

# **Bank of Portugal Lectures Summer 2006**

Sudden Stops and Output Drops

(An application of Business Cycle Accounting)

Based on work by Chari, Kehoe, and McGrattan

## **Sudden Stops and Output Drops** \_\_\_\_\_

- Two features of financial crises
  - Sudden stops of capital inflows
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  - Sudden stops of capital inflows
  - Drops in output
- Are they connected?
  - Simplest theory: Sudden stops don't lead to output drops
  - Need other frictions

## Original Economy

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$$\max \sum \beta^t \pi(s^t) U(c(s^t), l(s^t))$$

Country's budget constraint

$$c(s^t) + x(s^t) + b(s^t) = F(k(s^{t-1}), l(s^t)) + \sum q(s^{t+1}) b(s^{t+1})$$

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## Tightened Collateral Constraint Means Sudden Stop \_\_\_\_\_

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Rewritten budget constraint: Net exports

$$\underbrace{F(k(s^{t-1}), l(s^t)) - c(s^t) - x(s^t)}_{\text{net exports}} = \underbrace{b(s^t) - \sum q(s^{t+1}) b(s^{t+1})}_{\text{change in debt}}$$

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$V$  tighter  $\Rightarrow b(s^{t+1})$  falls  $\Rightarrow$  net exports rise

## Business Cycle Accounting

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- Exploits equivalence between
  - An original economy with distortions
  - An associated prototype economy with wedges
- Prototype economy
  - Closed economy growth model
  - Shocks
    - Government Consumption
    - Labor Taxes
    - Investment Taxes
    - Productivity Shocks

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- Prototype economy
  - Closed economy growth model
  - Wedges
    - Government Consumption Wedge
    - Labor Wedge
    - Investment Wedge
    - Efficiency Wedge

## Prototype Economy

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$$\max \sum \beta^t \pi(s^t) U(c(s^t), l(s^t))$$

Consumer's budget constraint

$$c(s^t) + x(s^t) = w(s^t)l(s^t) + r(s^t)k(s^{t-1}) + T(s^t)$$

Resource constraint

$$c(s^t) + x(s^t) + g(s^t) = F(k(s^{t-1}), l(s^t))$$

**Net Exports in Original = Gov't Spending in Prototype** \_\_\_\_\_

**Proposition.**

Given an equilibrium in original economy. Let  $g$  in prototype economy equal the net exports of original economy. Then the equilibria coincide.

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- If original economy has government spending then

$$g_{PROTOTYPE} = g_{ORIGINAL} + \text{net exports}$$

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- Increase in  $g$  leads to an output increase (standard result)

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⇒ Sudden stop leads to output rise

## Mexico's 1944–1995 Sudden Stop

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- Use Proposition 1 to focus on prototype growth model
- Estimate stochastic process for the wedges
- What is the effect of a sudden stop alone?

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- Use Proposition 1 to focus on prototype growth model
- Estimate stochastic process for the wedges
- What is the effect of a sudden stop alone?
- That is:

What does model predict from observed rise in net exports?

Figure 1. The Mexican Sudden Stop in 1994:4

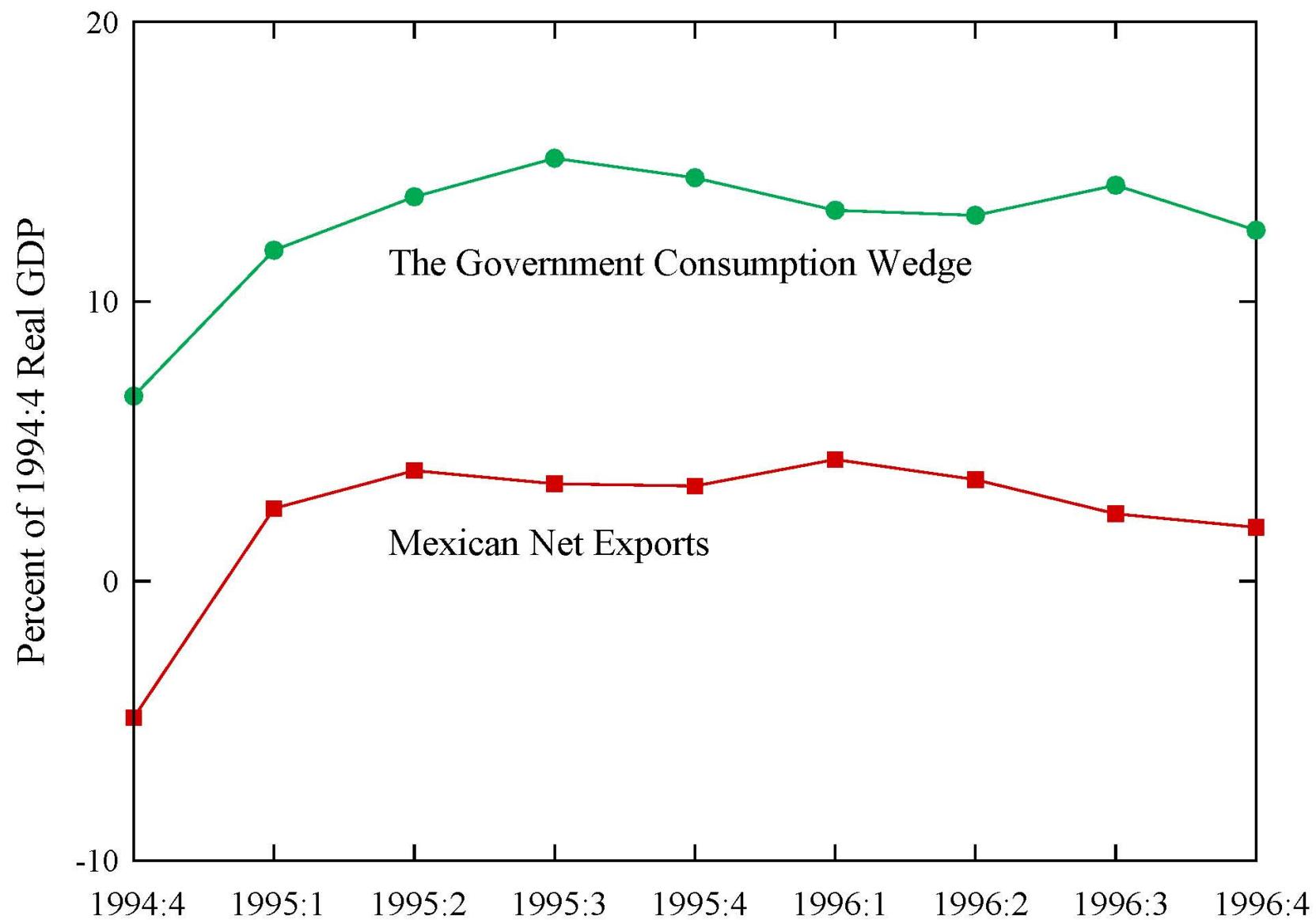
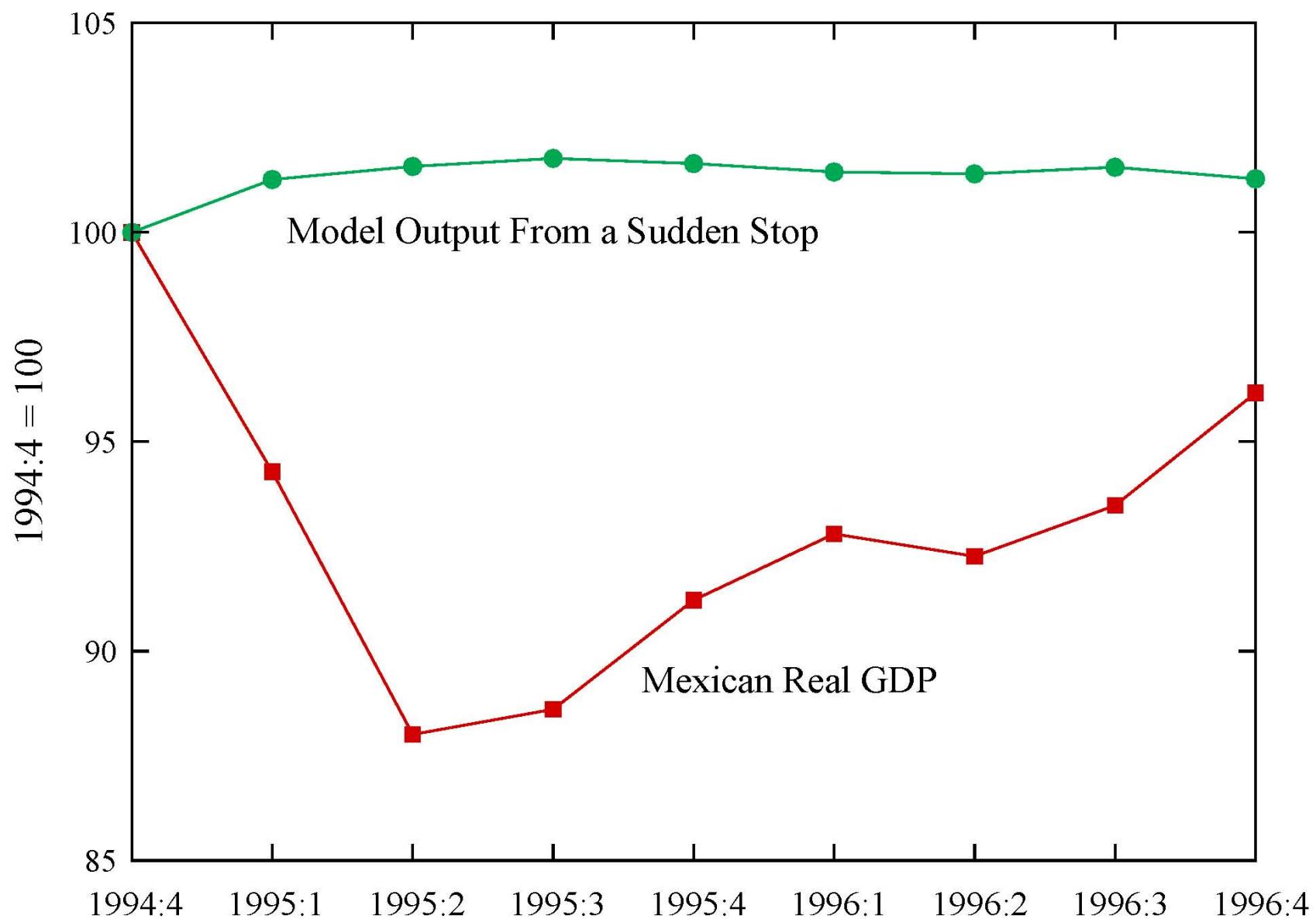


Figure 2. The Output Effect of a Pure Sudden Stop



## **Getting Output to Drop**

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- Common feature of models with output drops:

Advance payment constraints on firms

- Pay for period  $t + 1$  inputs at  $t$
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- Common feature of models with output drops:

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- Pay for period  $t + 1$  inputs at  $t$
- Must borrow to do so
- Advance payment constraint alone: No new wedge
- Need other frictions to get a wedge

## **Advance Payment Constraints Alone: No New Wedge** \_\_\_\_\_

Profits in period  $t$ : Pay  $t + 1$  wage bill at  $t$

$$F(k_t, l_t) - w_{t+1}l_{t+1}$$

## **Advance Payment Constraints Alone: No New Wedge** \_\_\_\_\_

Present value of profits

$$\sum p_t [F(k_t, l_t) - w_{t+1}l_{t+1}]$$

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Consumer budget

$$\sum p_t [c_t - w_{t+1}l_{t+1}]$$

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Consumer budget

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No labor wedge

$$\frac{U_{lt+1}}{U_{ct+1}} = F_{lt+1}$$

## Getting Output to Drop

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- Advance payment constraints *plus* other frictions
  - On labor plus escrow accounts

Perri-Neumeyer

- On intermediate goods plus collateral constraints

Mendoza, Christiano, Gust, Roldos

## Advance Payment Constraints: With Escrow Accounts \_\_\_\_\_

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- Firm
  - Borrows  $w_{t+1}l_{t+1}$  at  $t$  and escrows it
  - Pays workers at  $t + 1$  from escrow account
  - Pays lenders  $R_{t+1}w_{t+1}l_{t+1}$

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  - Pays lenders  $R_{t+1}w_{t+1}l_{t+1}$  at  $t + 1$
- Get labor wedge

$$\frac{U_{lt+1}}{U_{ct+1}} = \frac{F_{lt+1}}{R_{t+1}}$$

## Imported Intermediate Goods and TFP Fluctuations

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- Gross output  $G(k, l, z)$ ,  $z$  = intermediate goods
- Country's budget constraint with price of intermediates = 1

$$c(s^t) + b(s^t) + k(s^t) + \sum q(s^{t+1})z(s^{t+1}) \leq G(k(s^{t-1}), l(s^t), z(s^t)) + (1 - \delta)k(s^{t-1}) + \sum q(s^{t+1})b(s^{t+1})$$

- Collateral constraint

$$b(s^{t+1}) \leq V(s^{t+1})$$

## Distortions in the Intermediate Goods Economy

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First order conditions imply

$$G_z(s^{t+1}) = 1 + \frac{\mu(s^{t+1})}{U_c(s^{t+1})}$$

where  $\mu$  is multiplier on collateral constraint

- Production efficiency implies

$$G_z(s^{t+1}) = 1$$

# Associated Prototype Economy

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- Tax  $\tau$  on intermediate goods

- Firms

$$\max_z G(k, l, z) - (1+\tau)z$$

- solution  $z(k, l, \tau)$

- Value-added production function

$$F(k, l, -\tau) = G(k, l, z(\tau, k, l)) - z(\tau, k, l)$$

- Using Envelope Theorem

$$F_\tau = \tau z_\tau(\tau, k, l) < 0$$

- So lowering  $\tau$  increases measured productivity

# How much TFP fluctuations can movements in $P_z$ generate? \_\_

- Intermediate goods

- $G(v, z) = v^\alpha z^{1-\alpha}$  with  $v = k^\theta l^{1-\theta}$

- FOC:  $z(p) = \left(\frac{(1-\alpha)}{p}\right)^{1/\alpha} v$

- Value added:

$$y = G(v, z(p)) - pz(p) = vp^{-\left(\frac{1-\alpha}{\alpha}\right)} \bullet \text{constant}$$

- TFP

$$\log y - \log v = -\left(\frac{1-\alpha}{\alpha}\right) \log p + \text{constant}$$

## How much TFP fluctuations can movements in $P_z$ generate? \_\_

- $\Delta \text{TFP} = -\left(\frac{1-\alpha}{\alpha}\right) \Delta \log p$

- Rough calculation:

Imported intermediate goods = 1/6 of gross output

- So  $\alpha = 5/6$      $\Delta \text{TFP} = -\frac{\Delta \log p}{5}$
- If price of imported intermediates rises by 30% (Mendoza)  
then TFP falls by 6%

## Conclusion

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- Sudden stops alone do not give output drops
- Advance payments alone do not generate a wedge
- Need other frictions

## Conclusion

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- Sudden stops alone do not give output drops
- Advance payments alone do not generate a wedge
- Need *direct evidence* on other frictions