

Pegs and Pain

Stephanie Schmitt-Grohé

Martín Uribe

Columbia University

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Motivation: How much extra pain do currency pegs add to external crises?

Currency Pegs: Easy to adopt, hard to maintain.

The Achilles' Heel of Currency Pegs: The combination of downward nominal wage rigidity and a currency peg creates rigidity in real wages, which makes countries highly vulnerable to negative shocks.

Objectives of the paper:

- Build a model of the Achilles' Heel of currency pegs.
- Characterize aggregate dynamics under optimal exchange rate policy.
- Characterize aggregate dynamics under a currency peg.
- Quantify the costs of currency pegs in terms of unemployment and welfare.

A Disequilibrium Model

Nominal Wages are Downwardly Rigid

$$W_t \geq \gamma W_{t-1}$$

W_t = nominal wage rate in period t

$\gamma \geq 0$ degree of downward wage rigidity

Traded and Nontraded Goods

Traded goods: stochastic endowment y_t^T

Nontraded goods: produced with labor: $y_t^N = F(h_t)$

The relative price on nontradables: $p_t = \frac{P_t^N}{P_t^T}$

Law of one price holds for tradables: $P_t^T = P_t^* E_t$

$E_t =$ nominal exchange rate.

Assume that $P_t^* = 1$

Firms in the Nontraded Sector

$$\max_{\{h_t\}} p_t F(h_t) - w_t h_t,$$

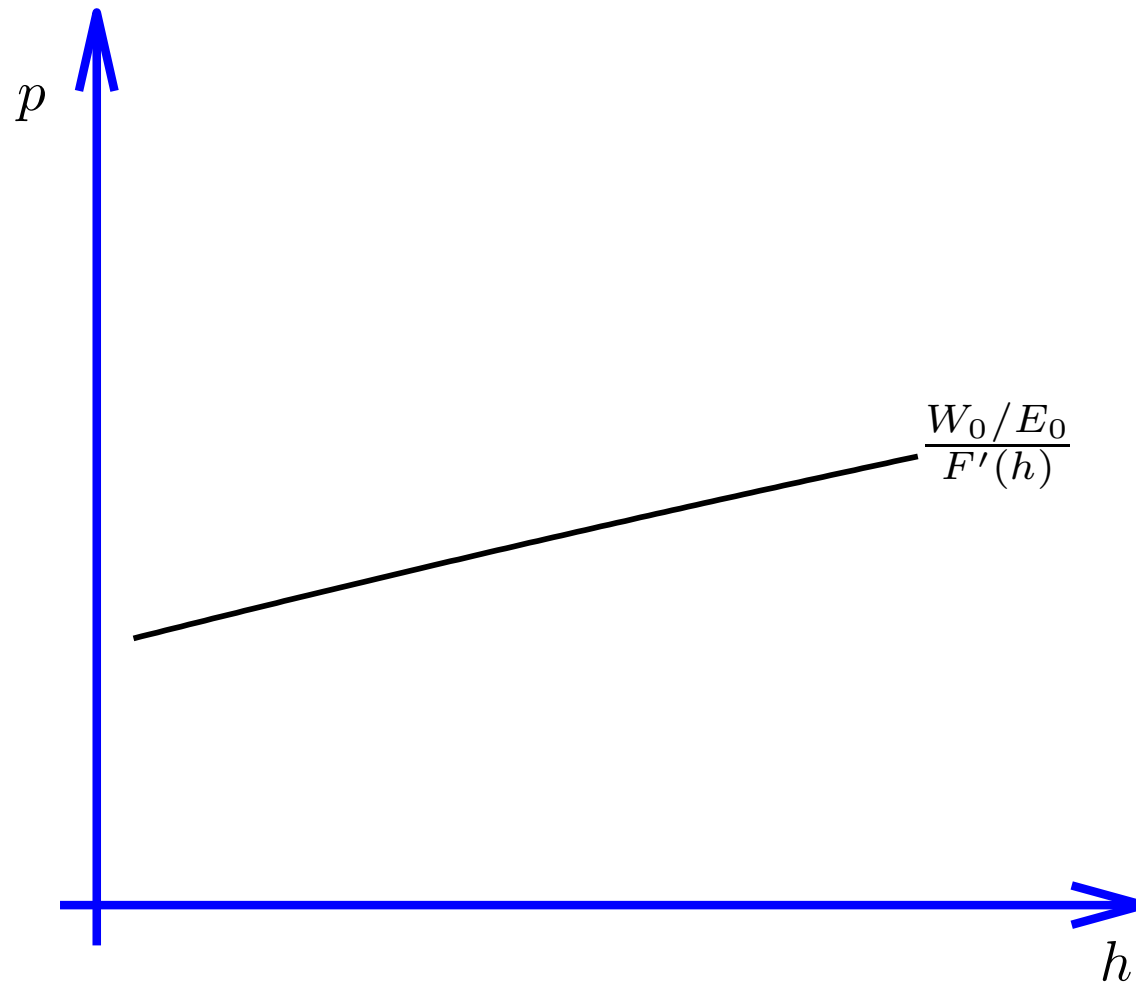
taking as given p_t and w_t ,

where $w_t \equiv W_t/E_t$ is the real wage in terms of tradables.

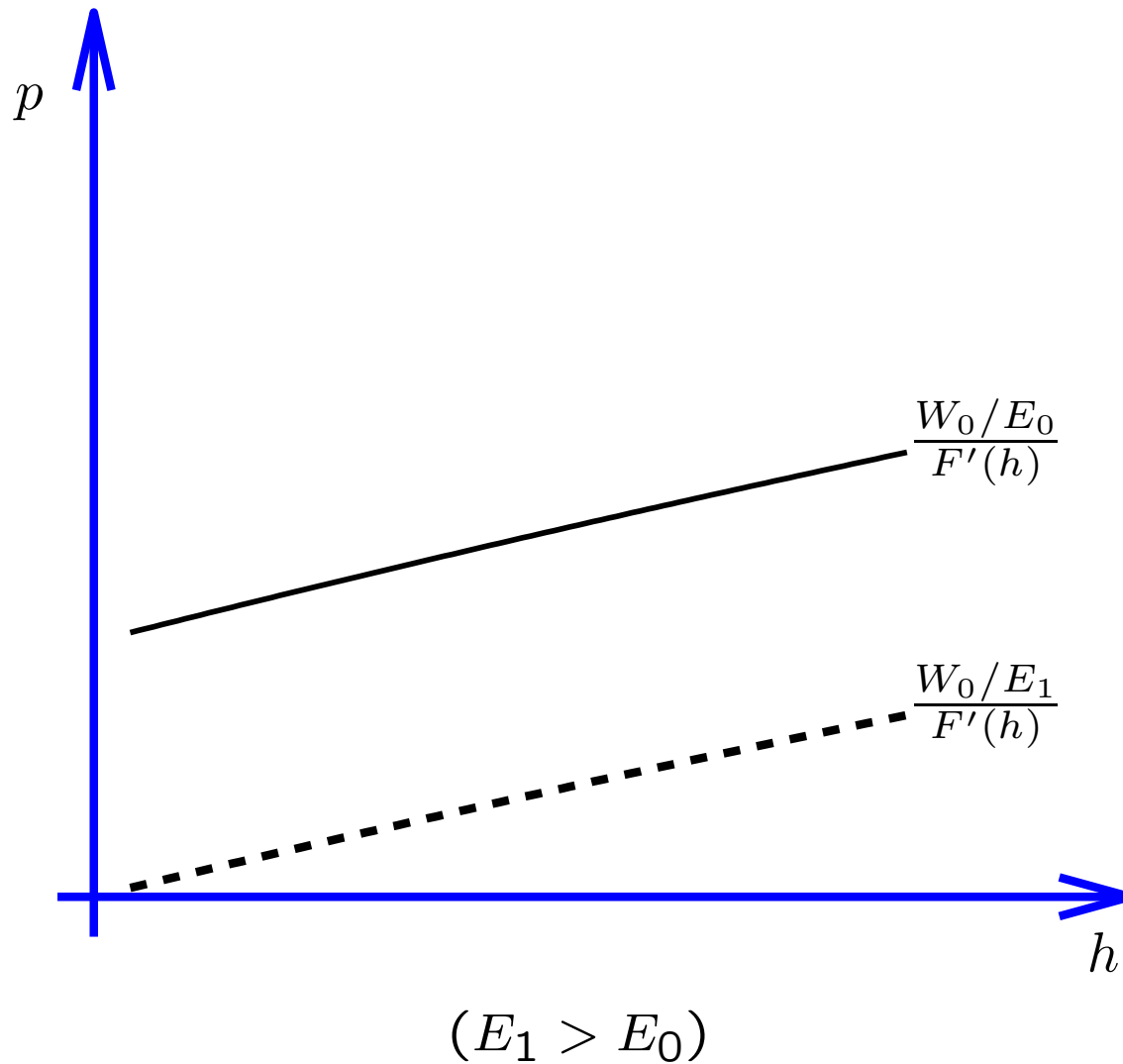
Optimality condition (or the Supply of Nontradables):

$$p_t = \frac{W_t/E_t}{F'(h_t)}$$

The Supply of Nontraded Goods



$E_t \uparrow$: A Devaluation Shifts The Supply Schedule Down



Households

$$\max_{\{c_t^T, c_t^N, d_{t+1}\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(c_t)$$

subject to

$$c_t = A(c_t^T, c_t^N)$$

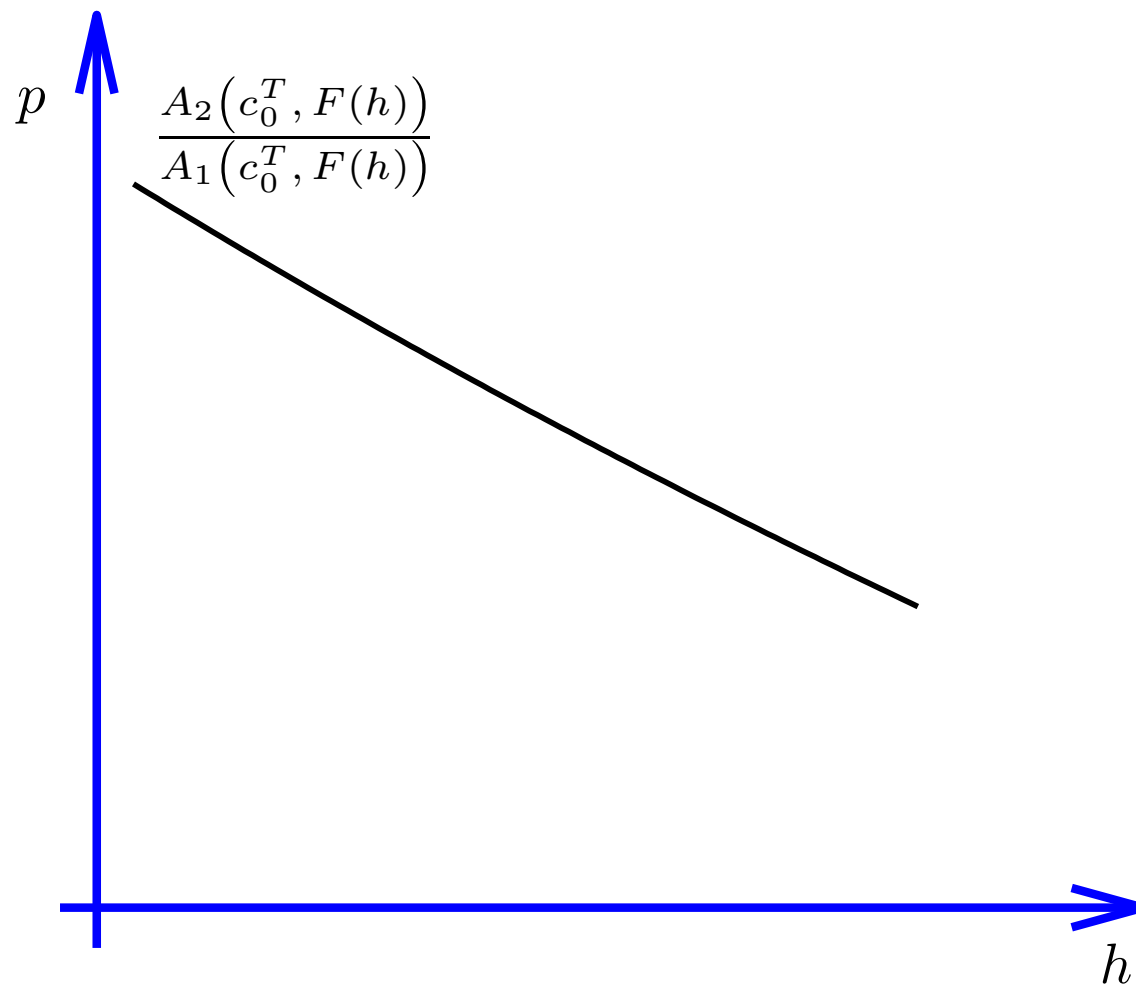
$$c_t^T + p_t c_t^N + d_t = y_t^T + w_t h_t + \frac{d_{t+1}}{1 + r_t} + \phi_t$$

$$d_{t+1} \leq \bar{d}$$

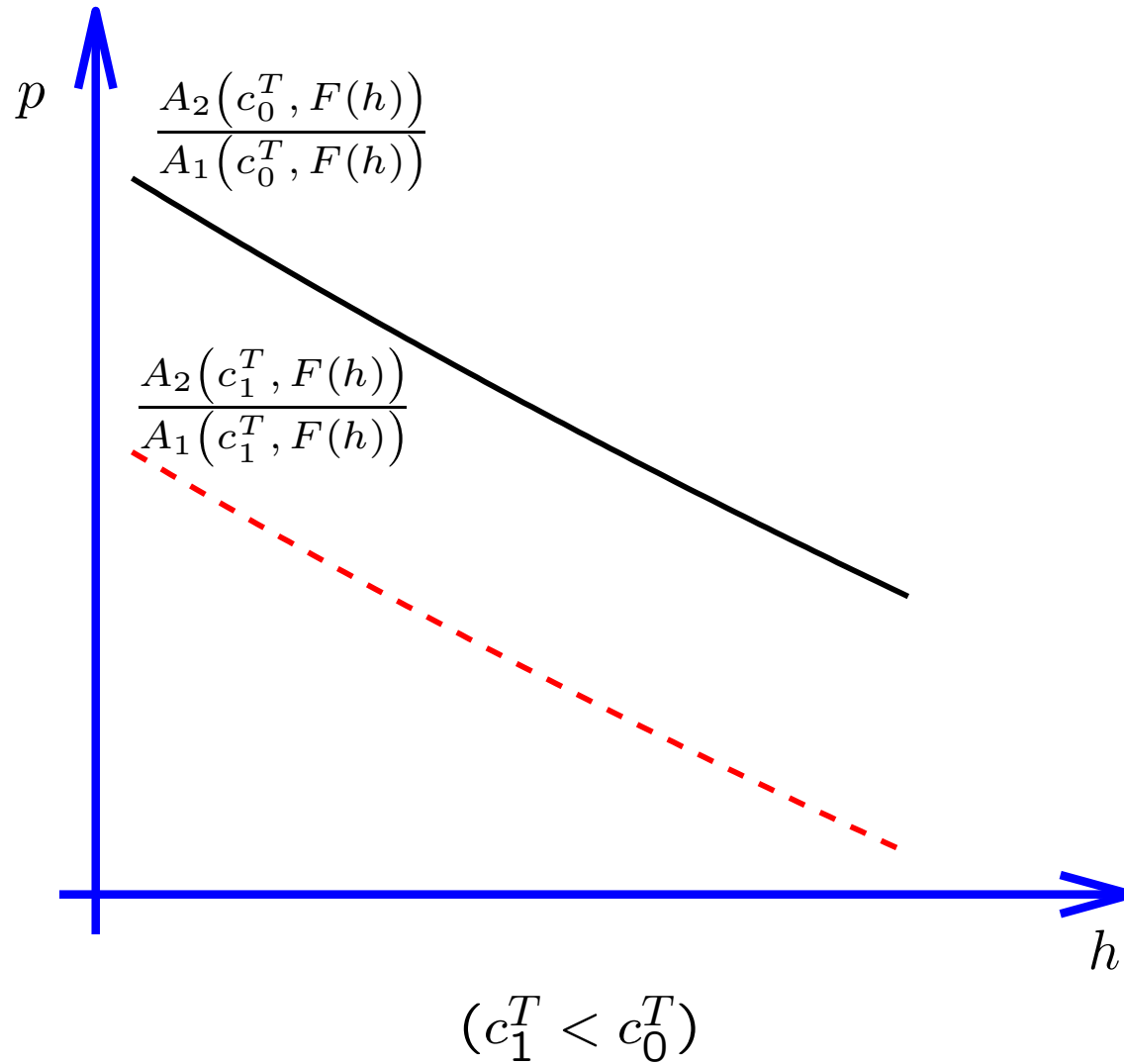
- Workers supply \bar{h} hours inelastically, but may not be able to sell them all. They take $h_t \leq \bar{h}$ as given.
- One first-order condition (Demand for Nontradables):

$$\frac{A_2(c_t^T, c_t^N)}{A_1(c_t^T, c_t^N)} = p_t$$

The Demand for Nontraded Goods



$c_t^T \downarrow$ Shifts the Demand Function Down



Disequilibrium in the Labor Market

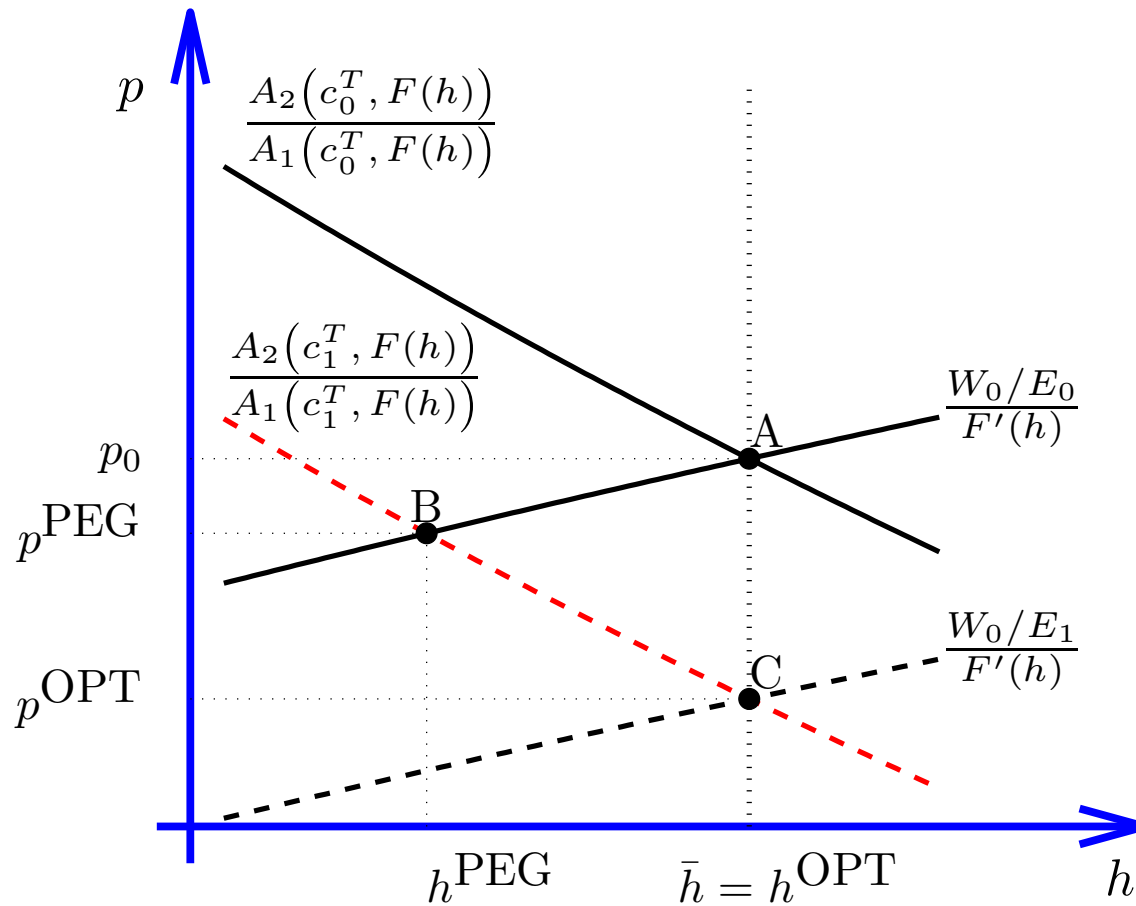
The following 3 conditions must hold at all times:

$$W_t \geq \gamma W_{t-1}$$

$$h_t \leq \bar{h}$$

$$(\bar{h} - h_t) (W_t - \gamma W_{t-1}) = 0$$

Currency Pegs and Unemployment



$c_1^T < c_0^T$ (negative shock) and $E_1 > E_0$ (optimal devaluation)

Optimal Exchange-Rate Policy

Set the (gross) devaluation rate, $\epsilon_t = E_t/E_{t-1}$, to eliminate unemployment:

$$\epsilon_t \equiv \max \left\{ 1, \frac{\gamma W_{t-1}/E_{t-1}}{\omega(c_t^T)} \right\}$$

where $\omega(c_t^T)$ denotes the full-employment real wage:

$$\omega(c_t^T) \equiv \frac{A_2(c_t^T, F(\bar{h}))}{A_1(c_t^T, F(\bar{h}))} F'(\bar{h}); \quad \omega'(c_t^T) > 0$$

Dynamics Under Optimal Exchange Rate Policy

$$v^{OPT}(y_t^T, r_t, d_t) = \max_{\{d_{t+1}, c_t^T\}} \left\{ U(A(c_t^T, F(\bar{h}))) + \beta \mathbb{E}_t v^{OPT}(y_{t+1}^T, r_{t+1}, d_{t+1}) \right\}$$

subject to $d_{t+1} \leq \bar{d}$ and

$$y_t^T + \frac{d_{t+1}}{1 + r_t} = d_t + c_t^T$$

Currency Pegs

Set the (gross) devaluation rate to unity:

$$\epsilon_t = 1.$$

- **Implied labor allocation**

$$h_t \begin{cases} = \bar{h} & \text{if } \omega(c_t^T) \geq \gamma \frac{W_{t-1}}{E_{t-1}} \\ \text{solves } \frac{A_N(c_t^T, F(h_t))}{A_T(c_t^T, F(h_t))} F'(h_t) = \gamma \frac{W_{t-1}}{E_{t-1}} & \text{if } \omega(c_t^T) < \gamma \frac{W_{t-1}}{E_{t-1}} \end{cases}$$

- **Disequilibrium dynamics** cannot be expressed as the solution to a Bellman equation.
- **Solution Method:** Iteration of disequilibrium conditions over the (discretized) 4-dimensional state space $\{y_t^T, r_t, d_t, w_{t-1}\}$.

Calibration and Functional Forms

$$U(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}$$

$$A(c^T, c^N) = \left[a(c^T)^{1-\frac{1}{\xi}} + (1-a)(c^N)^{1-\frac{1}{\xi}} \right]^{\frac{\xi}{\xi-1}}$$

$$F(h) = h^\alpha$$

Parameter	Value	Description
γ	0.99	Degree of downward nominal wage rigidity (also 0.98-0.96)
σ^{-1}	1/5	Intertemp. elast. subst. (Reinhart and Végh, 1995)
a	0.26	Share of tradables
ξ	0.44	Intratemp. elast. subst. (González-Rozada et al., 2004)
α	0.75	Labor share in nontraded sector
\bar{h}	1	Labor endowment
β	0.9375	Quarterly subjective discount factor

Nominal Wage Rigidity and the Great Depression:

The Gold Standard Hypothesis (Eichengreen and Sachs, 1985)

Countries that left gold early enjoyed much more rapid recoveries than those that stayed on gold. This difference in performance was associated with earlier reflation of price levels in the countries leaving gold

Gold Bloc: France, Belgium, Netherland, Italy

Sterling Bloc: (left gold early, 1931) : United Kingdom, Denmark, Finland, Sweden, Norway

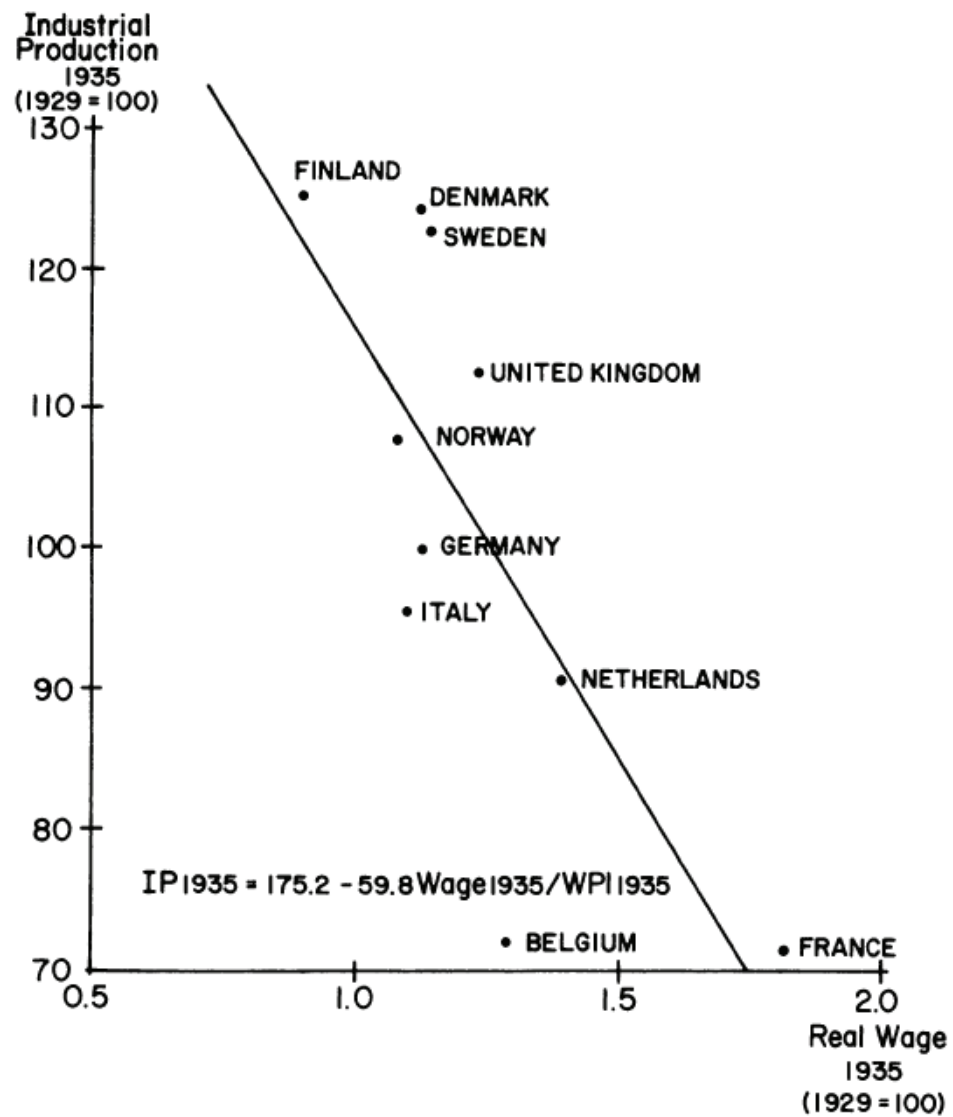


FIGURE 2
CHANGES IN REAL WAGES AND INDUSTRIAL PRODUCTION, 1929-1935

Probability of Decline, Increase, or No Change in Nominal Wages Between Interviews

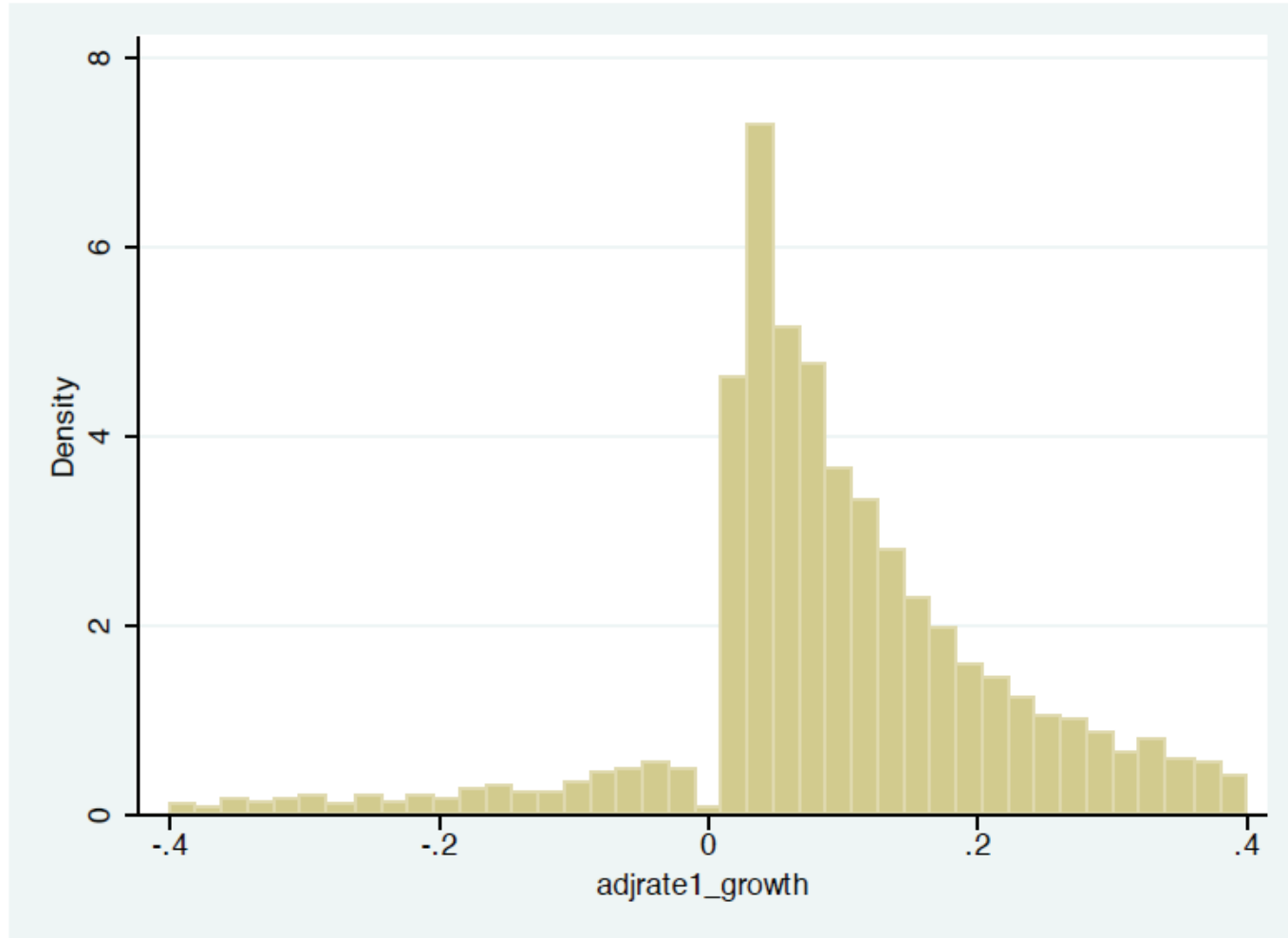
U.S. data, SIIP panel 1986-1993, within-job changes

	Interviews 1 Year apart		Interviews 4 months apart	
	Males	Females	Males	Females
Decline	5.1%	4.3%	2%	1.5%
Constant	53.7%	49.2%	85.8%	84.9%
Increase	41.2%	46.5%	12.3%	13.6%

Source: Gottschalk (2005)

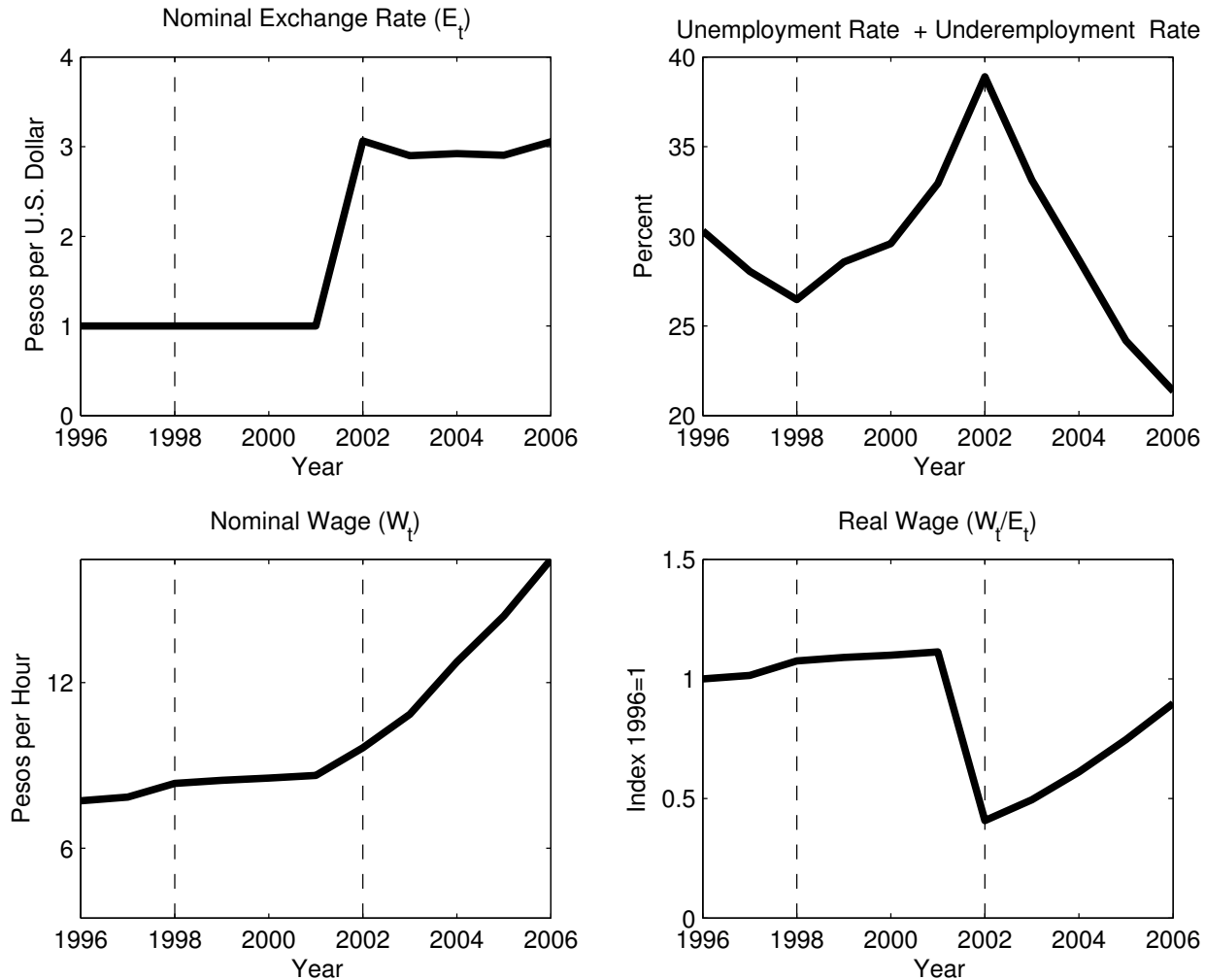
Note. Male and female hourly workers not in school, 18 to 55 at some point during the panel. All nominal-wage changes are within-job wage changes, defined as changes while working for the same employer.

Distribution of Non-Zero Wage Changes, Hourly Workers, 1996 F



Quarterly, 1996-99. Source: Barattieri, Basu, and Gottschalk (2010)

Argentina 1996-2006



Memo: Average annual CPI inflation 1998-2001: -0.86%

Unemployment, Nominal Wages, and γ Evidence from the Eurozone

Country	Unemployment Rate		Wage Growth	Implied Value of γ
	2008Q1 (in percent)	2011Q2 (in percent)	$\frac{W_{2011Q2}}{W_{2008Q1}}$ (in percent)	
Bulgaria	6.1	11.3	43.3	1.028
Cyprus	3.8	6.9	10.7	1.008
Estonia	4.1	12.8	2.5	1.002
Greece	7.8	16.7	-2.3	0.9982
Lithuania	4.1	15.6	-5.1	0.996
Latvia	6.1	16.2	-0.6	0.9995
Portugal	8.3	12.5	1.91	1.001
Spain	9.2	20.8	8.0	1.006
Slovenia	4.7	7.9	12.5	1.009
Slovakia	10.2	13.3	13.4	1.010

Note. W is an index of nominal average hourly labor cost in manufacturing, construction, and services. Unemployment is the economy-wide unemployment rate. Source: EuroStat.

The Driving Process:

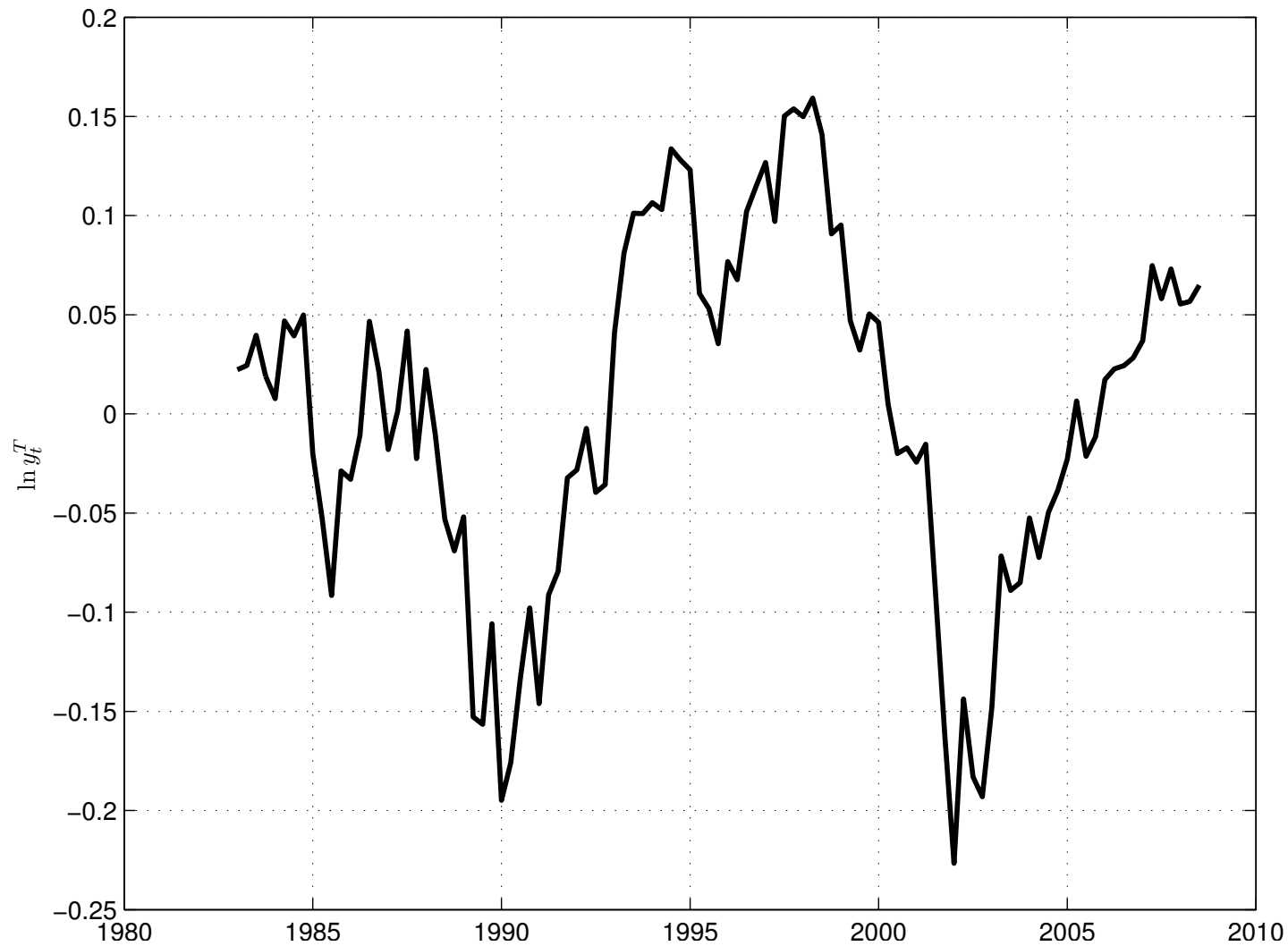
Estimate the following AR(1) system using Argentine data over the period 1983:Q1—2001:Q3:

$$\begin{bmatrix} \ln y_t^T \\ \ln \frac{1+r_t}{1+r} \end{bmatrix} = A \begin{bmatrix} \ln y_{t-1}^T \\ \ln \frac{1+r_{t-1}}{1+r} \end{bmatrix} + \epsilon_t,$$

Summary Statistics

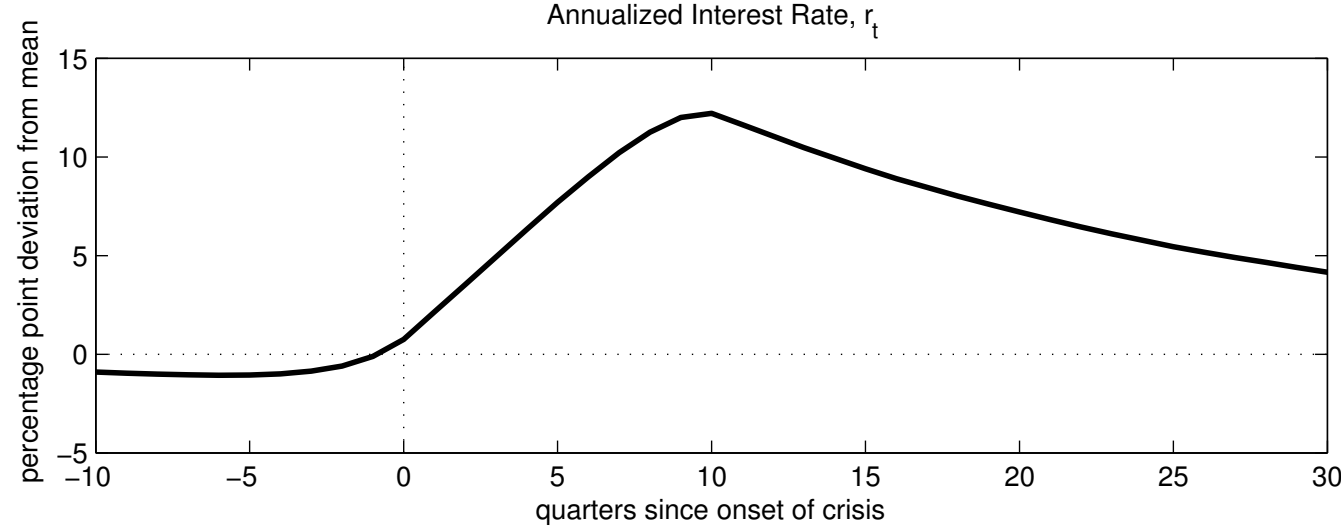
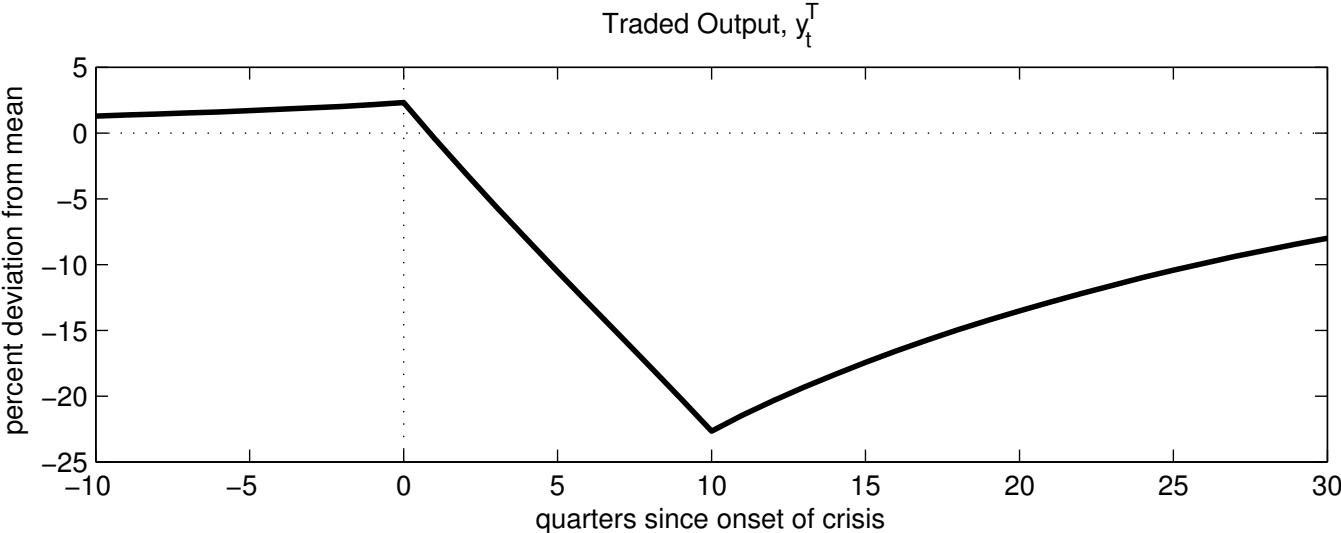
Statistic	y^T	r
Std. Dev.	12%	6%yr
Serial Corr.	0.95	0.93
Corr(y_t^T, r_t)	-0.86	
Mean	1	12%yr

Traded Output in Argentina 1983:Q1-2008:Q3

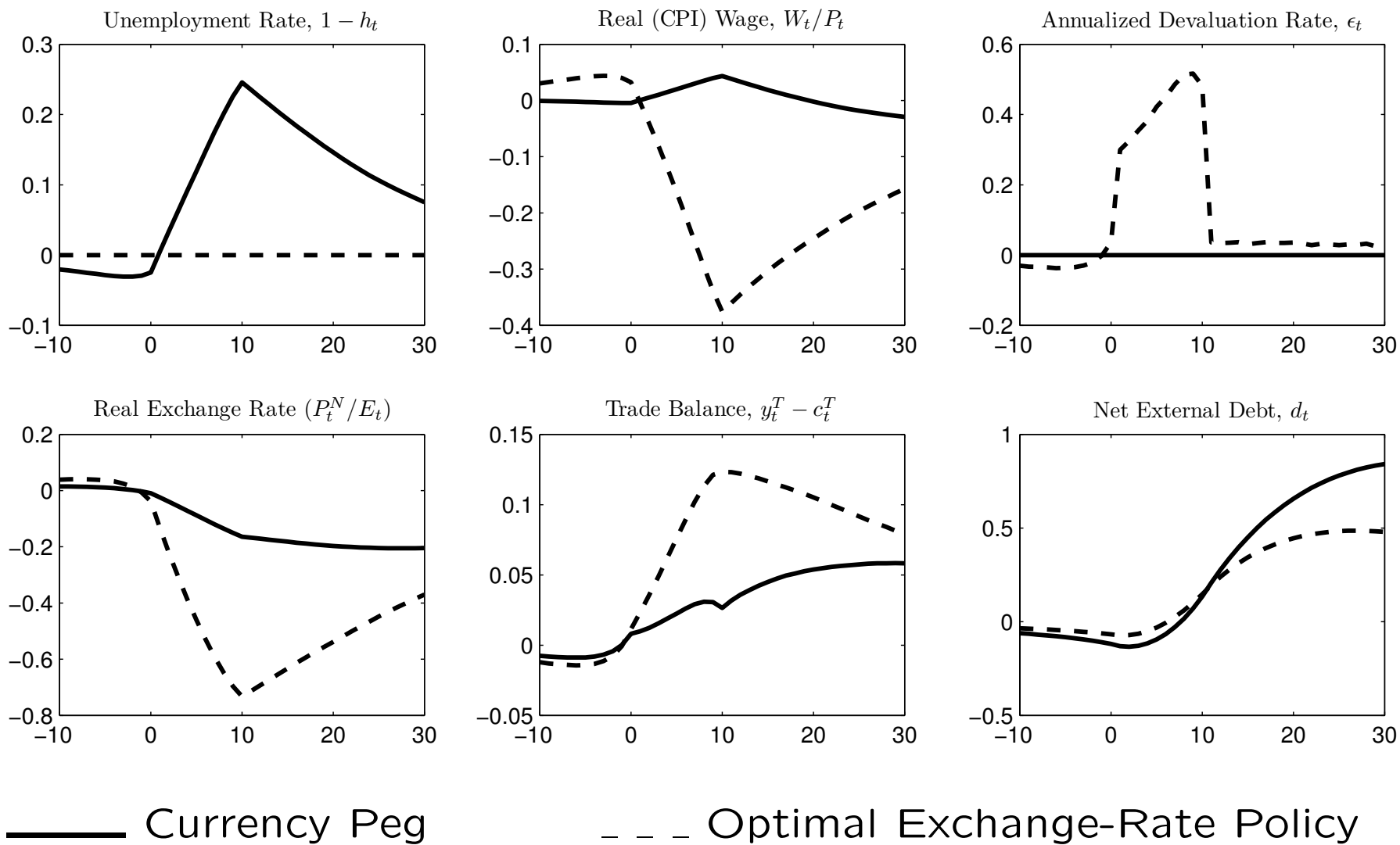


Note. Detrended and seasonally adjusted.

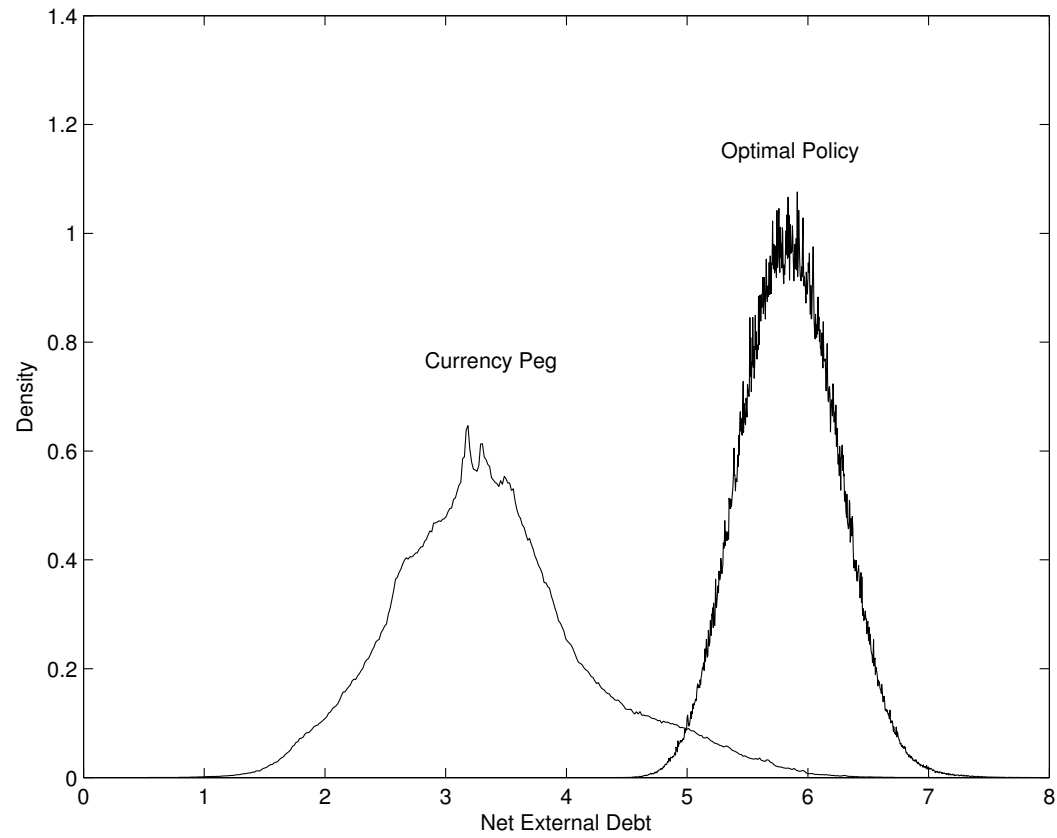
The Origin of a Crisis



The Dynamics of a Crisis



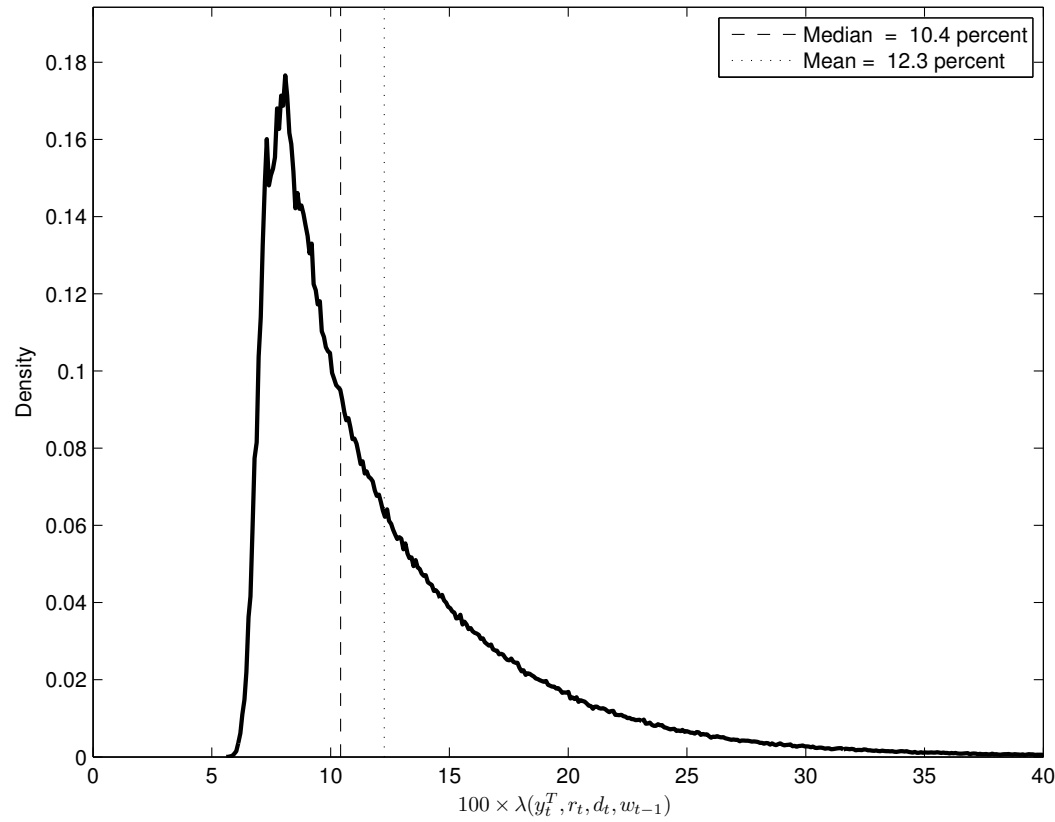
The Distribution of External Debt



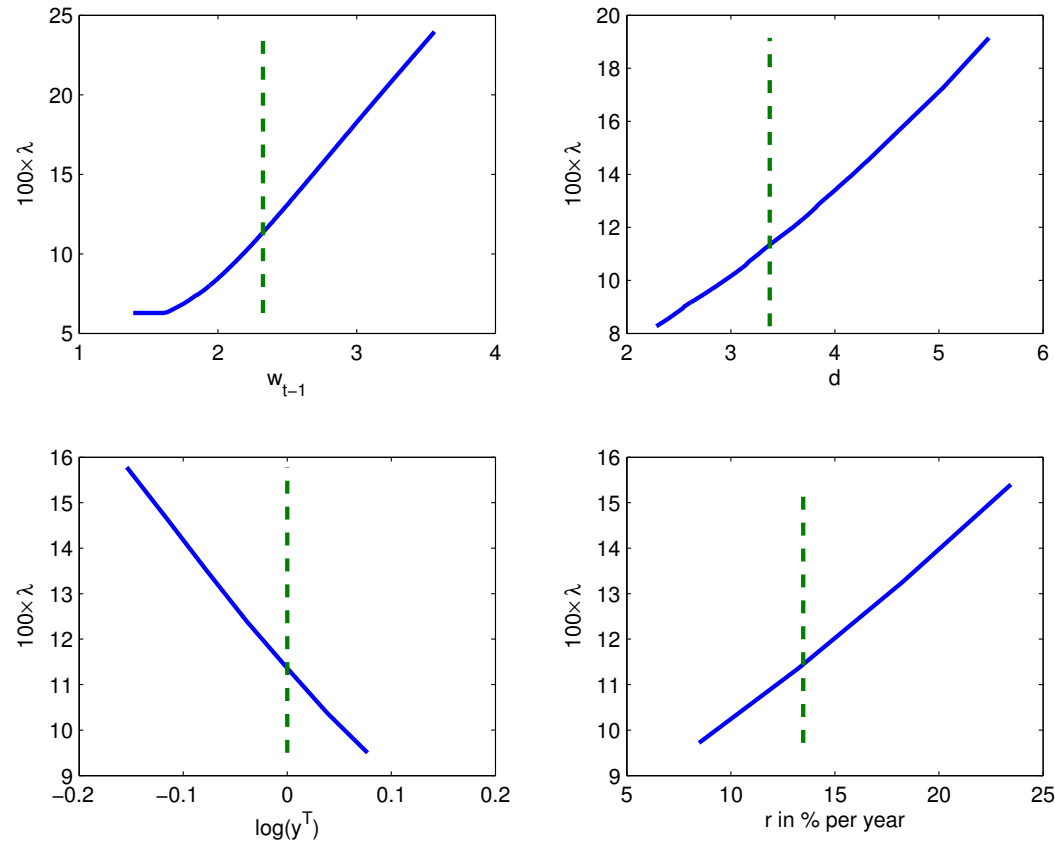
The Welfare Cost of Currency Pegs

$$\mathbb{E} \left\{ \sum_{t=0}^{\infty} \beta^t U \left(c_t^{\text{PEG}} (1 + \lambda(s_0)) \right) \middle| s_0 \right\} = \mathbb{E} \left\{ \sum_{t=0}^{\infty} \beta^t U \left(c_t^{\text{OPT}} \right) \middle| s_0 \right\}$$

where $s_0 = \{y_0^T, r_0, d_0, w_{-1}\}$.



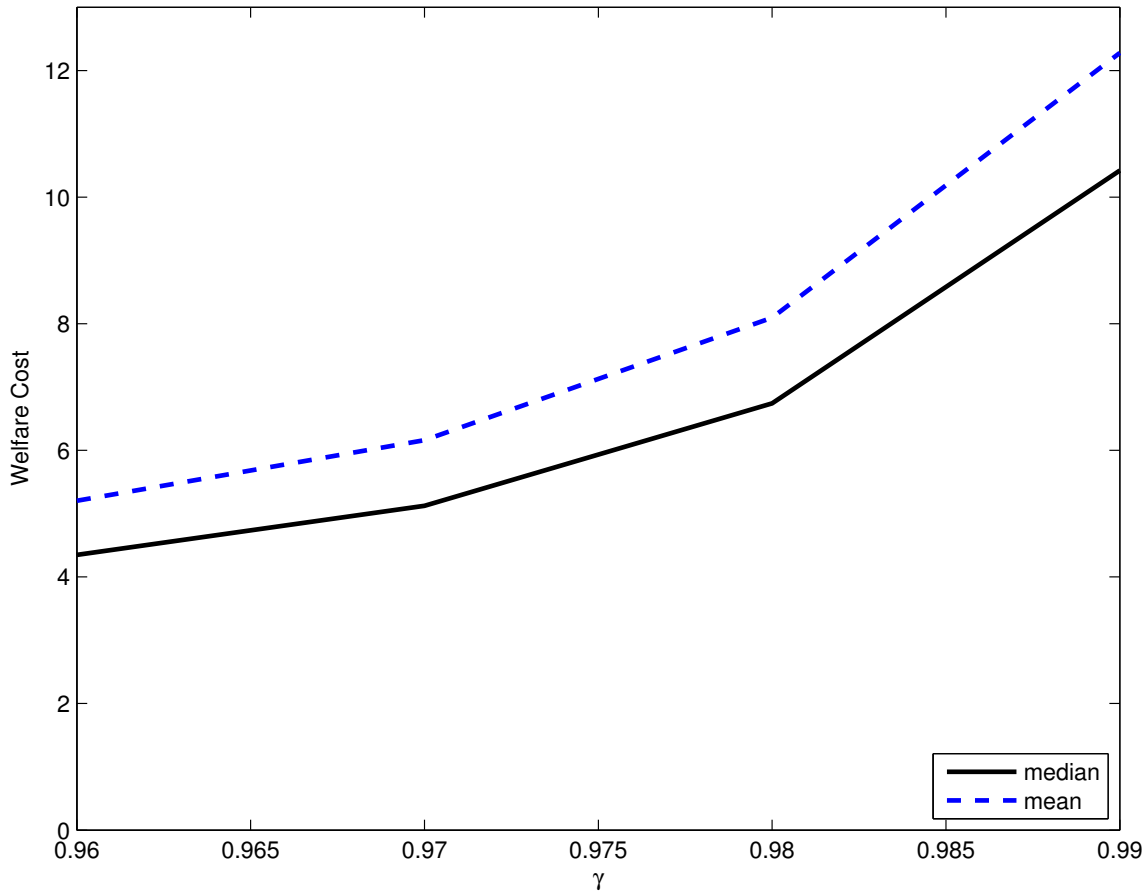
Welfare Cost of Currency Pegs as a Function of the State Variables



Note. All states except the one shown on the horizontal axis are fixed at their unconditional means. Dashed lines indicate the mean of the state displayed on the horizontal axis.

Sensitivity Analysis (I)

The Welfare Costs of Pegs As a Function of γ



Sensitivity Analysis (II) Endogenous Labor Supply

$$U(c_t, h_t) = \frac{c_t^{1-\sigma} - 1}{1-\sigma} + \varphi \frac{(\bar{h} - h_t)^{1-\theta} - 1}{1-\theta}$$

θ	$E \frac{\bar{h} - h_t}{h_t \theta}$	Welfare Cost	
		Median	Mean
1.001	3.1	4.5	6.2
6	0.20	6.8	8.6

$$\bar{h} = 3, \phi = 4.4.$$

Sensitivity Analysis (III)

Parameterization	Welfare Cost of a Peg	
	Median	Mean
Baseline	10.4	12.3
Higher patience ($\beta = 0.945$)	8.0	9.2
Higher intratemp. elast. subst. ($\xi = 0.88$)	8.6	10.8
Higher intertemp. elast. subst. ($\sigma = 2$)	9.9	10.8

Inducing the Efficient Allocation Through Fiscal Policy

- Maintain the peg (i.e., set $\epsilon_t = 1$).
- Subsidize wages at the rate, τ_t , when real wage is ‘too high’:

$$\tau_t = \max \left\{ 0, 1 - \frac{\omega(c_t^T)}{\gamma w_{t-1}} \right\},$$

$\omega(c_t^T)$ = flexible-wage real wage

$(1 - \tau_t)w_t$ = wage rate faced by firms

- Observation I : The optimal policy calls for fiscal expansion (not austerity).
- Observation II: The optimal policy calls for facilitating the expenditure switch, not for widespread increases in public spending. (e.g., it would be counterproductive to expand public absorption of tradables).

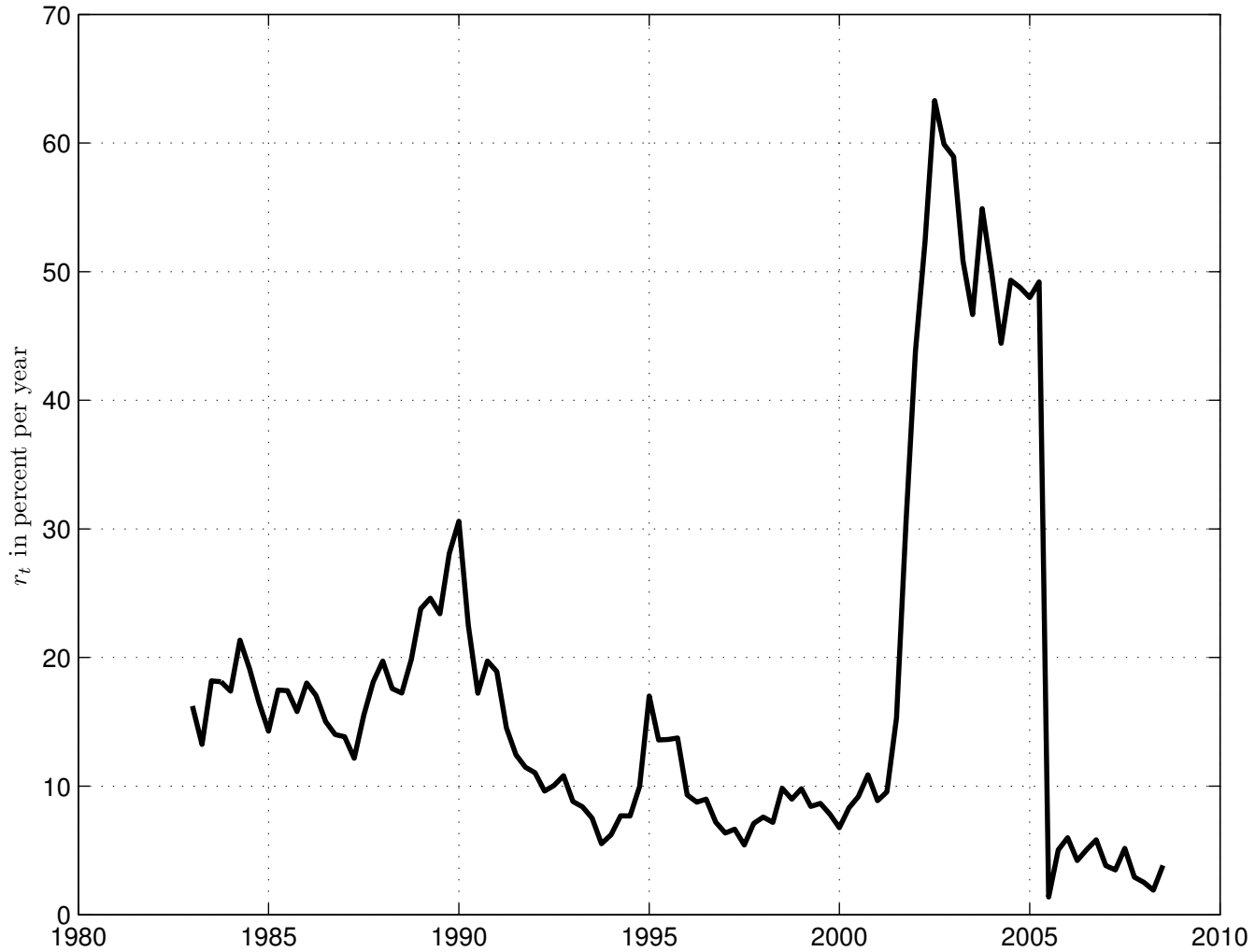
Summary of Main Findings:

- The costs of currency pegs are large, both in terms of welfare (4 to 10% of consumption) and unemployment (up to 15%).
- Large external crises call for large devaluations (over 100%).

⇒ We turn the sentence “Devaluations are contractionary” on its head and say instead that “Contractions are *devaluatory*.”

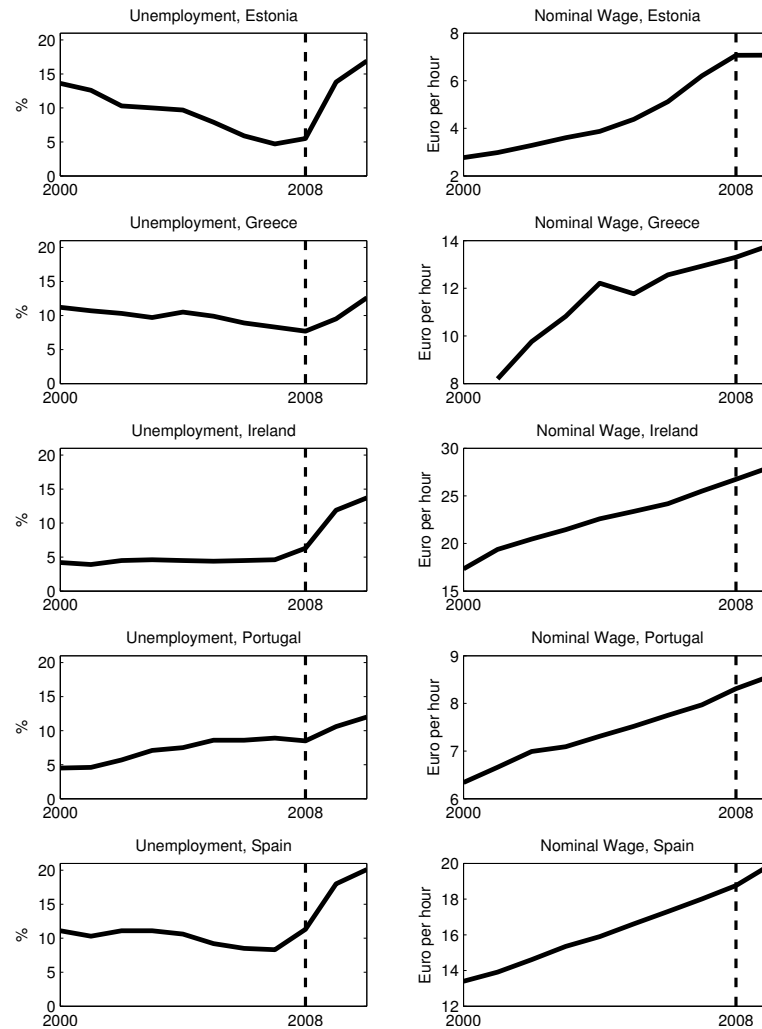
EXTRAS

Interest Rate in Argentina 1983:Q1-2008:Q3

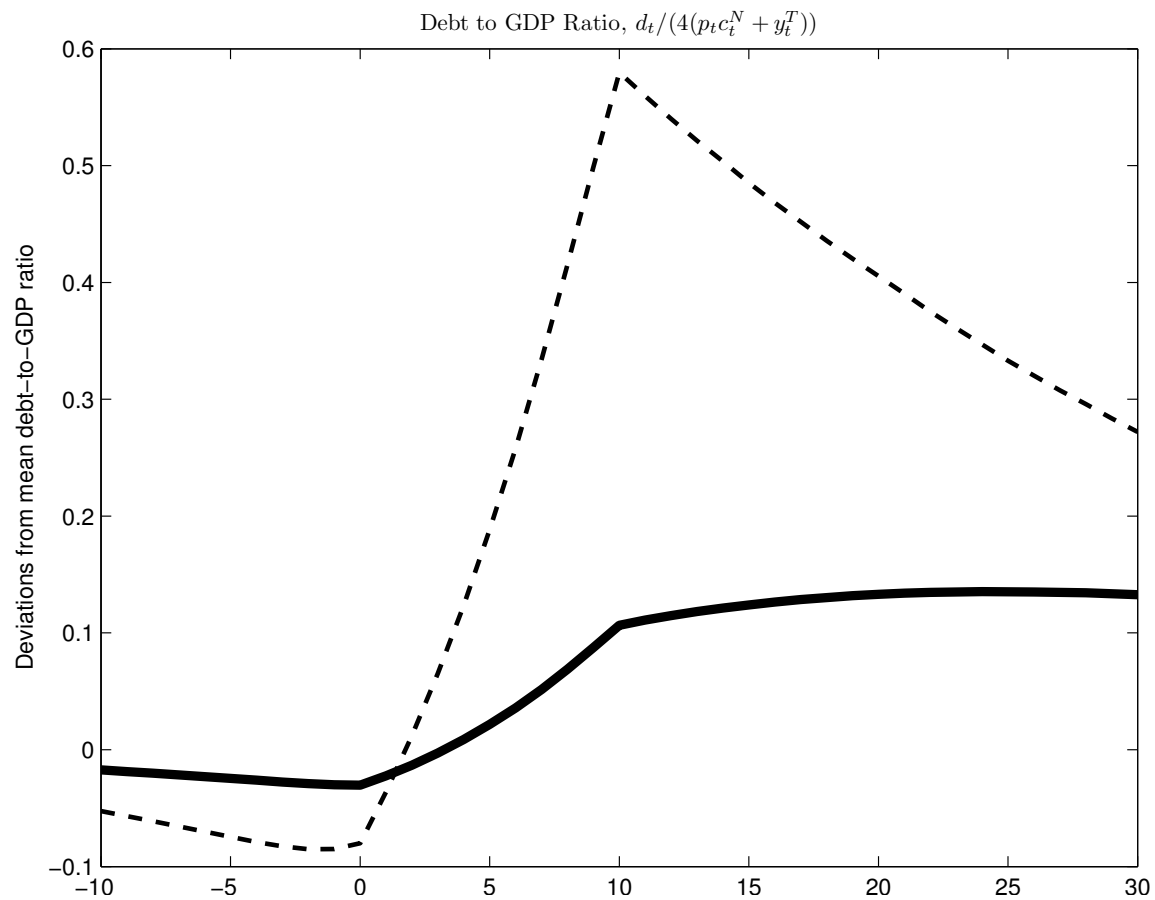


Note. EMBI+ plus US treasury rate minus US expected inflation. Percent per year

Unemployment and Nominal Wages in Peripheral Europe



The Debt-to-GDP Ratio During a Crisis



— Currency Peg

- - - Optimal Exchange-Rate Policy