Pegs and Pain

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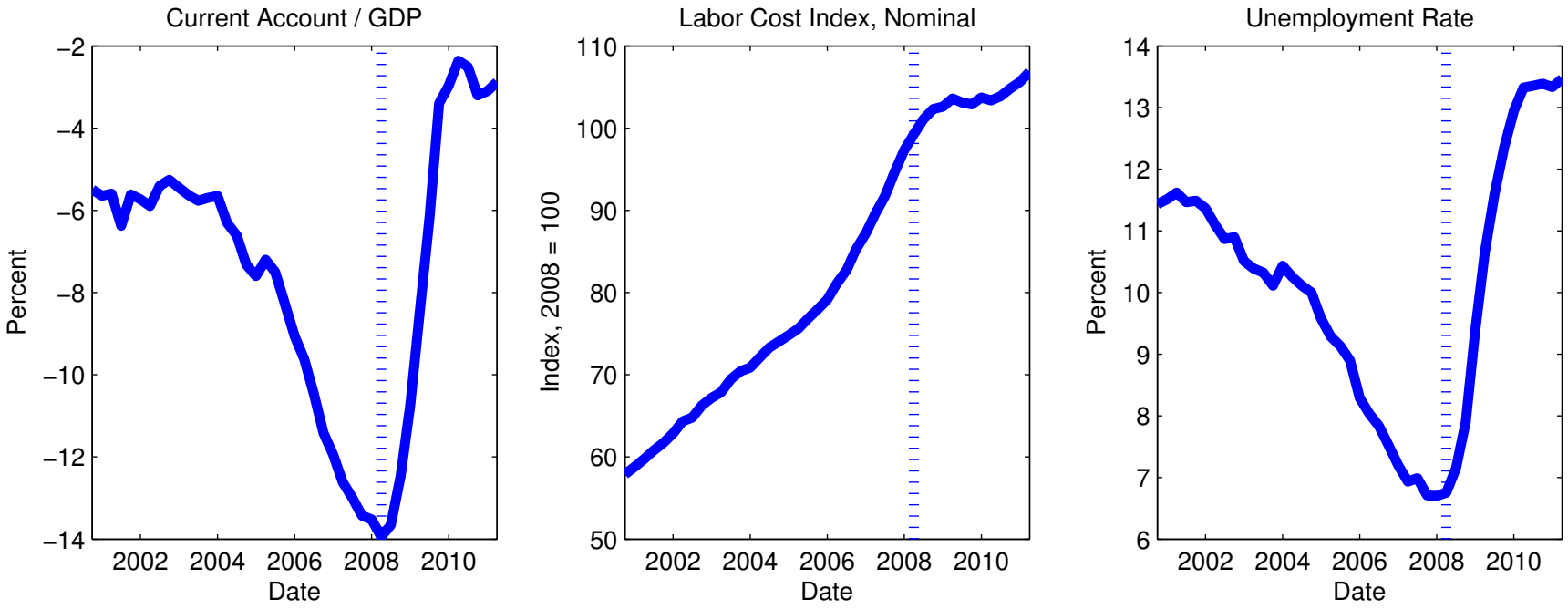
Motivation

- History suggests that currency pegs are easy to adopt, but 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.

- Our question: How much extra unemployment and pain do currency pegs add to external crises?

Boom-Bust Cycle in Peripherical Europe: 2000-2011



Data Source: Eurostat. Data represents arithmetic mean of Bulgaria, Cyprus, Estonia, Greece, Lithuania, Latvia, Portugal, Spain, Slovenia, and Slovakia

Related Literature:

Eichengreen and Sachs, 1985 (gold standard theory of great depression, empirical)

Welfare cost of peg:
Kollmann, 2002 (small open economy with sticky prices, 4 shocks, monopolistic competition, incomplete markets, welfare costs of pegs $< 1\%$)

Galí and Monacelli, 2005 (small open economy with sticky prices, small welfare costs of pegs)

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

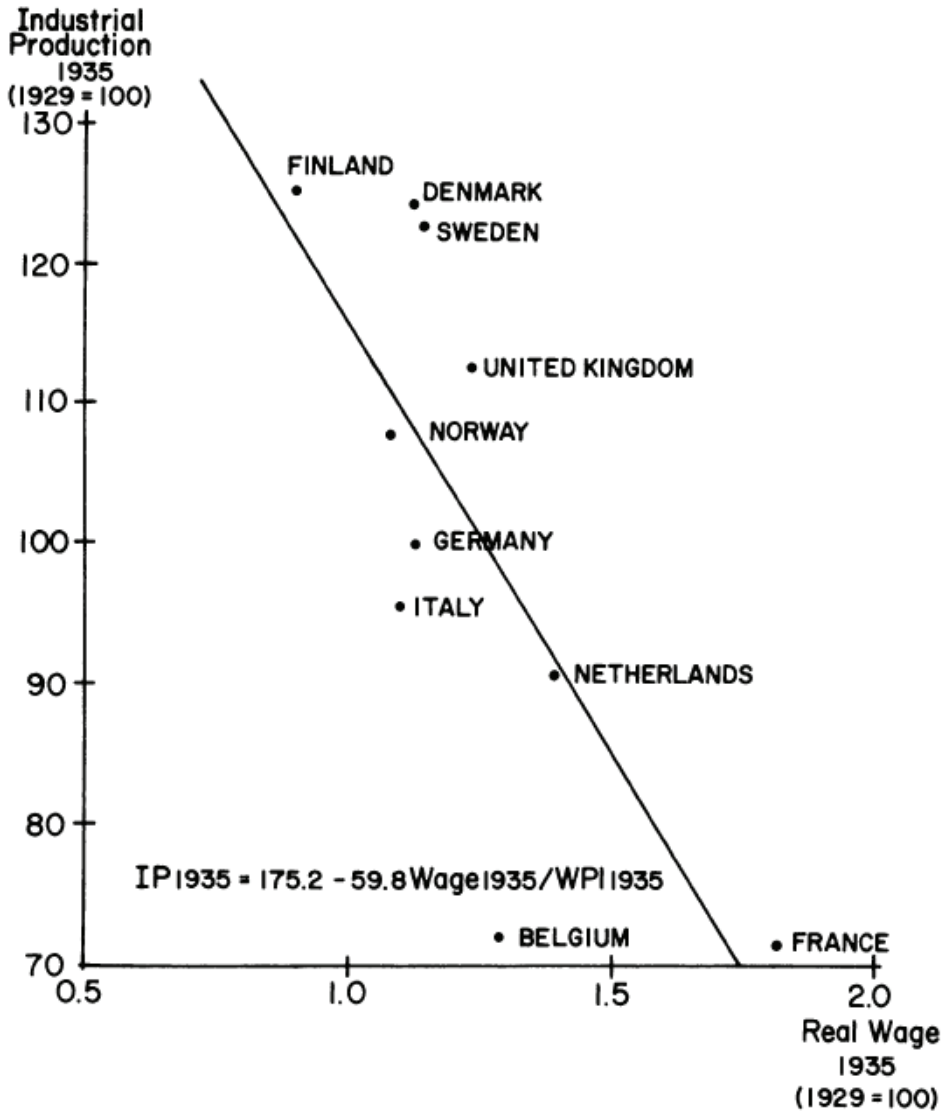


FIGURE 2
CHANGES IN REAL WAGES AND INDUSTRIAL PRODUCTION, 1929–1935

What the paper does:

- Build a traded-nontraded good small open economy model with downward nominal wage rigidity and liability dollarization.

- Characterize aggregate dynamics under optimal exchange rate policy and under a currency peg.

- Quantify the costs of currency pegs in terms of unemployment and welfare.

Preview of Main Findings

- Currency pegs are extremely painful.

- They induce an average unemployment rate of 14 percent and lower aggregate consumption by 5 percent on average.

- The median welfare costs of pegs is 4–10 percent of consumption.

A Model of unemployment due to downward nominal wage rigidity

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

$W_t =$ nominal wage rate in period t

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

Empirical Evidence on Downward Nominal Wage Rigidity — what is a plausible value for γ

Some Evidence that Nominal Wage Rigidity is One-Sided

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

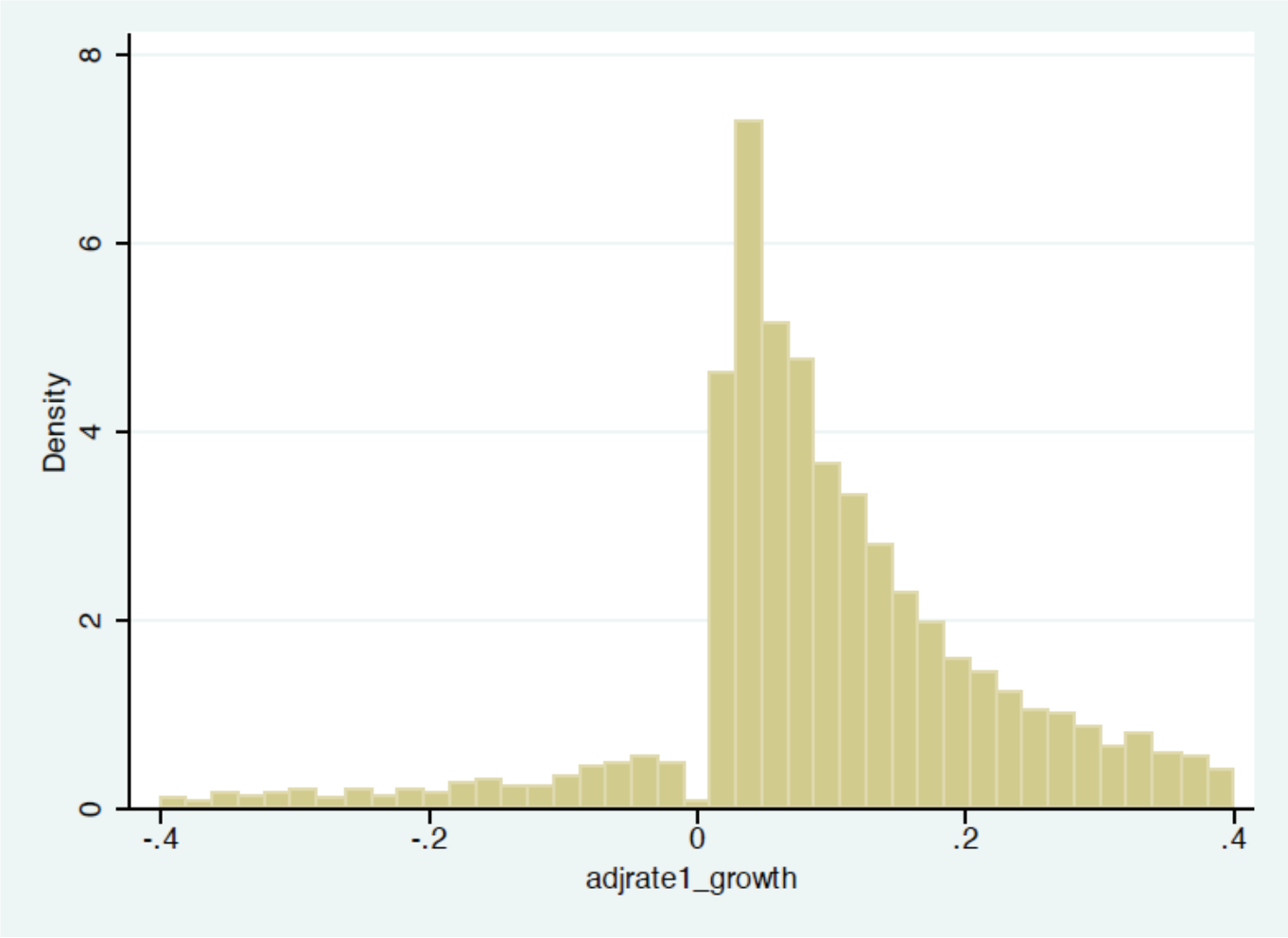
U.S. data, SIIP panel 1986-1993, within-job changes

	Interviews One Year apart	
	Males	Females
Decline	5.1%	4.3%
Constant	53.7%	49.2%
Increase	41.2%	46.5%

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.

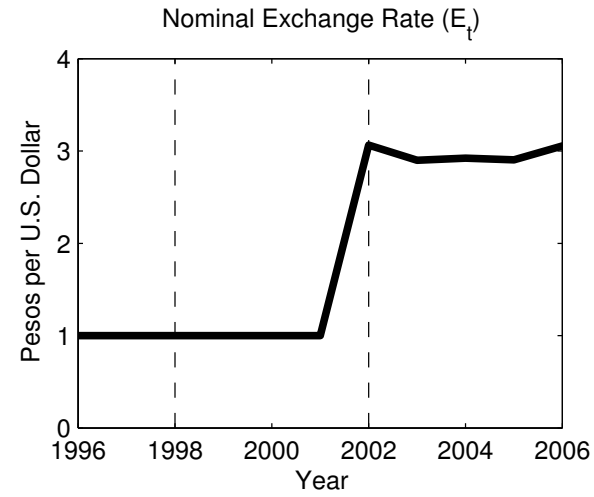
Distribution of Non-Zero Wage Changes, Hourly Workers, 1996 F

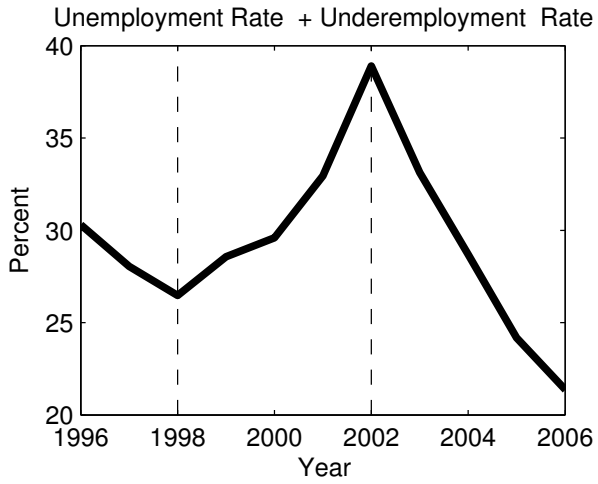


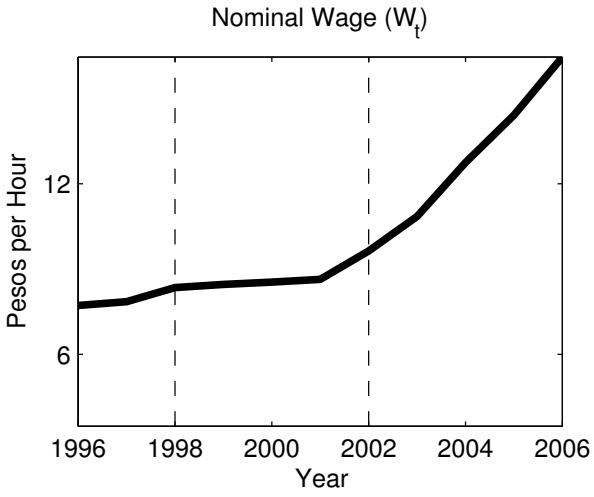
Quarterly, 1996-99. Source: Barattieri, Basu, and Gottschalk (2010)

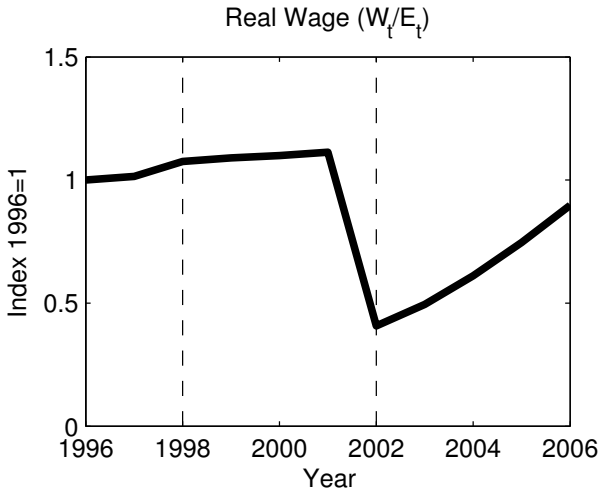
Evidence on the size of γ

Argentina 1996-2006









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

Unemployment, Nominal Wages, and γ Evidence from the Eurozone

Country	Unemployment Rate 2008Q1 (in percent)	Unemployment Rate 2011Q2 (in percent)	Wage Growth $\frac{W_{2011Q2}}{W_{2008Q1}}$ (in percent)	Implied Value of γ
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 Model

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: $P_t^T = P_t^* E_t$

Nominal exchange rate: E_t

Assume that $P_t^* = 1$

Firms in the Nontraded Sector

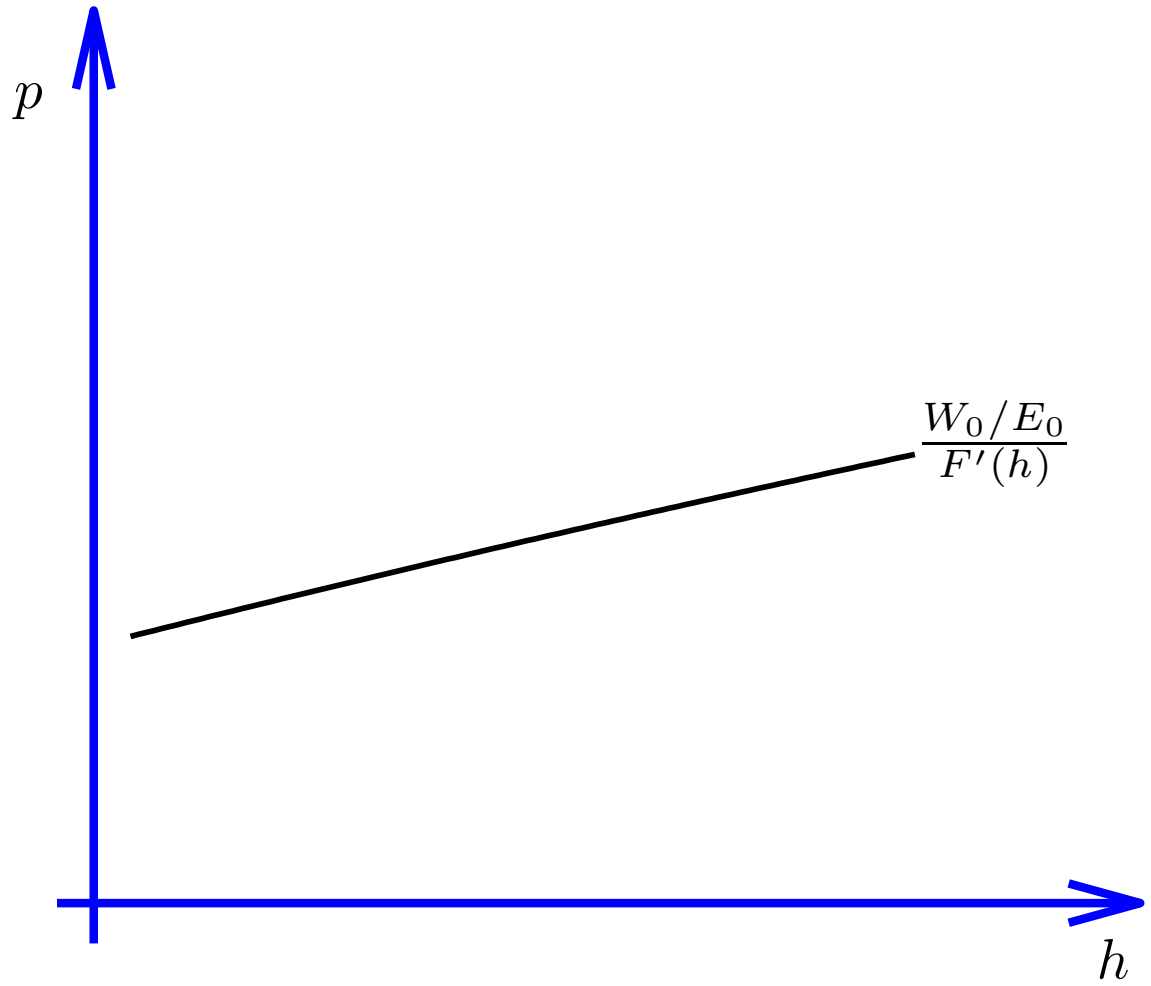
$$\max_{\{h_t\}} \quad p_t F(h_t) - w_t h_t,$$

taking as given p_t and w_t,
where $w_t \equiv W_t/E_t$ is the real wage in terms of tradables.

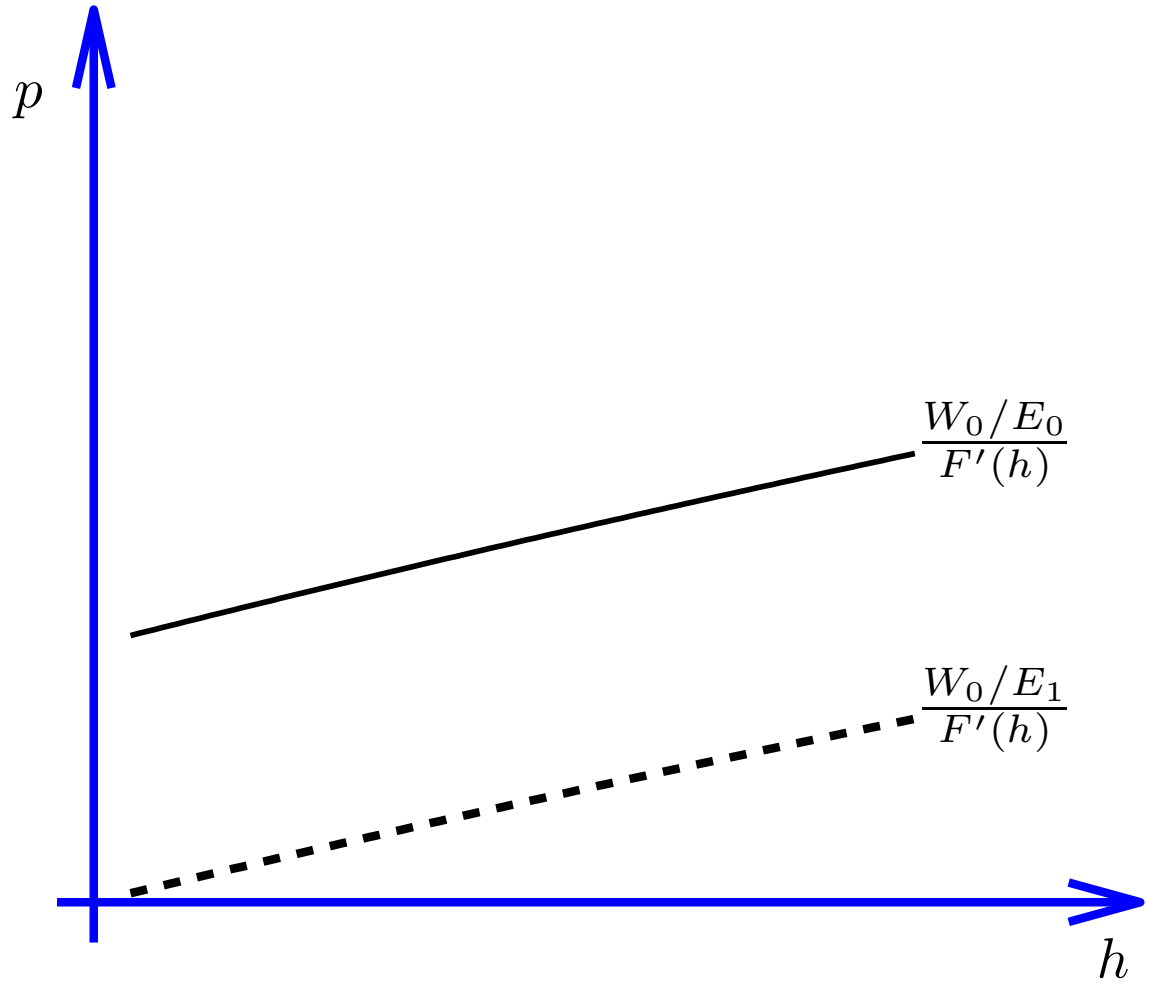
Optimality condition (or the Supply of Nontradables):

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

The Supply of Nontraded Goods



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



$(E_1 > E_0)$

Households

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

subject to

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

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

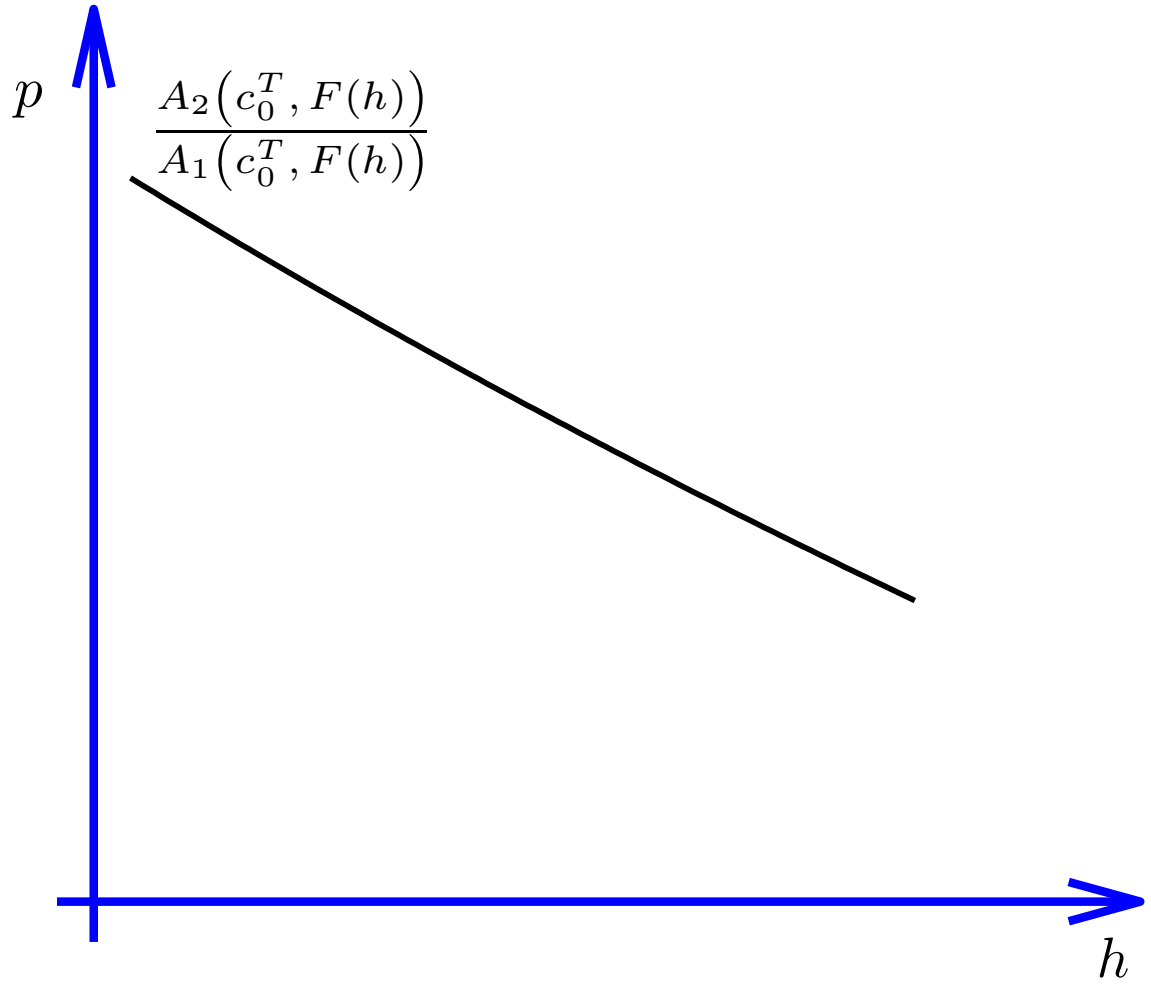
$$d_{t+1} \leq \bar{d}$$

- Workers supply $\bar{h}$ hours inelastically, but may not be able to sell them all. They take $h_t \leq \bar{h}$ as given.

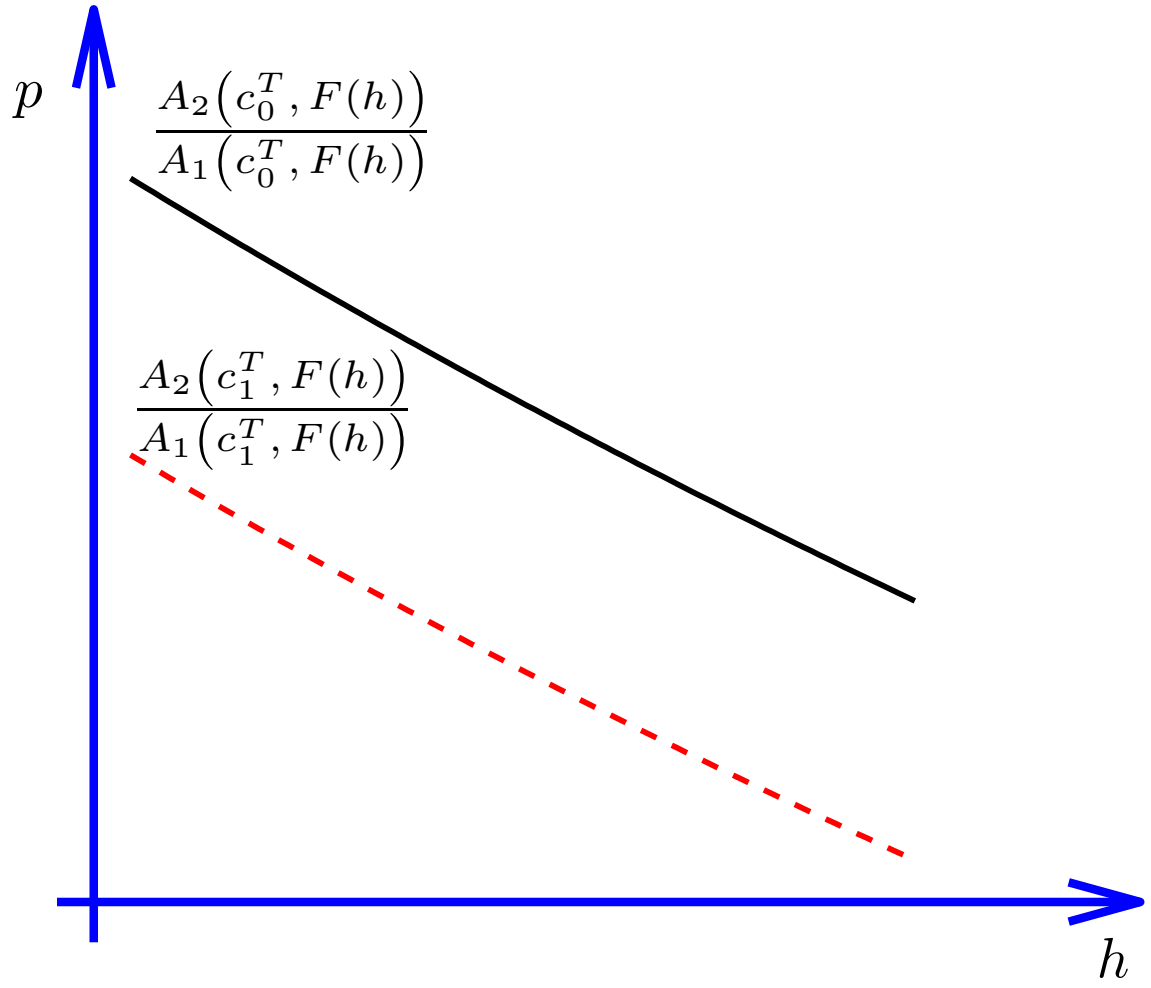
- One first-order condition (Demand for Nontradables):

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

The Demand for Nontraded Goods



A Contraction in Traded Absorption, $\mathbf{c_t^T \downarrow}$, Shifts the Demand for Nontradables Down and to the Left



$(c_1^T < c_0^T)$

Disequilibrium in the Labor Market

The following 3 conditions must hold at all times:

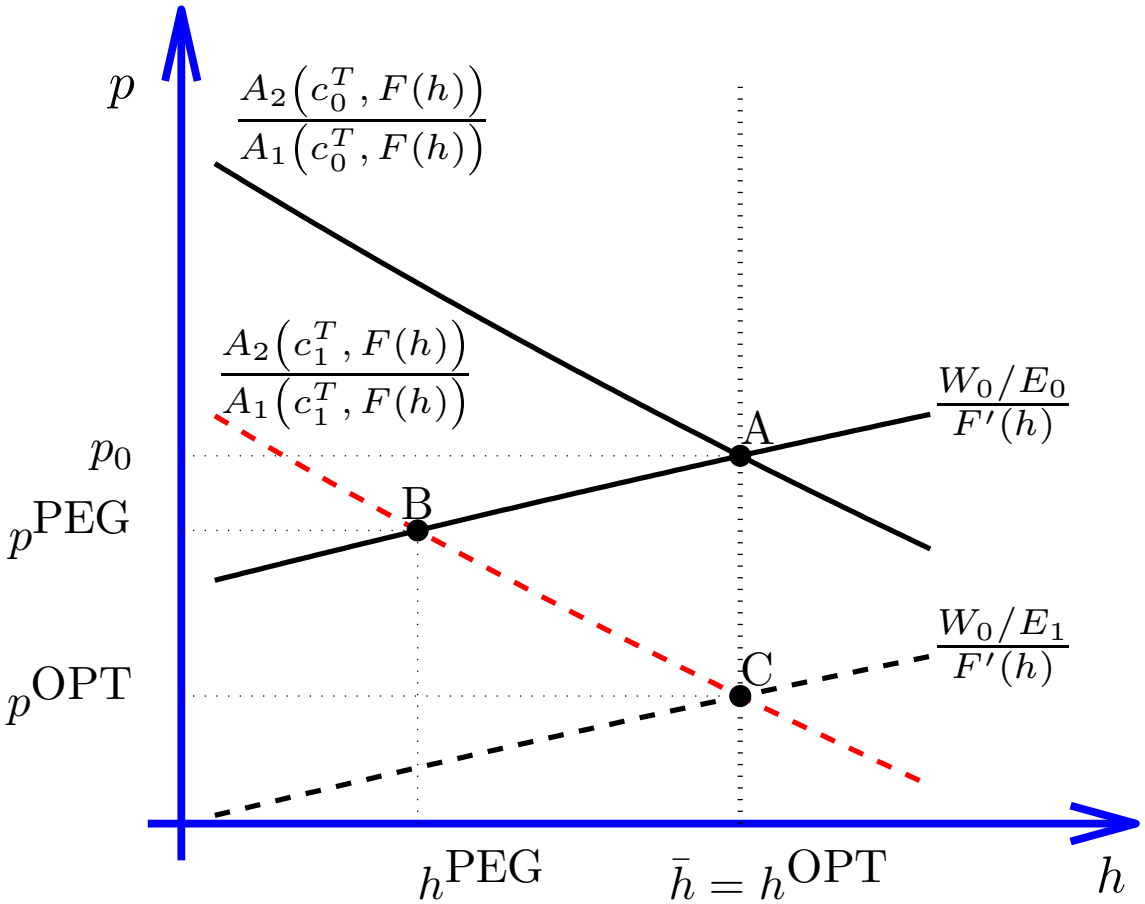
$$W_t \geq \gamma W_{t-1}$$

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

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

Currency Pegs and Unemployment

(here assume that $\gamma = 1$)



$c_1^T < c_0^T$ (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 without additional state variables.

- **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

The Driving Process:

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

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

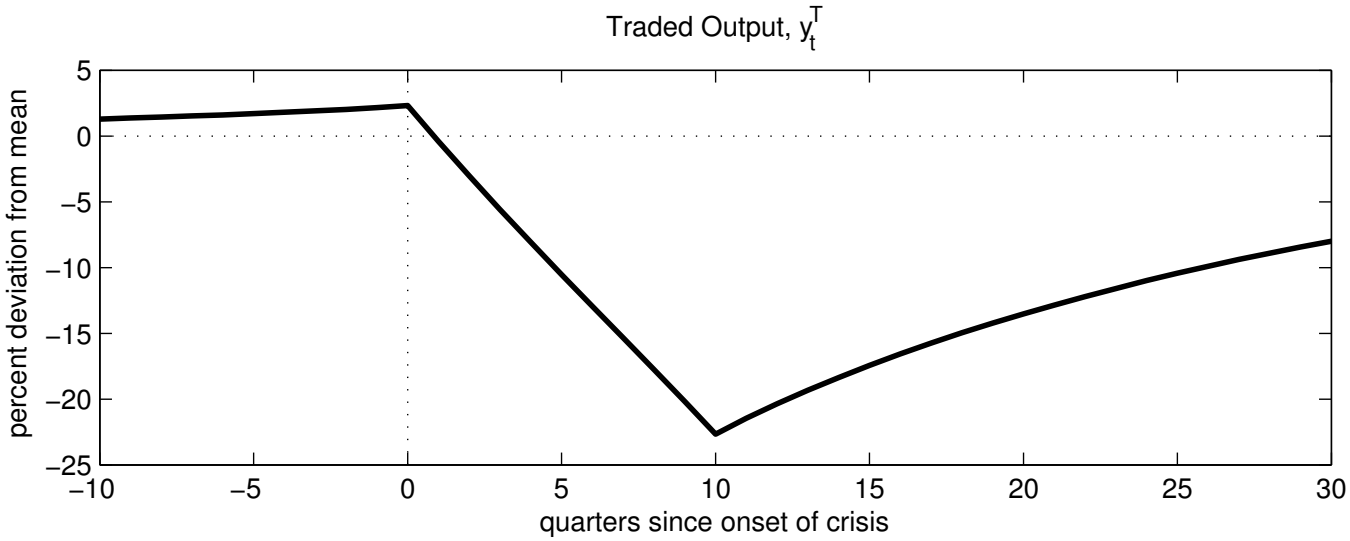
Summary Statistics

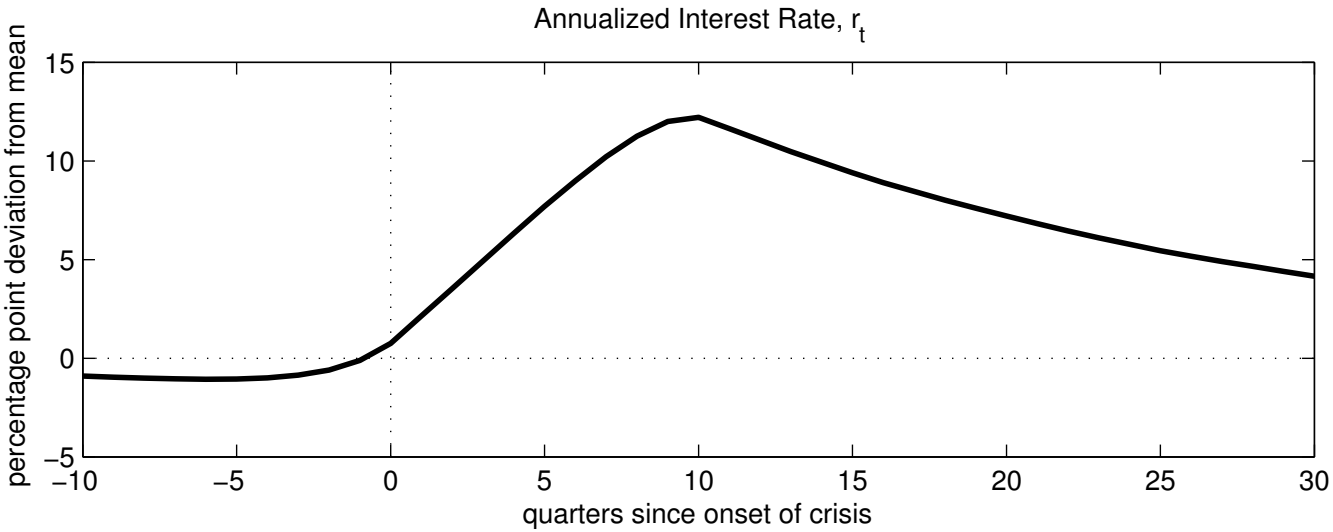
Statistic	y^T	r
Std. Dev.	12%	6%yr
Serial Corr.	0.95	0.93
Corr(y_t^T, r_t)	-0.86	
Mean	1	12%yr

Traded Output in Argentina 1983:Q1-2008:Q3

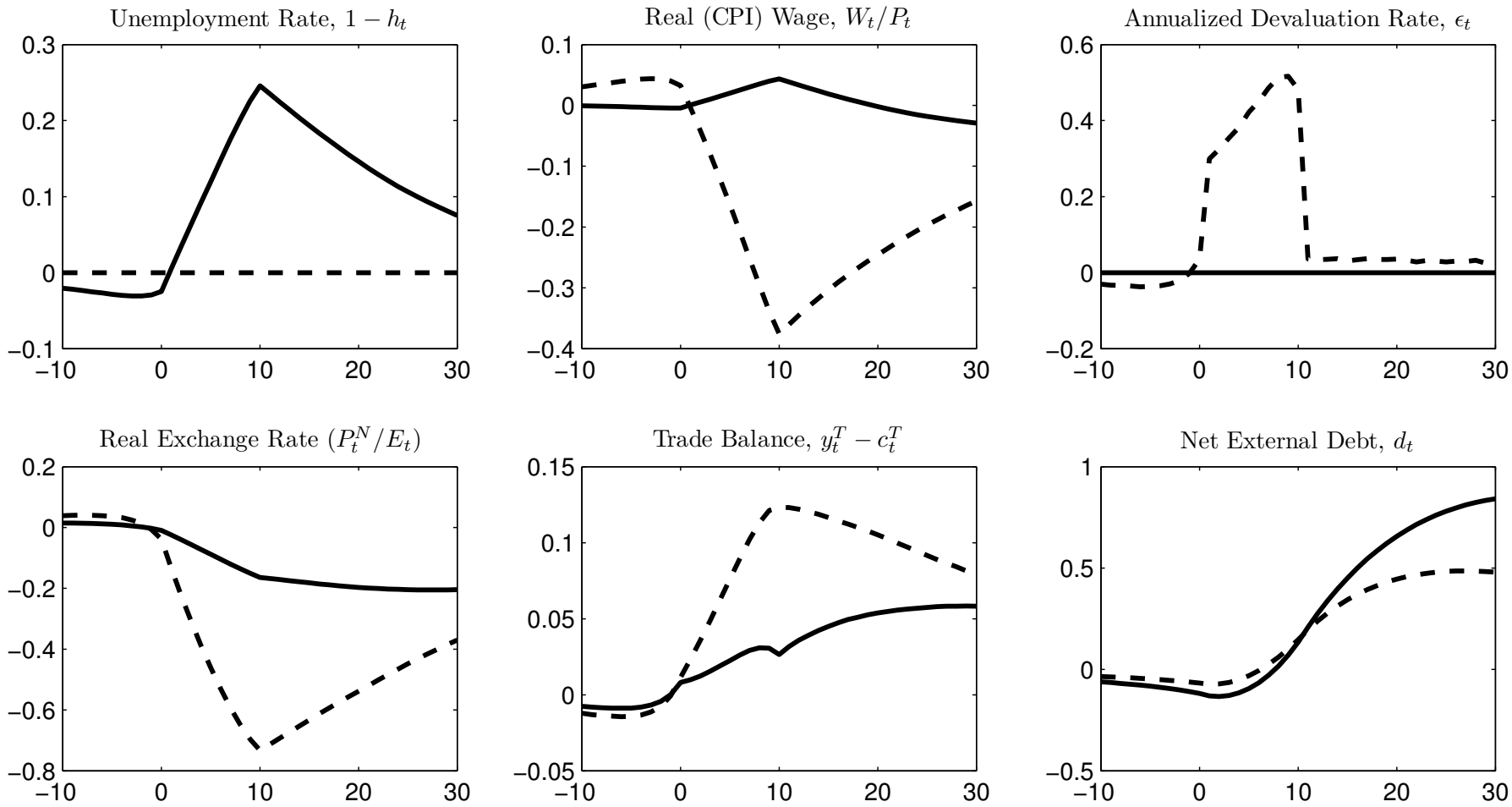
Note. Detrended and seasonally adjusted.

The Origin of a Crisis

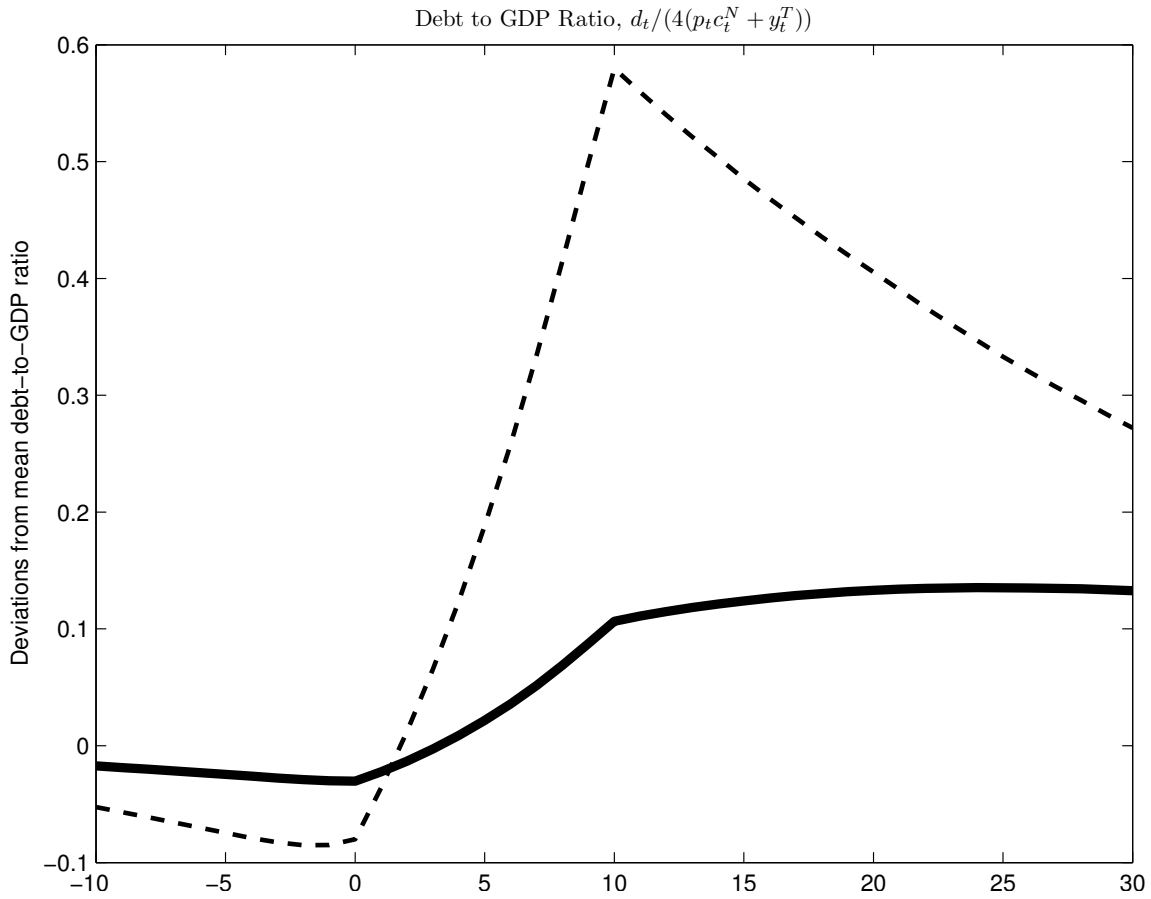




The Dynamics of a Crisis

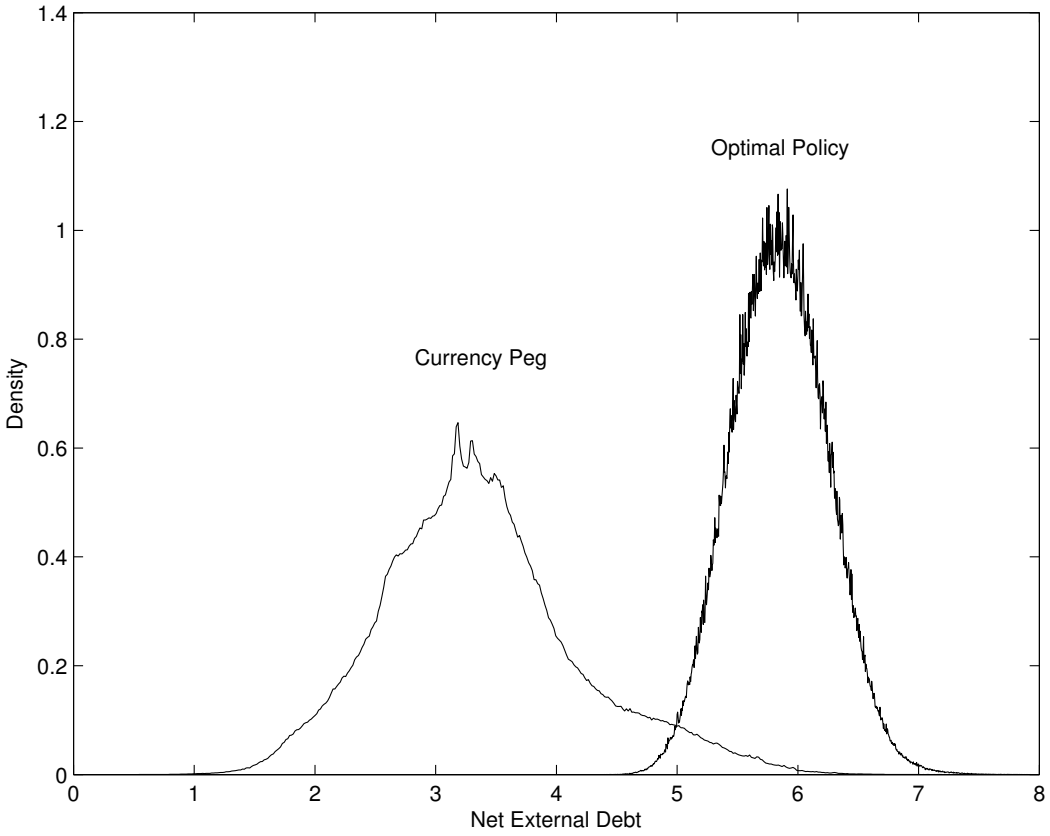


The Debt-to-GDP Ratio During a Crisis



Currency Peg _ _ _ Optimal Exchange-Rate Policy

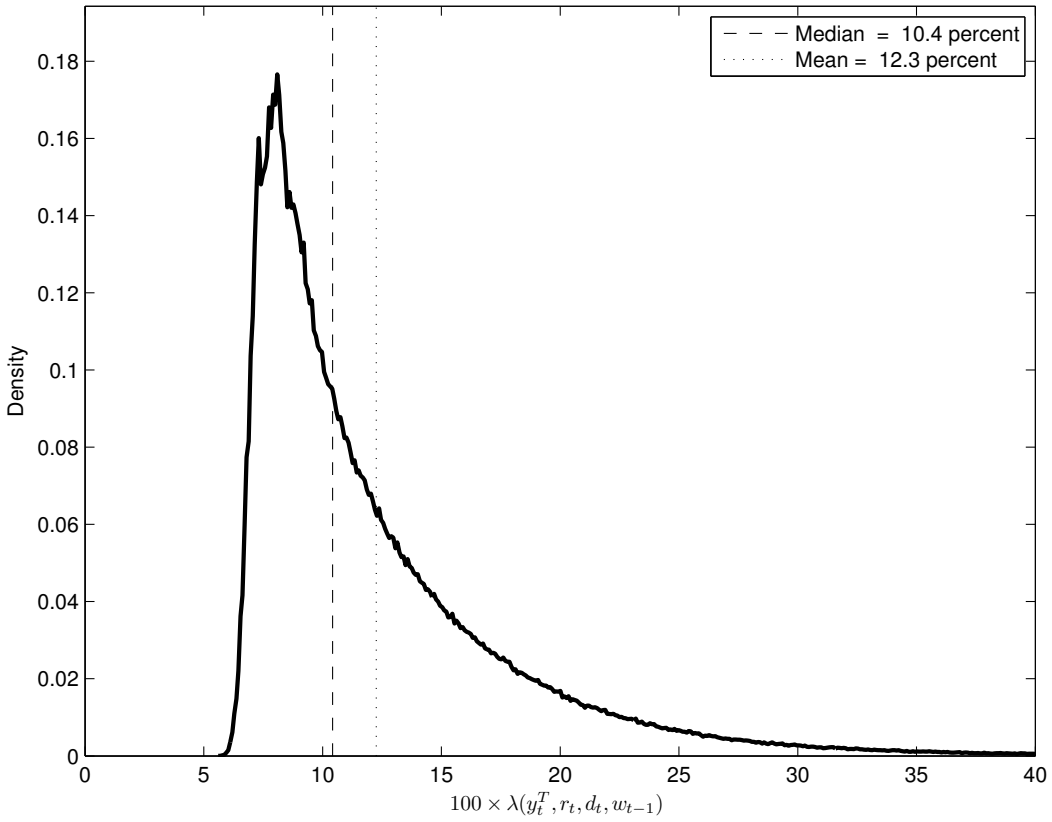
The Distribution of External Debt



The Welfare Cost of Currency Pegs

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

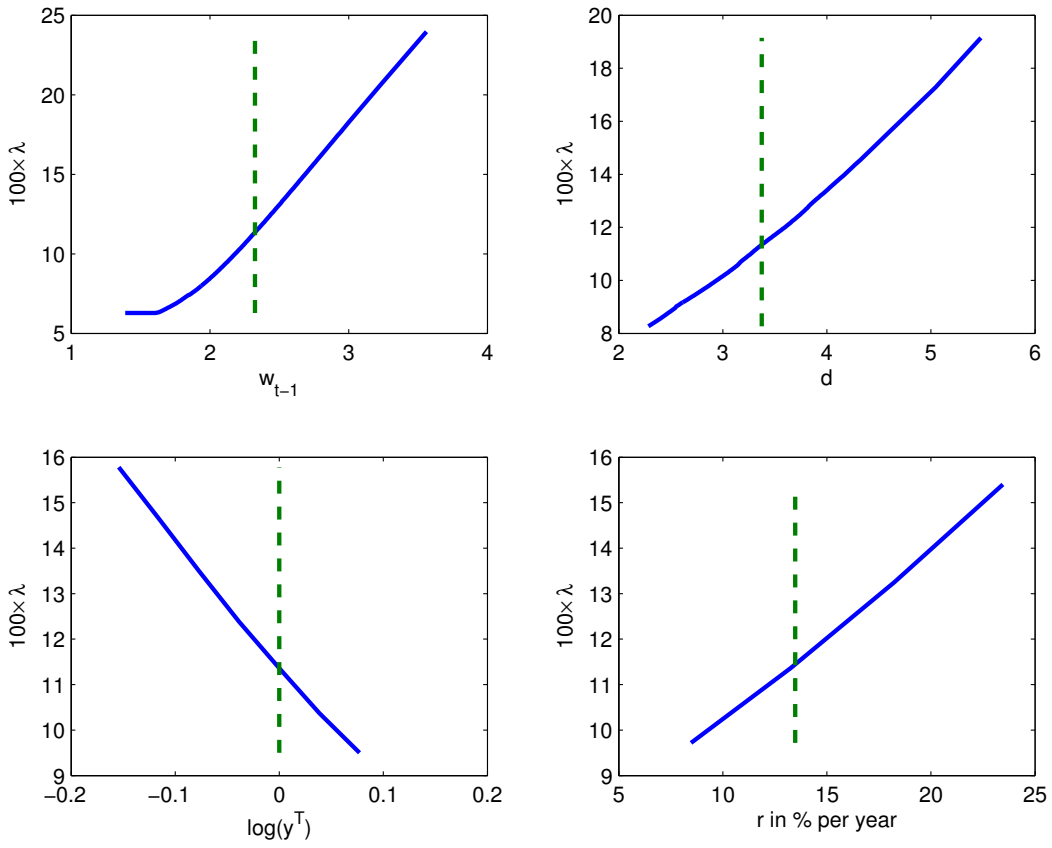
where $s_0 = \{y_0^T, r_0, d_0, w_{-1}\}$.



The importance of asymmetric wage rigidity for the size of welfare cost

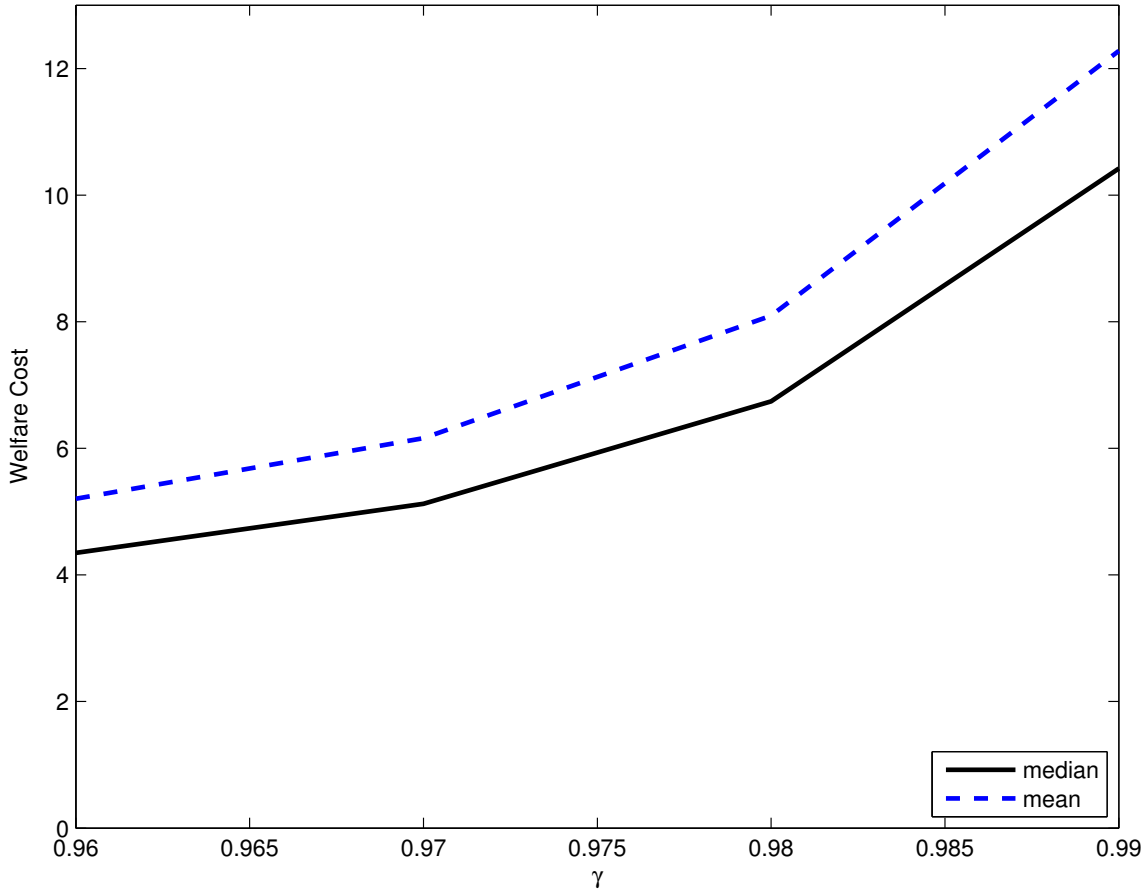
Type of Wage Rigidity	Mean Welfare Cost of a Peg
Only downward: $W_t \geq \gamma W_{t-1}$	12.3 %
Symmetric: $\frac{1}{\gamma} W_{t-1} \geq W_t \geq \gamma W_{t-1}$	5.8%

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

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

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

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

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:

- Large external crises call for large devaluations (over 100%).

  $\Rightarrow$ We turn the sentence "Devaluations are contractionary" on its head and say instead that "Contractions are *devaluatory*."

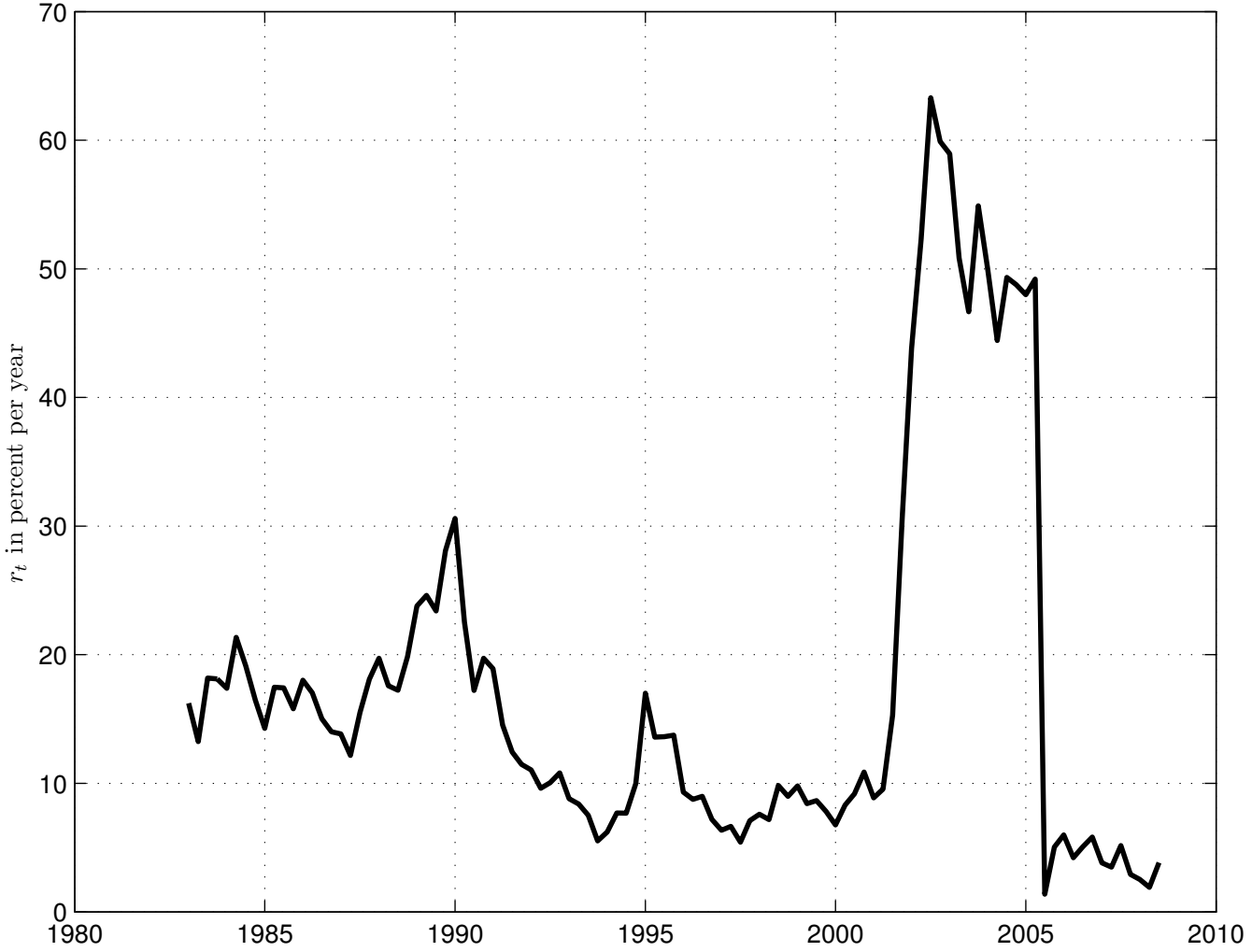
- The costs of currency pegs are large,

  both in terms of welfare (4 to 10% of consumption)

  and unemployment (up to 15%).

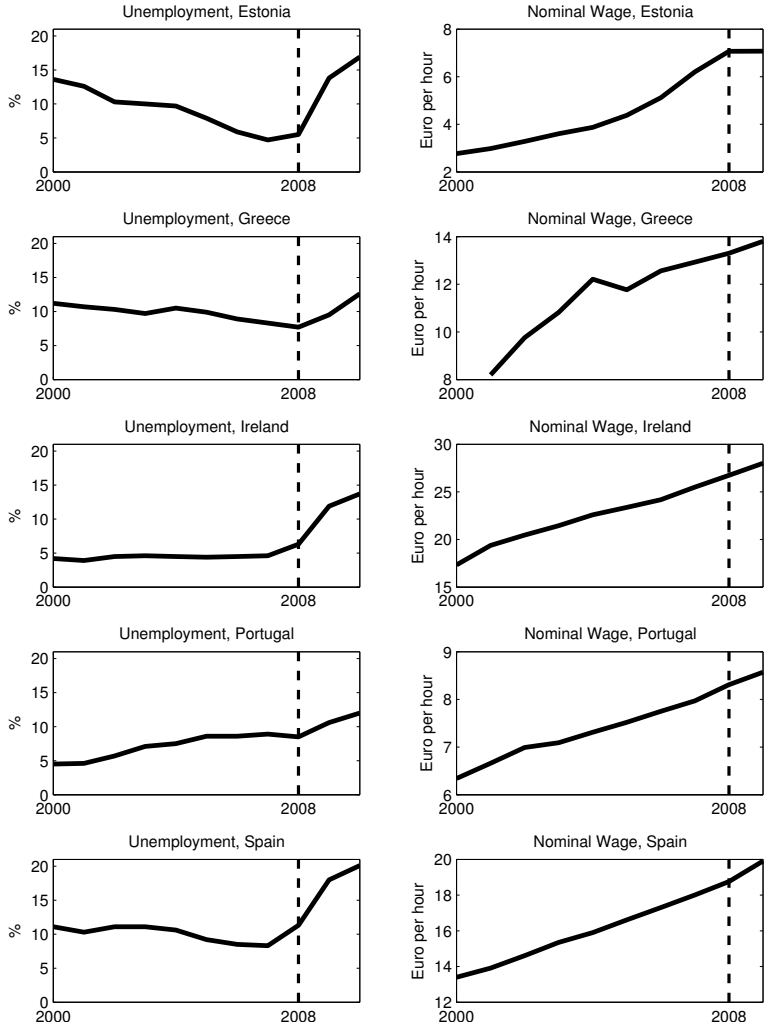
EXTRAS

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 Peripherical Europe



Bulgaria, not on the Euro, but fixed exchange rate since June 2004;

Cyprus, on the Euro since 2008, fixed exchange rate since 1999;

Estonia, on the Euro since 2011, fixed exchange rate since 1999;

Greece on the euro;

Lithuania: not on the Euro, but fixed exchange rate with the Euro since Feb 2002;

Latvia: not on the Euro, but fixed exchange rate with the euro since Jan. 2005;

Portugal on the Euro; Spain on the Euro;

Slovenia: on the Euro since 2007, pegged to Euro since june 2004;

Slovakia: on the Euro since Jan 2009, prior to that Slovak koruna was **NOT** fixed, instead it appreciated against the Euro from 45 Slovak koruna to 30.