The Vanishing Procyclicality of Labor Productivity

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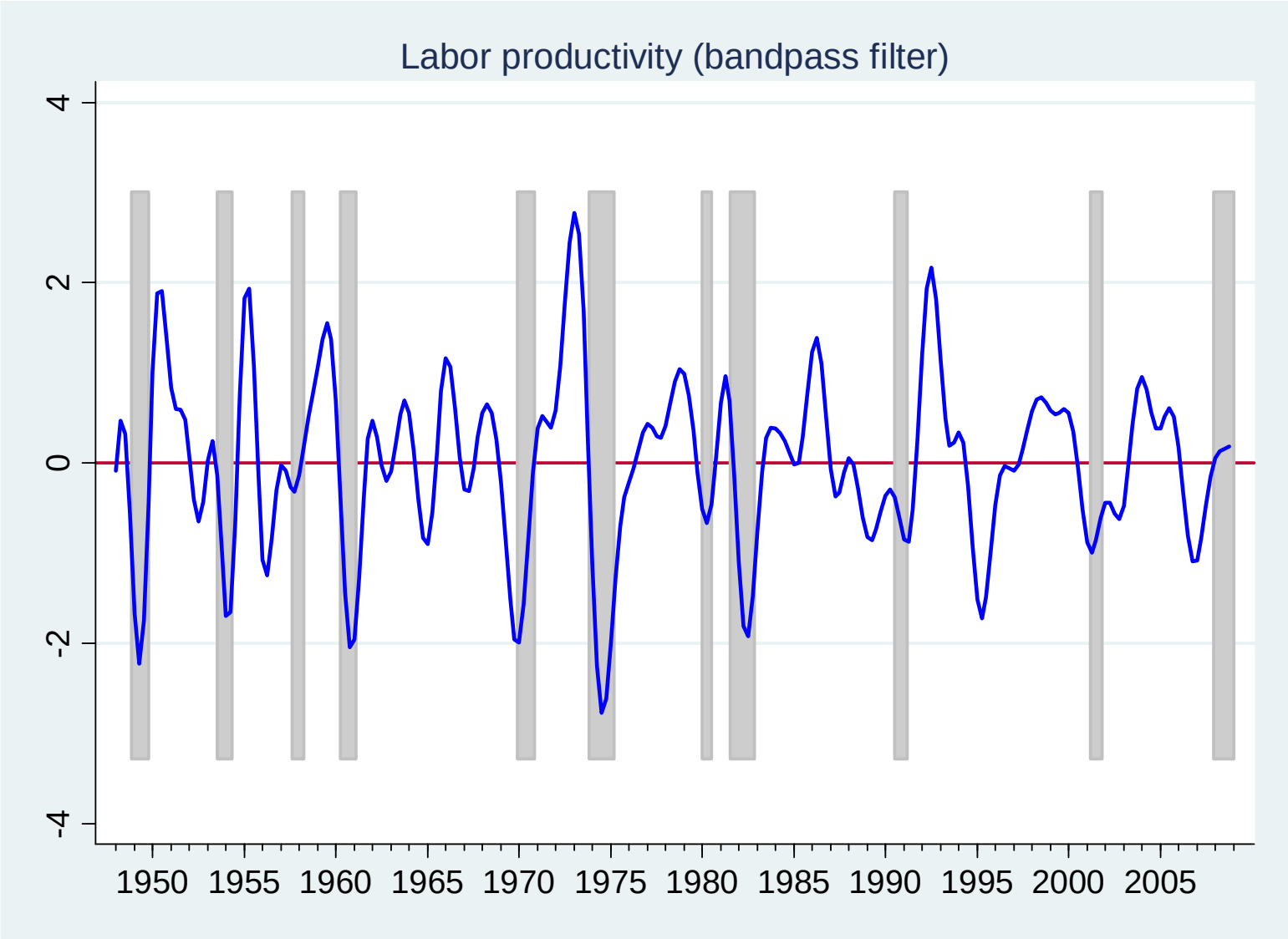

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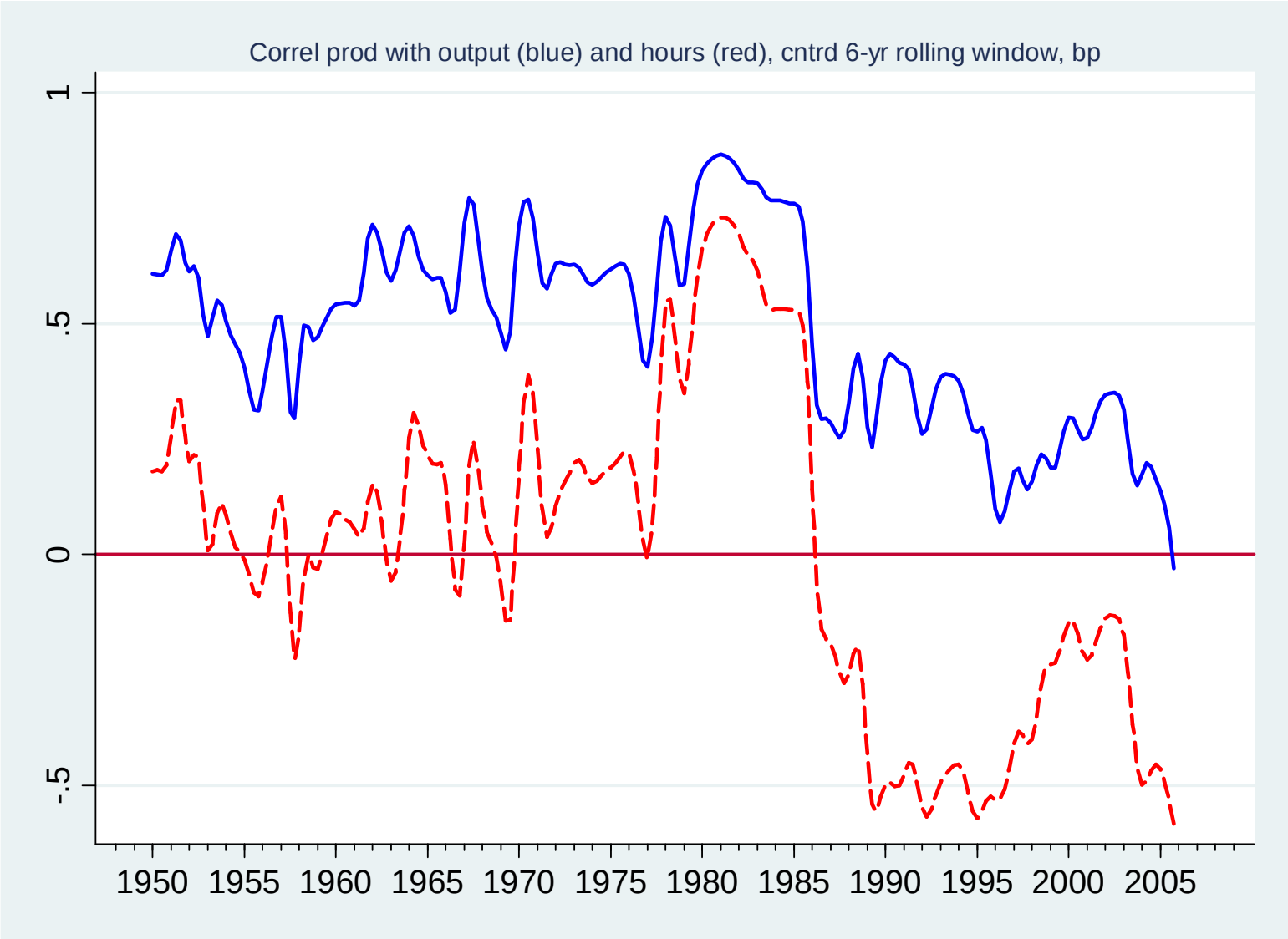

The Vanishing Procyclicality of Labor Productivity

	Pre-84	Post-84	Change
Corr prod with output	0.78	0.60	−0.18
	[0.04]	[0.05]	[0.06]
Corr prod with labor input	0.31	−0.15	−0.47
	[0.08]	[0.10]	[0.13]

- BP, 1949-2007
  - prod = output / worker
  - labor input = employment
- Robustness

Changes in Labor Market Dynamics

	Pre-84	Post-84	Ratio
Std.dev. employment	1.57	0.91	0.58
	[0.08]	[0.05]	[0.04]
Relative std.dev. empl	0.66	0.81	1.23
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Std.dev. wages	0.71	0.99	1.38
	[0.05]	[0.06]	[0.12]
Relative std.dev. wages	0.30	0.88	2.93
	[0.02]	[0.07]	[0.31]

- Robustness

Changes in Labor Market Dynamics

1. Procyclicality labor productivity 'vanished'
    - Correlation with output: less procyclical
    - Correlation with labor input: countercyclical
2. Relative volatility labor input increased
3. Relative volatility wages increased
4. Volatility output decreased (Great Moderation)

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$$y_t - n_t = a_t - \alpha n_t + (1 - \alpha)\psi e_t$$

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$$y_t - n_t = a_t - \alpha n_t + (1 - \alpha)\psi e_t$$

  - Wages *endogenously* become more flexible

Outline

- Facts
- Model
- Results I
- Endogenous wage rigidity
- Results II
- Discussion

Model

- RBC model with labor market frictions (adjustment costs)
  - No capital
  - No other frictions or market imperfections
- Intensive margin for labor input (effort)
- Two types of shocks
  - Technology shocks (TFP)
  - Non-technology shocks (preference shocks)

Firms

- Choose vacancies and labor demand to maximize

$$E_0 \sum_{t=0}^{\infty} Q_{0,t} \left[Y_t - W_t N_t - g\left(V_t\right) \right]$$

subject to

$$N_t = \left(1-\delta\right) N_{t-1} + qV_t$$

- Output

$$Y_t = A_t \left(\int_0^{N_t} \mathcal{E}_{it}^{\psi} di \right)^{1-\alpha} = A_t \left(\mathcal{E}_t^{\psi} N_t \right)^{1-\alpha}$$

Households

- Choose consumption and labor supply to maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[Z_t u\left(C_t\right) - \gamma L_t \right]$$

subject to (given new hires qV_t)

$$C_t = W_t N_t$$

$$N_t = \left(1-\delta\right) N_{t-1} + qV_t$$

- Total effective labor supply

$$L_t = \int_0^{N_t} \frac{1+\zeta \mathcal{E}_{it}^{1+\phi}}{1+\zeta} di = \frac{1+\zeta \mathcal{E}_t^{1+\phi}}{1+\zeta} N_t$$

Effort and Wages

- Effort is set to maximize match surplus (MDU = MP)

$$\mathcal{E}_{it}^{1+\phi} = \mathcal{E}_{t}^{1+\phi} = \frac{\psi}{1+\phi}\frac{1+\zeta}{\zeta}\frac{Z_t u'(C_t)}{\gamma}\frac{(1-\alpha)\,Y_t}{N_t}$$

  - Effort increases with preference shocks and technology shocks
  - Effort decreases with employment N_t (substitutes)

- Wages are set to share surplus equally (Nash bargaining)

$$W_t = \tfrac{1}{2}\left(W_t^{UB} + W_t^{LB}\right)$$

where $S_t^H = W_t - W_t^{LB}$ and $S_t^F = W_t^{UB} - W_t$

Equilibrium

- Efficiency condition for effort

- Job creation equation

$$\begin{aligned}\frac{g'(V_t)}{q} &= W_t^{UB} - W_t \\ &= E_t \sum_{s=0}^{\infty} (1-\delta)^s Q_{t,t+s} \left[(1-\Psi_F) \frac{(1-\alpha) Y_{t+s}}{N_{t+s}} - W_{t+s} \right]\end{aligned}$$

- Nash bargaining over wages

- Good market clearing

$$Y_t = C_t + g(V_t)$$

Preview of the Results

- Infinite matching frictions $\Rightarrow$ Employment is constant

$$\begin{aligned} e_t &= (1-\eta)\, a_t + z_t \\ y_t &= (1+\phi)\, a_t + (1-\alpha)\, \psi z_t \\ y_t - n_t &= y_t \end{aligned}$$

- Frictionless labor market $\Rightarrow$ Effort is constant

$$\begin{aligned} n_t &= (1-\eta)\, a_t + z_t \\ y_t &= a_t + (1-\alpha)\, z_t \\ y_t - n_t &= \eta a_t - \alpha z_t \end{aligned}$$

Calibration

- Standard parameters

α	β	$u(C_t)$	γ	δ
$1/3$	0.99	$\log C_t$	$\bar{N} = 0.7$	$6\%/\text{qrt}$

- Non-standard parameters
  - Relative variance preference shocks
    $\Rightarrow$ match relative volatility employment
  - Labor market frictions: $0 - 3\%$ of output
    (Silva-Toledo 2007: $1 - 1.4\%$)
- Free parameter
  - Importance of effort, $\phi + \psi$

Results I

	$\bar{N}$	$\rho(p, y)$	$\rho(p, n)$	$\frac{\text{sd}(n)}{\text{sd}(y)}$	$\frac{\text{sd}(w)}{\text{sd}(y)}$
Data					
Pre-84		0.78	0.31	0.66	0.30
Post-84		0.60	−0.15	0.81	0.88
Model					
frictions 3%	0.57			0.66	
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frictionless	0.70				

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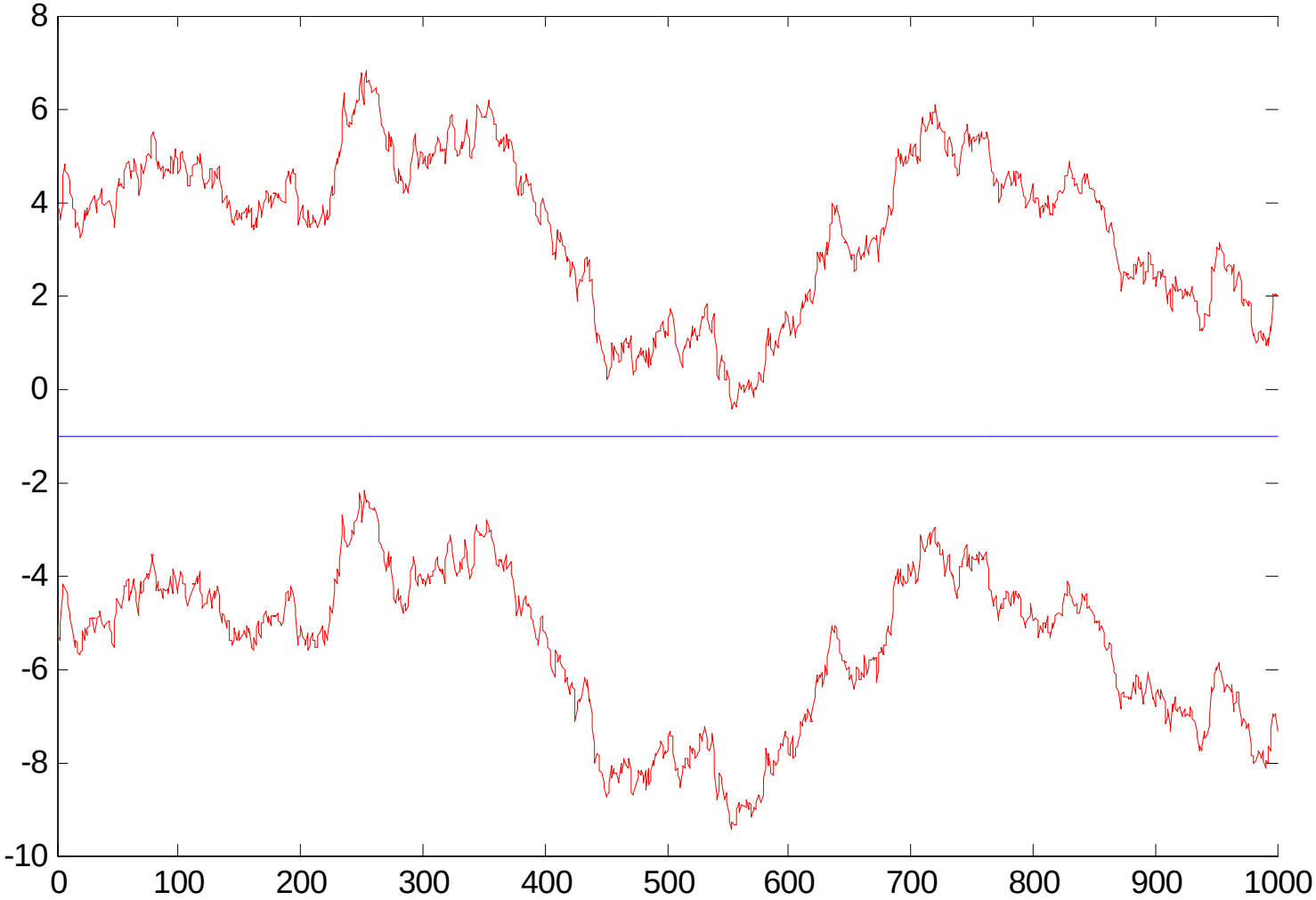
Endogenous wage rigidity

- With flexible wages, wage proportional to MP of labor
- Search frictions allow for equilibrium wage rigidity (Hall 2005)
- Endogenizing wage rigidity
  - Wages are rigid within the bargaining set
  - The width of the bargaining set is determined by search frictions
- Reduction in labor market frictions makes wages more flexible

Endogenous wage rigidity



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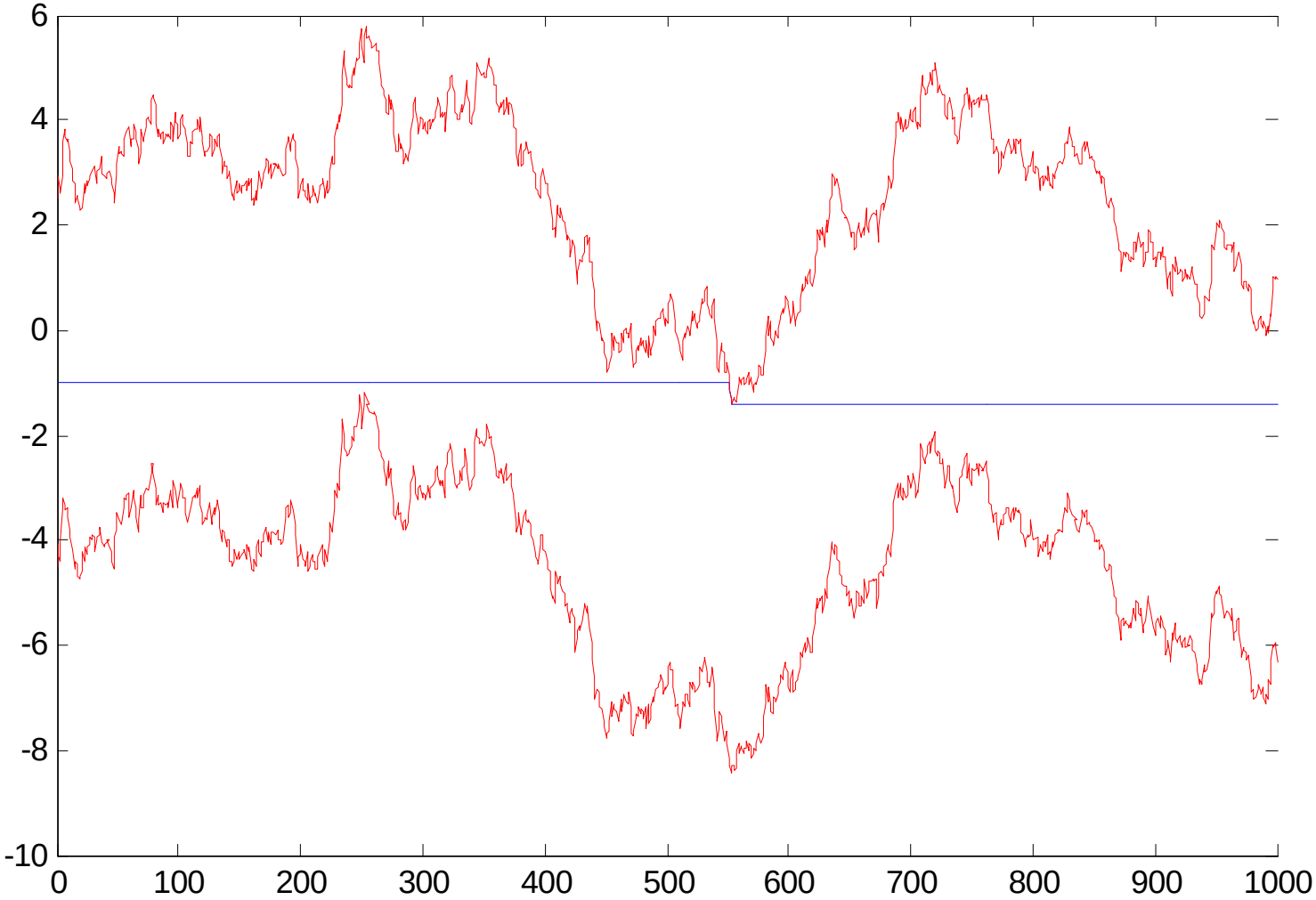

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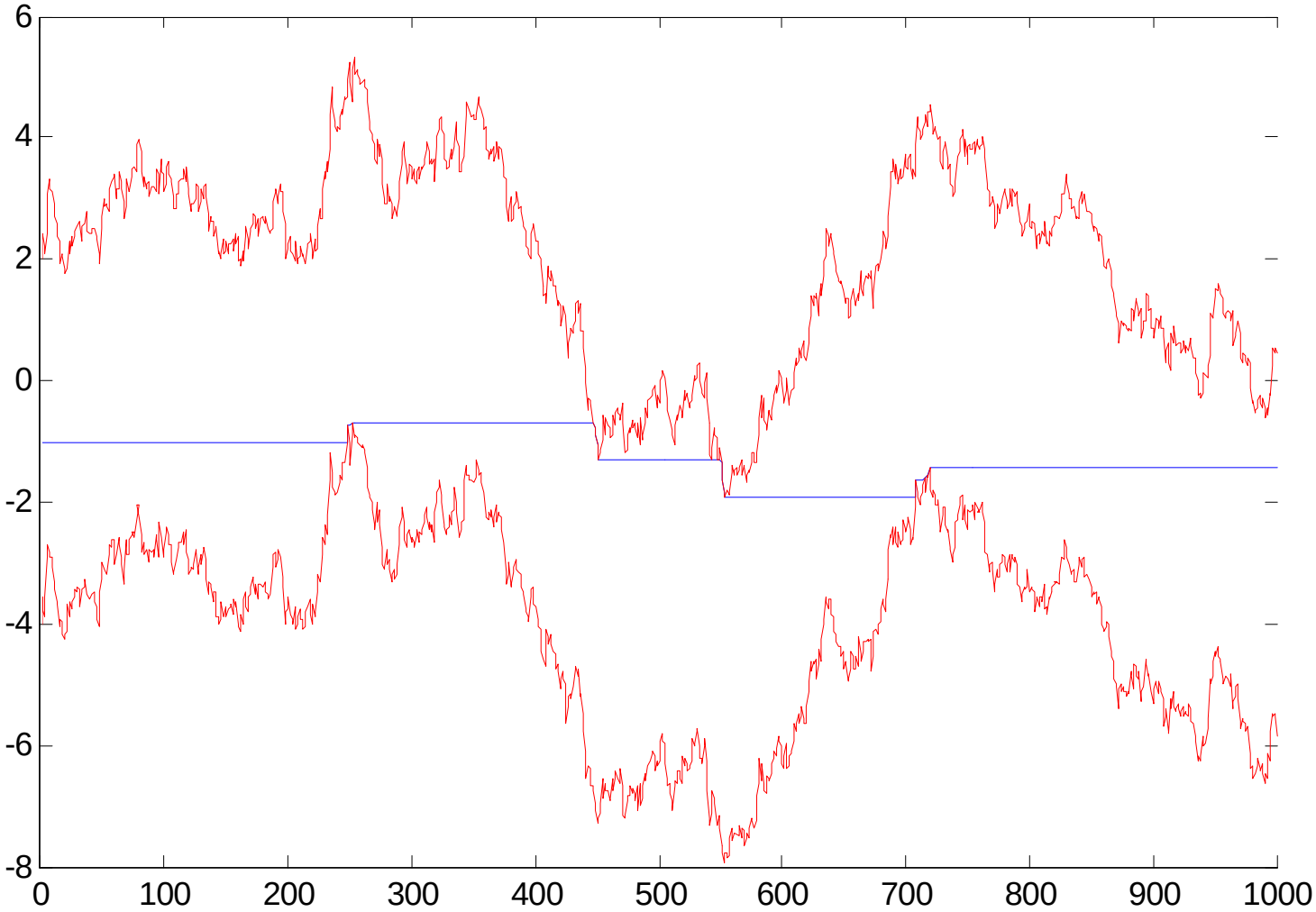

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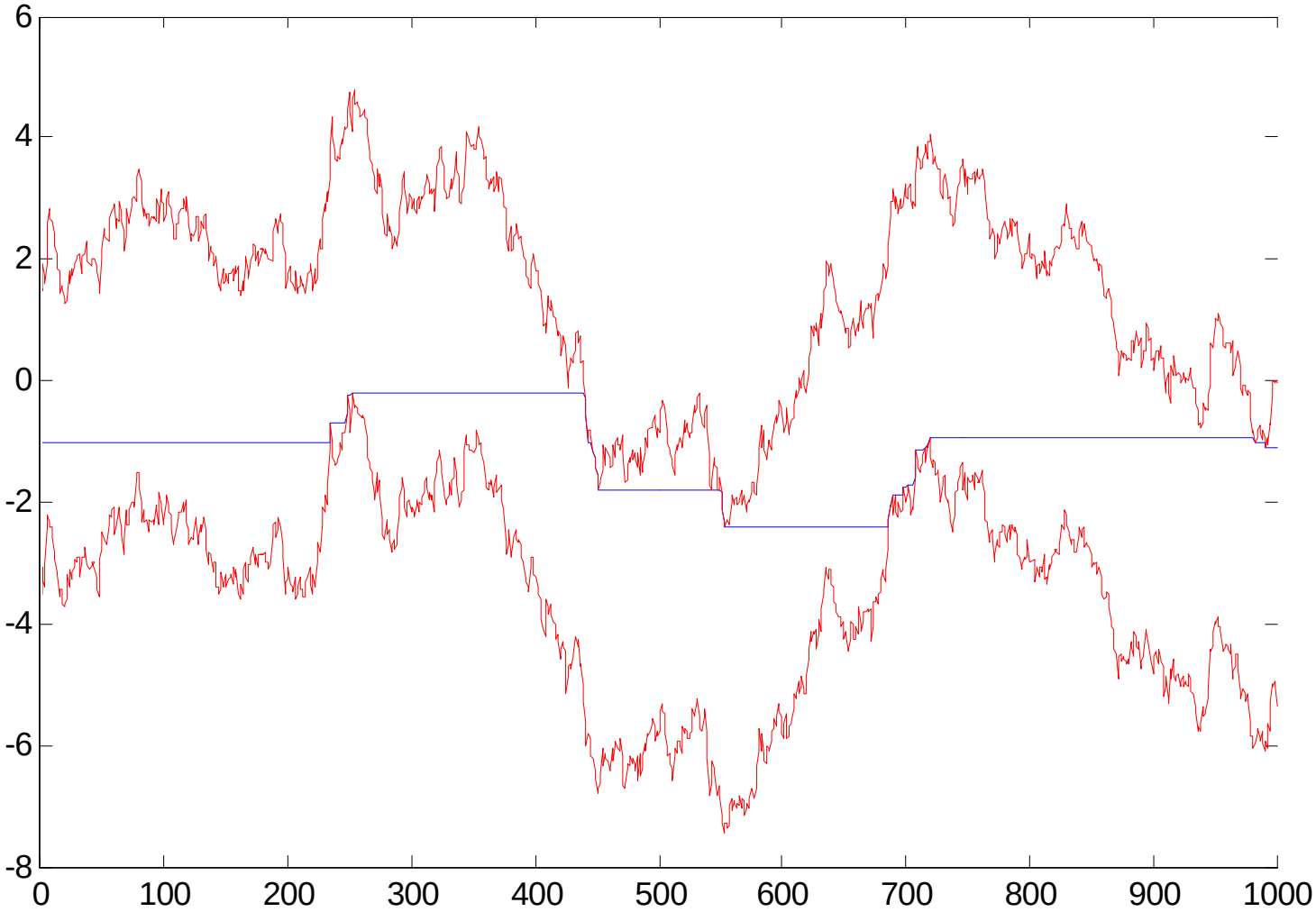

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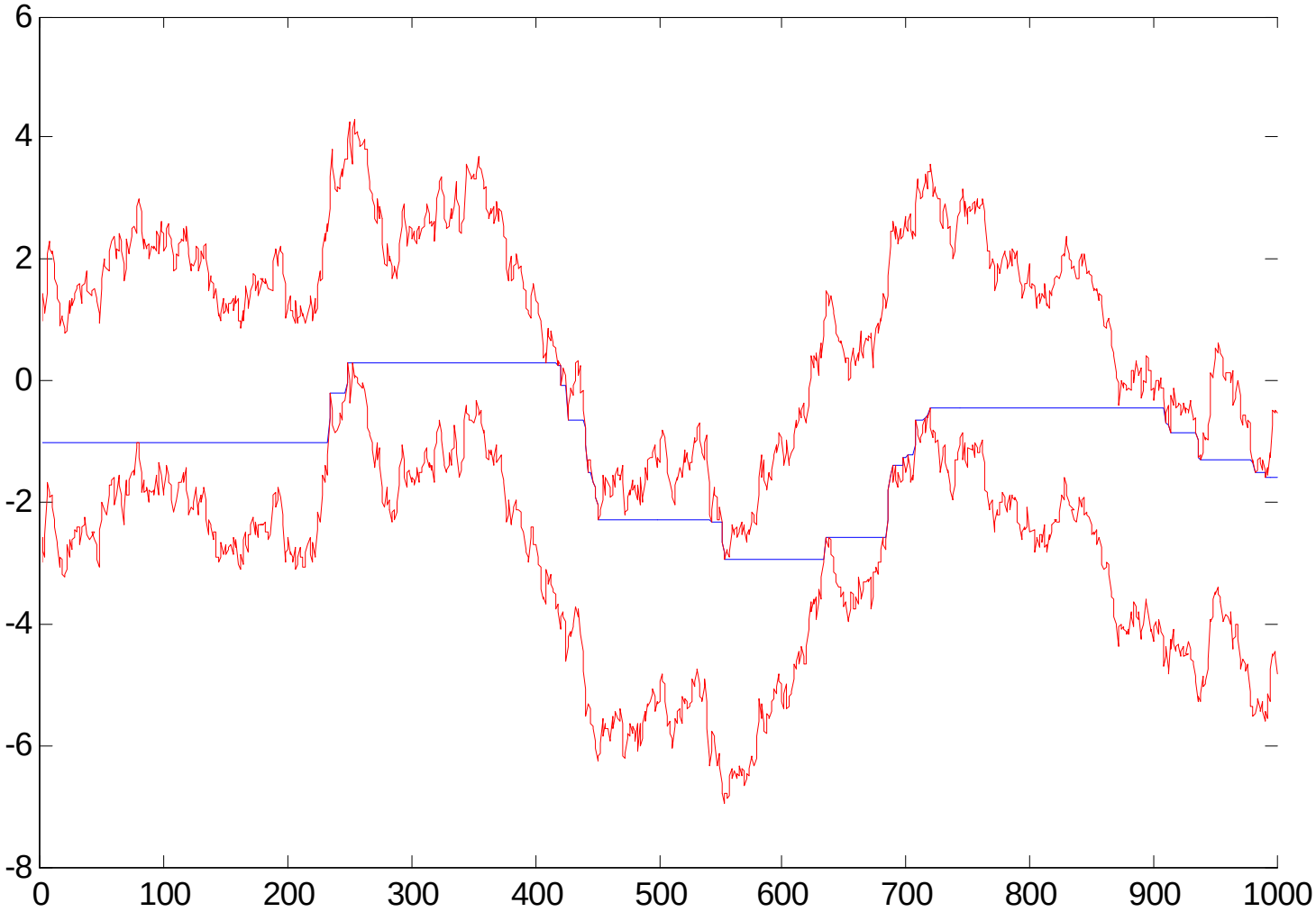

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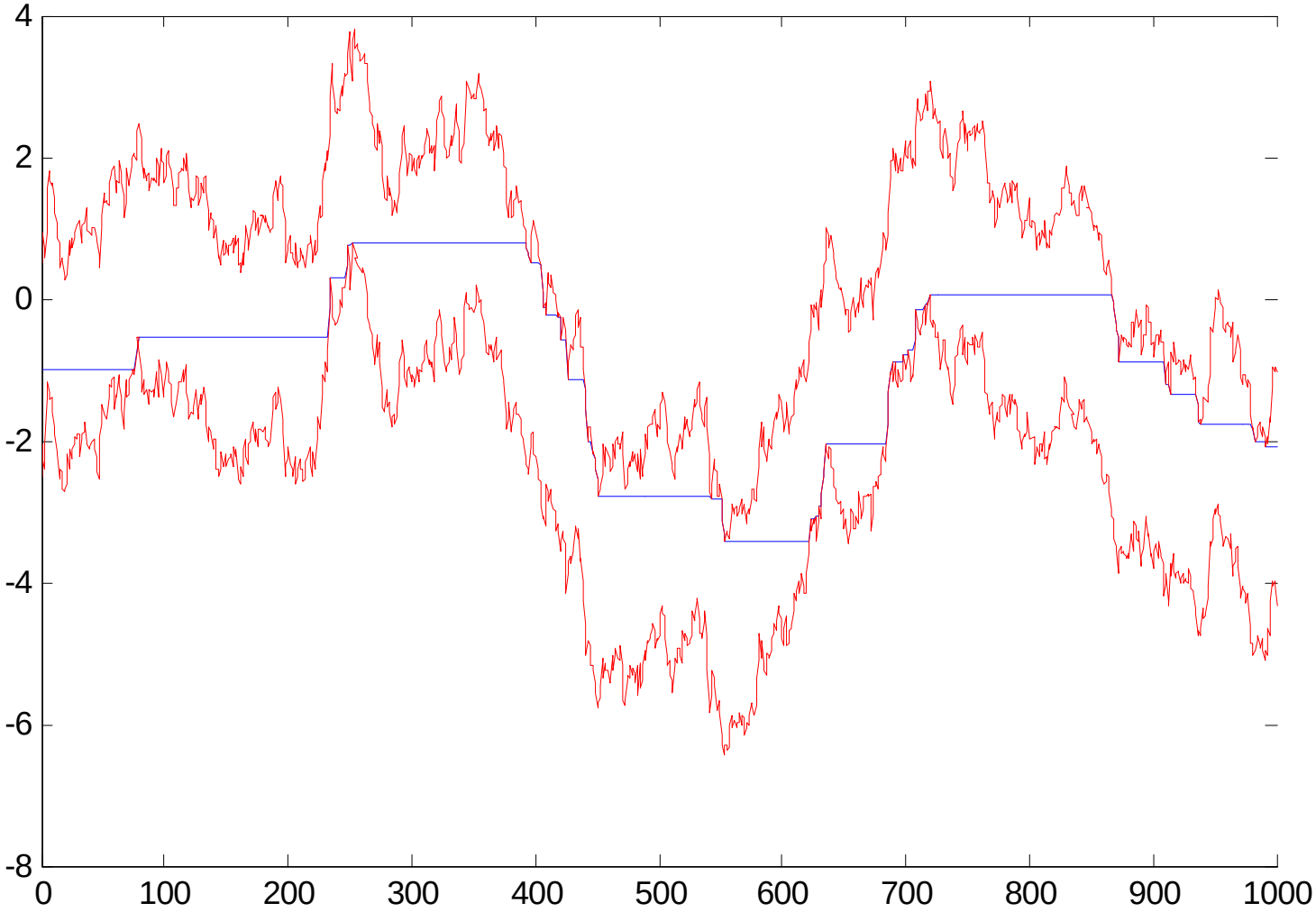

Wage Rule

- Wages are rigid within the bargaining set

$$W_t = R_t W_{t-1} + (1 - R_t) \frac{1}{2} \left(W_t^{UB} + W_t^{LB} \right)$$

- The width of the bargaining set is determined by search frictions

- Degree of rigidity $R_t \in [0, 1]$ is endogenous

$$R_t = \bar{R} \left[1 - \left(\frac{W_t - \frac{1}{2} \left(W_t^{UB} + W_t^{LB} \right)}{\frac{1}{2} \left(W_t^{UB} - W_t^{LB} \right)} \right)^{2\rho} \right]$$

  - Guarantees that $W_t \in \left(W_t^{LB}, W_t^{UB} \right)$

- Need non-linear solution method: 2nd order approximation

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  - Maximum wage rigidity, $\bar{R}$

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  - If fluctuations driven largely by labor demand (technology) shocks

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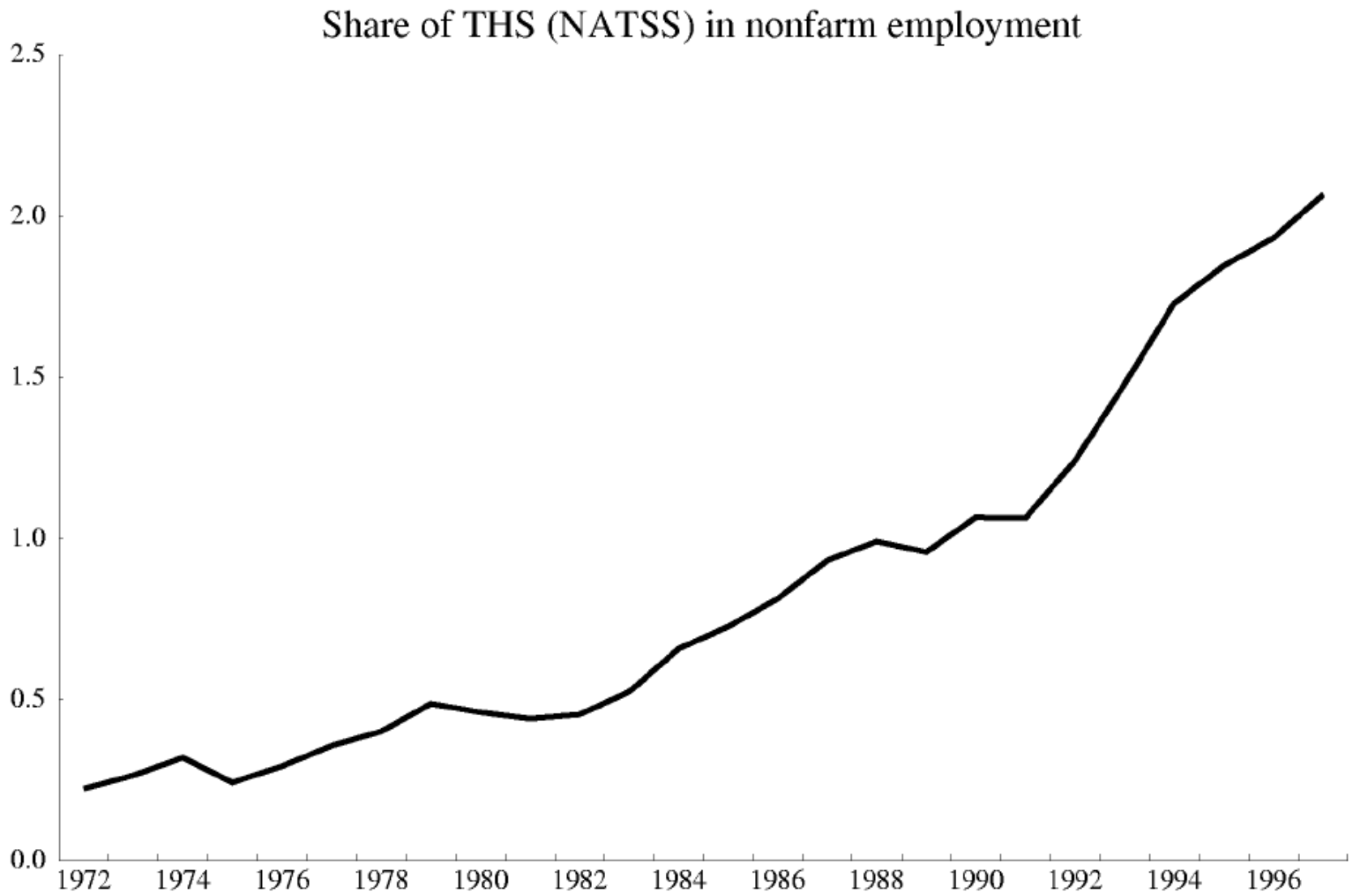

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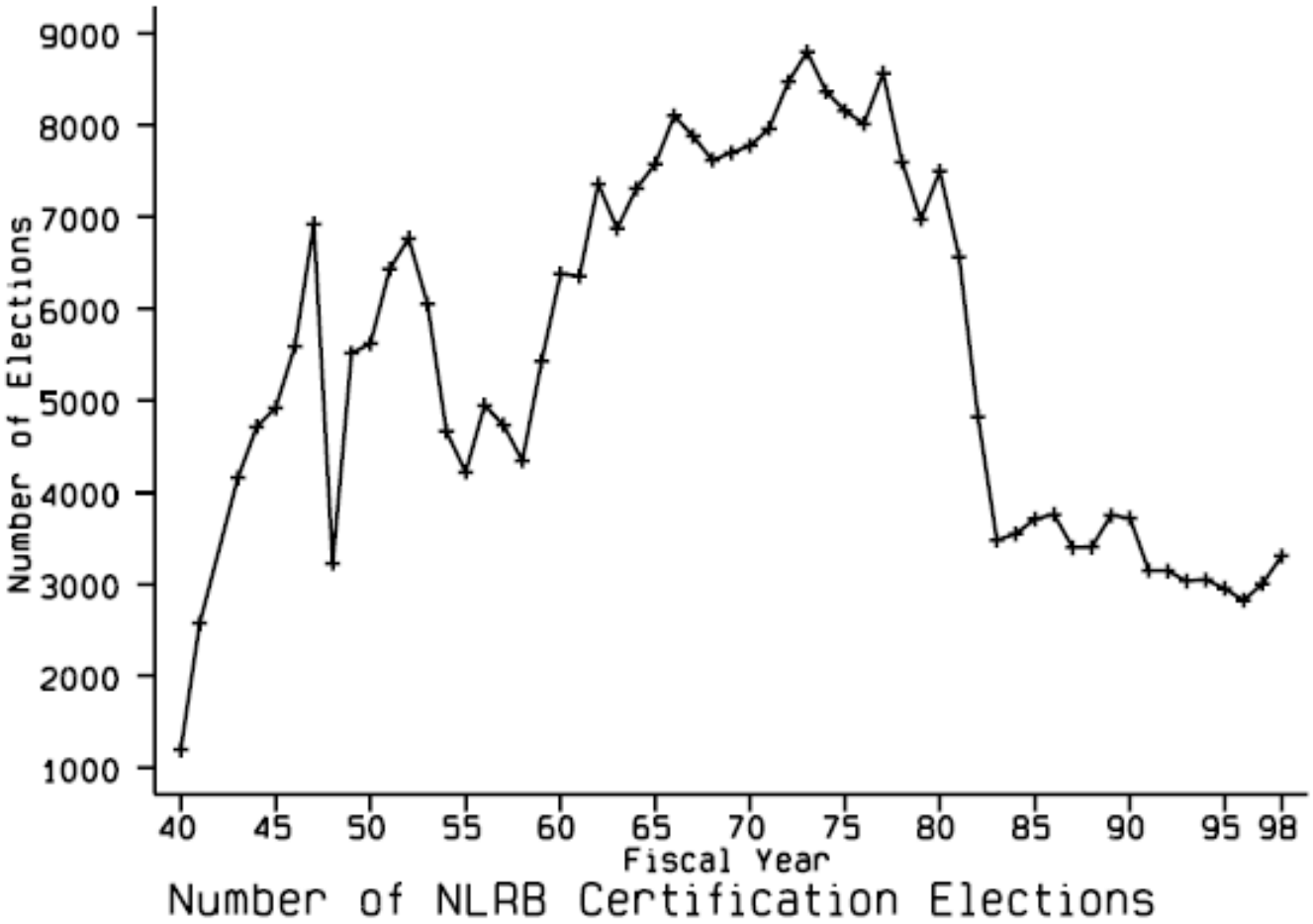

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