest-elastic) money demand
- More general preferences

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- Dynamic Calvo price and wage setting [▶ show](#)
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- More general preferences
- **Definition:** Consider an equilibrium path of the economy with $\mathcal{E}_t = \mathcal{E}_0(1 + \delta_t)$, given $\{M_t\}$.

Fiscal $\{\delta_t\}$ -devaluation is a sequence

$$\{M'_t, \tau_t^m, \varsigma_t^x, \tau_t^v, \varsigma_t^p, \varsigma_t^c, \tau_t^n, \tau_t^d\}$$

that leads to the same real allocation, but with $\mathcal{E}'_t \equiv \mathcal{E}_0$.

- Anticipated and unanticipated devaluations

Two Key Dynamic Equations

- Flow budget constraint of a country:

$$\sum_{j \in \Omega_t} \frac{Q_t^{j*}}{P_t^*} B_{t+1}^j - \sum_{j \in \Omega_{t-1}} \frac{Q_t^{j*} + D_t^{j*}}{P_t^*} B_t^j = \frac{P_{Ht}^*}{P_t^*} [C_{Ht}^* - C_{Ft} S_t],$$

- International risk sharing condition:

$$\mathbb{E}_t \left\{ \frac{Q_{t+1}^{j*} + D_{t+1}^{j*}}{Q_t^{j*}} \frac{P_t^*}{P_{t+1}^*} \left[\left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \frac{Q_{t+1}}{Q_t} - \left(\frac{C_{t+1}^*}{C_t^*} \right)^{-\sigma} \right] \right\} = 0 \quad \forall j \in \Omega_t$$

- Terms of Trade and Real Exchange Rate:

$$S_t = \frac{P_{Ft}}{P_{Ht}^*} \frac{1}{\mathcal{E}_t} \frac{1 - \tau_t^v}{1 + \tau_t^m} \quad \text{and} \quad Q_t = \frac{P_t^* \mathcal{E}_t}{P_t / (1 + s_t^c)}$$

Result I

Complete markets

Proposition

A fiscal $\{\delta_t\}$ -devaluation in a dynamic PCP or LCP economy with complete markets:

$$\left. \begin{array}{l} \text{(FDD')} \quad \tau_t^m = \varsigma_t^x = \tau_t^d = \delta_t \\ \text{(FDD'')} \quad \tau_t^v = \varsigma_t^p = \frac{\delta_t}{1+\delta_t}, \tau_t^d = 0 \end{array} \right] \quad \text{and} \quad \varsigma_t^c = \tau_t^n = \delta_t,$$

and a suitable choice of $\{M'_t\}$.

- analogous to static economy: terms of trade, RER
- interest-elastic money demand: no additional tax instruments

$$\chi C_t^\sigma \left(\frac{M_t(1 + \varsigma_t^c)}{P_t} \right)^{-\nu} = \frac{i_{t+1}}{1 + i_{t+1}}$$

Results II

Incomplete markets

① Foreign-currency risk-free bond:

- Home country budget constraint:

$$Q_t^* B_{t+1}^f - B_t^f = \left[P_{Ht}^* C_{Ht}^* - P_{Ft} C_{Ft} \frac{1}{\mathcal{E}_t} \frac{1 - \tau_t^v}{1 + \tau_t^m} \right]$$

- The optimal risk sharing condition

$$Q_t^* = \beta \mathbb{E}_t \left\{ \left(\frac{C_{t+1}^*}{C_t^*} \right)^{-\sigma} \frac{P_t^*}{P_{t+1}^*} \right\} = \beta \mathbb{E}_t \left\{ \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \frac{P_t}{P_{t+1}} \frac{(1 + \varsigma_{t+1}^c) \mathcal{E}_{t+1}}{(1 + \varsigma_t^c) \mathcal{E}_t} \right\}$$

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- Same proposition applies: (FDD') and (FDD'')
 - dynamic savings decision

② Same for international trade in equities [▶ show](#)

③ Home-currency bond: additionally requires partial default

$$1 - d_t = (1 + \delta_{t-1}) / (1 + \delta_t)$$

Results III

Unanticipated devaluation

Proposition

A one-time unanticipated fiscal δ -devaluation in an incomplete markets economy:

$$\left. \begin{array}{l} \text{(FDR')} \quad \tau_t^m = \varsigma_t^x = \tau_t^d = \delta \\ \text{(FDR'')} \quad \tau_t^v = \varsigma_t^p = \frac{\delta}{1+\delta}, \quad \tau_t^d = 0 \end{array} \right] \quad \text{and} \quad M'_t \equiv M_t,$$

together with a one-time partial default (haircut) $\tau^h = \delta/(1 + \delta)$ on home-currency debt.

- No consumption subsidy needed
- Applies to risk-free-bond and international-equity economies
- Generalization of revenue neutrality:

$$TR_t = -\frac{\delta_t}{1+\delta_t} NX_t + \frac{\delta_t}{1+\tau_t^d} \Pi_t$$

Implementation

- 1 Non-uniform VAT (e.g., non-tradables)
 - match payroll subsidy
- 2 Multiple variable inputs (e.g., capital)
 - uniform subsidy
 - [▶ Model w/capital](#)
- 3 Tax pass-through assumptions: equivalence of
 - VAT and exchange rate pass-through into foreign prices
 - VAT and payroll tax pass-through into domestic prices
 - [▶ Generalization](#)
- 4 Non-zero initial tax: $\tau_t^v = \frac{\bar{\tau}_0^v + \delta_t}{1 + \delta_t}$
- 5 Quantitative investigation [▶ show](#)

Implementation in a Monetary Union

- Coordination with union central bank:
 - Union-wide money supply:

$$\bar{M}_t = M_t + M_t^*$$

— M_t/M_t^* is endogenous

- Division of seigniorage between members:

$$\Delta \bar{M}_t = \Omega_t + \Omega_t^*$$

- Special cases: unilateral fiscal adjustment suffices
 - seigniorage is small ($\Delta \bar{M}_t \rightarrow 0$)
 - devaluing country is small ($\Delta \bar{M}_t / \bar{M}_t \rightarrow 0$)

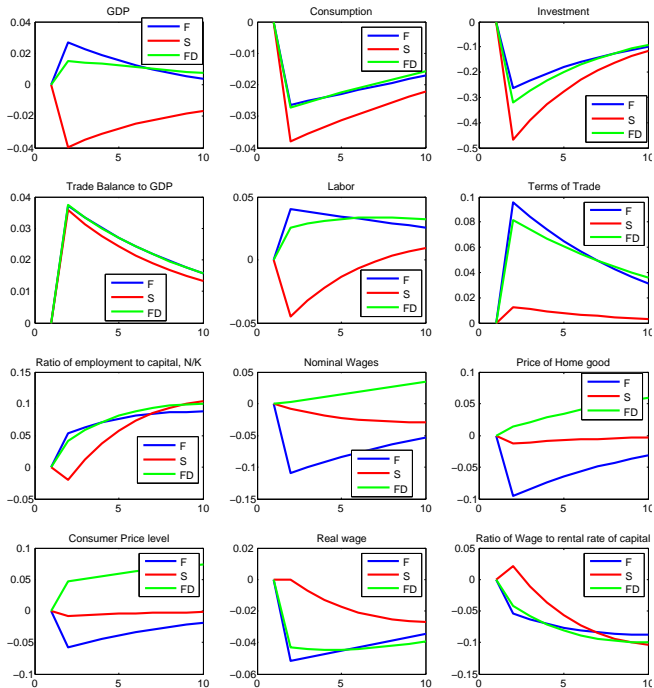
Numerical example

Setup

- Small open economy calibrated to Spain
- With nominal friction: wage stickiness
- With capital and adjustment cost
- Initial distortionary taxes (as in Spain)
- Money-in-the-utility to match M1 or M2-to-GDP ratio
- Initial debt-to-GDP of 87%
- Shock to country risk premium to generate the 2008 recession:

$$i_{t+1} = i^* + \psi(e^{B^* - B_{t+1}} - 1) + \varepsilon_t, \quad \varepsilon_t \sim AR(1)$$

- Scenarios:
 - Flexible wages
 - Sticky wages, no policy intervention
 - 10% fiscal devaluation (one-time unanticipated)
 - Various incomplete fiscal devaluations



Incomplete fiscal devaluations

	Loss relative to no shock	
	Permanent	10 quarters
Sticky wages, no intervention	-0.64%	-3.65%
Flexible wages	-0.47%	-2.66%
10% one-time devaluation	-0.45%	-2.55%
		Of this gap
— 10% fiscal devaluation		100%
— 5% fiscal devaluation		53%
— Fiscal devaluation w/out capital subsidy		68%
— Anticipated fiscal devaluation		79%
— No seigniorage transfer		83%

Summary

- Two **robust FD policies**:
 - uniform import tariff and export subsidy, OR
 - uniform increase in VAT and reduction in payroll tax
- Unanticipated devaluation: no additional instruments.
Overall, *small set of conventional* fiscal instruments
- Require minimal information: size of desired devaluation δ
- Robust in particular to:
 - price and wage setting
 - asset market structure
- Revenue-neutrality
- Sidesteps the **trilemma** in international macro

- Popular arguments for abandoning Euro and devaluation:

- Feldstein (FT 02/2010):

If Greece still had its own currency, it could, in parallel, devalue the drachma to reduce imports and raise exports. . . The rest of the eurozone could allow Greece to take a temporary leave of absence with the right and the obligation to return at a more competitive exchange rate.

- Krugman (NYT): *Why devalue? The Euro Trap, Pain in Spain*

Now, if Greece had its own currency, it could try to offset this contraction with an expansionary monetary policy – including a devaluation to gain export competitiveness. As long as its in the euro, however, Greece can do nothing to limit the macroeconomic costs of fiscal contraction.

- Roubini (FT 06/2011): *The Eurozone Heads for Break Up*

. . . there is really only one other way to restore competitiveness and growth on the periphery: leave the euro, go back to national currencies and achieve a massive nominal and real depreciation.

- Keynes (1931) in the context of Gold standard

Precisely the same effects as those produced by a devaluation of sterling by a given percentage could be brought about by a tariff of the same percentage on all imports together with an equal subsidy on all exports, except that this measure would leave sterling international obligations unchanged in terms of gold.

Related Literature

Comparison to ACT (Adao, Correia and Teles, JET, 2009)

	ACT (2009)	FGI (2011)	
Allocation	Flexible-price (first best)	Nominal devaluation	— one-time unexpected
Implementation	General non-constructive fiscal implementation principle	Specific implementation: — simplicity, robustness, feasibility	
Environment – Nominal frictions – Int'l asset markets	Sticky prices (PCP or LCP) Risk-free nominal bonds	Sticky prices (PCP and LCP) and sticky wages Arbitrary degree of completeness	Arbitrary incomplete markets
Instruments	Separate consumption taxes by origin of the good and income taxes in both countries; additional instruments in other cases	VAT, payroll, consumption and income tax in one country	VAT and payroll tax only in one country
Implementability – Analytical characterization of taxes – Int'l coordination of taxes – Tax dependence on microenvironment – Tax dynamics	No Yes In general, yes In general, complex dynamic path	Yes, simple characterization and expressions No, unilateral policy No, robust to any changes in environment Path of taxes follows the path of devaluation	Only one-time tax change

Local currency pricing

- Law of one price does not hold
- Price setting in consumer currency

$$P_H^* = \bar{P}_H^{*\theta_p} \left[\mu_p \frac{1 - \zeta^p}{1 + \zeta^x} \frac{1}{\mathcal{E}} \frac{W}{A} \right]^{1-\theta_p},$$

$$P_F = \bar{P}_F^{\theta_p} \left[\mu_p \frac{1 + \tau^m}{1 - \tau^v} \mathcal{E} \frac{W^*}{A^*} \right]^{1-\theta_p}$$

- Terms of trade appreciates

$$S = \frac{P_F}{P_H^*} \frac{1}{\mathcal{E}} \frac{1 - \tau^v}{1 + \tau^m}$$

- Foreign firm profit margins decline

$$\Pi^* = P_F^* C_F^* + P_F C_F \frac{1}{\mathcal{E}} \frac{1 - \tau^v}{1 + \tau^m} - W^* N^*$$

Price setting

$$\bar{P}_{Ht}(i) = \frac{\mathbb{E}_t \sum_{s \geq t} (\beta \theta_\rho)^{s-t} C_s^{-\sigma} P_s^{-1} P_{Hs}^\rho Y_s \frac{\rho}{\rho-1} \frac{(1+\varsigma_s^c)(1-\varsigma_s^p)}{1+\tau_s^d} W_s / A_s(i)}{\mathbb{E}_t \sum_{s \geq t} (\beta \theta_\rho)^{s-t} C_s^{-\sigma} P_s^{-1} \frac{(1+\varsigma_s^c)(1-\tau_s^v)}{1+\tau_s^d}},$$

- Under (FDD''), $(1 + \varsigma_s^c)(1 - \tau_s^v) = (1 + \varsigma_s^c)(1 - \varsigma_s^p) = 1$, therefore the reset price \bar{P}_{Ht} stays the same, and hence so does P_{Ht}
- (FDD') additionally requires compensating with $\tau_s^d = \delta_t$, unless devaluation is unanticipated

International trade in equities

- Budget constraint

$$\begin{aligned} \frac{P_t C_t}{1 + \zeta_t^c} + M_t + (\omega_{t+1} - \omega_t) \mathbb{E}_t \{ \Theta_{t+1} V_{t+1} \} - (\omega_{t+1}^* - \omega_t^*) \mathbb{E}_t \{ \Theta_{t+1} \mathcal{E}_{t+1} V_{t+1}^* \} \\ \leq \frac{W_t N_t}{1 + \tau_t^n} + \omega_t \frac{\Pi_t}{1 + \tau_t^d} + (1 - \omega_t^*) \mathcal{E}_t \Pi_t^* + M_{t-1} - T_t, \end{aligned}$$

- Value of the firm:

$$V_t = \mathbb{E}_t \sum_{s=t}^{\infty} \Theta_{t,s} \frac{\Pi_s}{1 + \tau_s^d}, \quad \Theta_{t,s} = \prod_{\ell=t+1}^s \Theta_{\ell}, \quad \Theta_{\ell} = \beta \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \frac{P_t}{P_{t+1}} \frac{1 + \zeta_{t+1}^c}{1 + \zeta_t^c},$$

$$V_t^* = \mathbb{E}_t \sum_{s=t}^{\infty} \Theta_{t,s}^* \Pi_s^*$$

- Risk-sharing conditions

$$\mathbb{E}_t \sum_{s=t}^{\infty} \left(\Theta_{t,s} - \Theta_{t,s}^* \frac{\mathcal{E}_t}{\mathcal{E}_s} \right) \frac{\Pi_s}{1 + \tau_s^d} = 0 \quad \text{and} \quad \mathbb{E}_t \sum_{s=t}^{\infty} \left(\Theta_{t,s} \frac{\mathcal{E}_s}{\mathcal{E}_t} - \Theta_{t,s}^* \right) \Pi_s^* = 0.$$

Home-currency Bond

- Partial defaults on home-currency bonds: contingent sequence $\{d_t\}$
- The international risk sharing condition becomes

$$\begin{aligned}
 Q_t &= \beta \mathbb{E}_t \left\{ \left(\frac{C_{t+1}^*}{C_t^*} \right)^{-\sigma} \frac{P_t^* \mathcal{E}_t}{P_{t+1}^* \mathcal{E}_{t+1}} (1 - d_{t+1}) \right\} \\
 &= \beta \mathbb{E}_t \left\{ \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \frac{P_t}{P_{t+1}} \frac{1 + \varsigma_{t+1}^c}{1 + \varsigma_t^c} (1 - d_{t+1}) \right\},
 \end{aligned}$$

- Country budget constraint can now be written as

$$Q_t \frac{1}{\mathcal{E}_t} B_{t+1}^h - (1 - d_t) \frac{\mathcal{E}_{t-1}}{\mathcal{E}_t} \frac{1}{\mathcal{E}_{t-1}} B_t^h = (1 - \gamma) \left[P_t^* C_t^* - P_t C_t \frac{1}{\mathcal{E}_t} \frac{1 - \tau_t^v}{1 + \tau_t^m} \right]$$

Model with capital

- Choice of capital input by firms:

$$\frac{N_t}{K_t} = \frac{\alpha}{1 - \alpha} \frac{(1 - \varsigma_t^R)}{(1 - \varsigma_t^P)} \frac{R_t}{W_t}$$

- Choice of capital investment by households:

$$U_{c,t} \frac{(1 + \varsigma_t^c)}{(1 + \varsigma_t^I)} = \beta \mathbb{E}_t U_{c,t+1} \left[\frac{R_{t+1}}{P_{t+1}} \frac{(1 + \varsigma_{t+1}^c)}{(1 + \tau_{t+1}^K)} + (1 - \delta) \frac{(1 + \varsigma_{t+1}^c)}{(1 + \varsigma_{t+1}^I)} \right]$$

- Results:

- 1 When consumption subsidy ς_t^c is not used, only capital expenditure subsidy to firms ς_t^R is required (parallel to payroll subsidy). All variable inputs should be subsidized uniformly
- 2 Otherwise, investment subsidy and capital income tax need to be used in addition:

$$\varsigma_t^I = \tau_t^K = \varsigma_t^c = \delta_t$$

Pass-through of VAT and payroll tax

- Static model with differential pass-through $\xi_p > \xi_\tau$:

$$P_H = \left[\bar{P}_H \cdot \frac{(1 - \varsigma^p)^{\xi_p}}{(1 - \tau^v)^{\xi_\tau}} \right]^{\theta_p} \left[\mu_p \frac{1 - \varsigma^p}{1 - \tau^v} \frac{W}{A} \right]^{1 - \theta_p}$$

Proposition

Fiscal devaluation is as characterized in Results I-III, but with payroll subsidy given by

$$\varsigma^p = 1 - \left(\frac{1}{1 + \delta} \right)^{\frac{\xi_v \theta_p + 1 - \theta_p}{\xi_p \theta_p + 1 - \theta_p}} .$$

- still $\tau^v = \delta/(1 + \delta)$, to mimic international relative prices
- $\xi_v > \xi_p$ implies $\varsigma^p > \tau^v = \delta/(1 + \delta)$
- as θ_p decreases towards 0, ς^p decreases towards $\delta/(1 + \delta)$

Quantitative investigation

Source: Gopinath and Wang (2011)

	Germany	Spain	Portugal	Italy	Greece
Taxes					
— VAT	13%	7%	11%	9%	8%
— payroll contributions	14%	18%	9%	24%	12%
— including employee's SSC	27%	22%	16%	29%	22%
% change, 1995-2010					
– wages	25%	61%	64%	39%	127%
– productivity	17%	19%	28%	3%	42%
Required devaluation*		34%	28%	28%	77%
Maximal fiscal devaluation**		23%	11%	32%	14%
— with German fiscal revaluation		38%	26%	47%	29%
— additionally reducing employee's SSC		43%	34%	56%	43%

- Required devaluation brings unit labor cost (W_t/A_t) relative to Germany to its 1995 ratio
- Maximal fiscal devaluation is constrained by zero lower bound on payroll contributions and 45% maximal VAT rate (which is never binding). A reduction of x in payroll tax and similar increase in VAT is equivalent to a $x/(1-x)$ devaluation
- Maximal German revaluation is an additional decrease in German VAT of 13% and a similar increase in German payroll tax, equivalent to an additional 15% devaluation against Germany

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