Devaluation Risk and the Business Cycle Implications of Exchange Rate Management

Enrique G. Mendoza
University of Pennsylvania & NBER

Based on JME, vol. 53, 2000,

joint with Martin Uribe from Columbia University

Questions

1. *What are the key elements of the transmission mechanism that produces the robust business-cycle regularities associated with managed exchange rates (e.g. disinflation programs based on currency pegs)?*

Price distortions and wealth effects induced by non diversifiable devaluation risk (or lack of policy credibility)

Questions

2. *What are the welfare implications and policy lessons that follow from that transmission mechanism?*

   Distortions driven by devaluation induce large welfare costs. Tax policy can be a useful instrument to counter these distortions and support managed exchange-rate regimes.

Objectives of the Paper

1. *Develop a model of the real effects of managed ex. rates that emphasizes uncertainty & asset market structure.*

Devaluation risk under incomplete markets produces state-contingent interest differentials that trigger:

I. Tax-like distortions on money demand, saving, investment, and labor supply

II. State-contingent wealth effects via suboptimal investment and shocks to government absorption in response to changes in inflation tax

Objectives of the Paper

2. *Assess whether the model can account for the quantitative & qualitative features of the data*
3. *Quantify welfare implications of devaluation-risk distortions*

- ➢ 2. and 3. require developing a solution method that can keep track of the model's state contingent evolution of wealth

EMPIRICAL BACKGROUND AND LITERATURE REVIEW

Stylized facts of exchange-rate based disinflations

I. Booms followed by recessions and devaluations

II. Sharp, non-linear real appreciations that are highly correlated with private expenditures booms

III. Large widening of external deficits that narrow around the time of currency crises

IV. Sharp decline in the velocity of circulation of money, with a sudden rise around the time of collapse

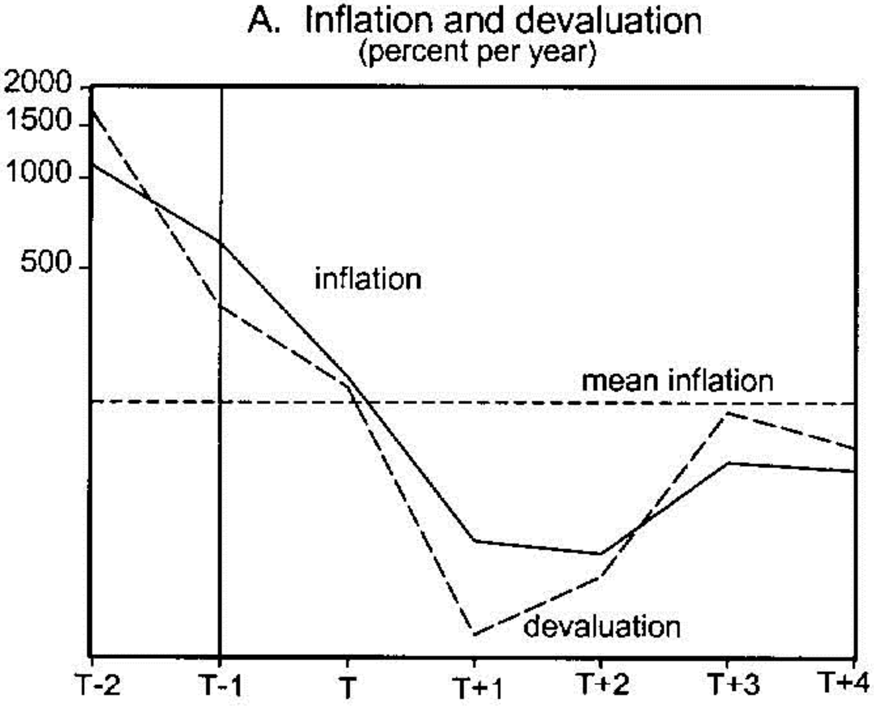
[Helpman & Razin (87), Végh (92), Kiguel & Leviathan (92), surveys by Rebelo & Végh (96) Calvo & Végh (98)]

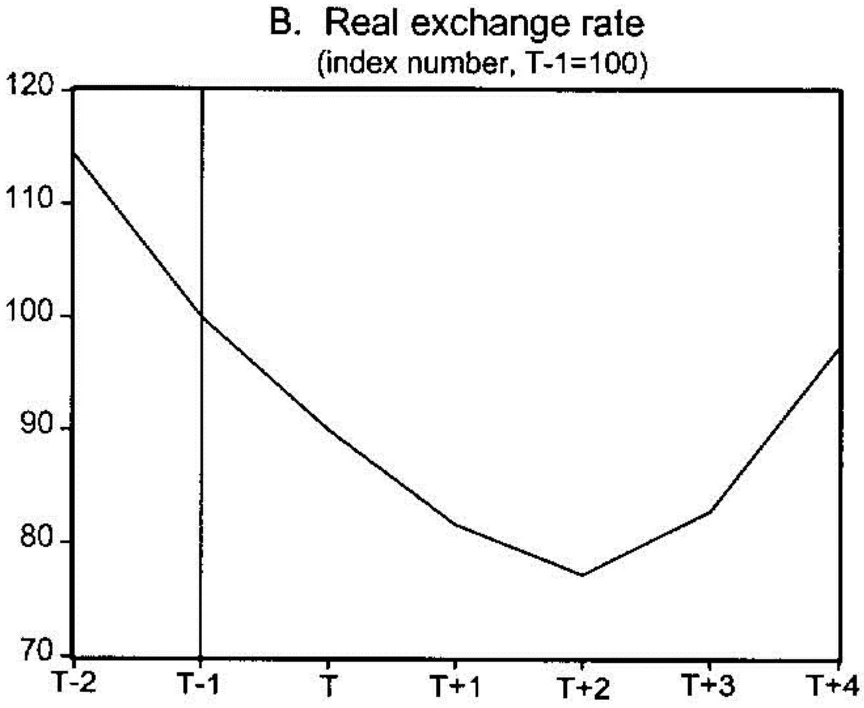
Exchange-Rate-Based Stabilization Plans
(Calvo & Vegh (1998))

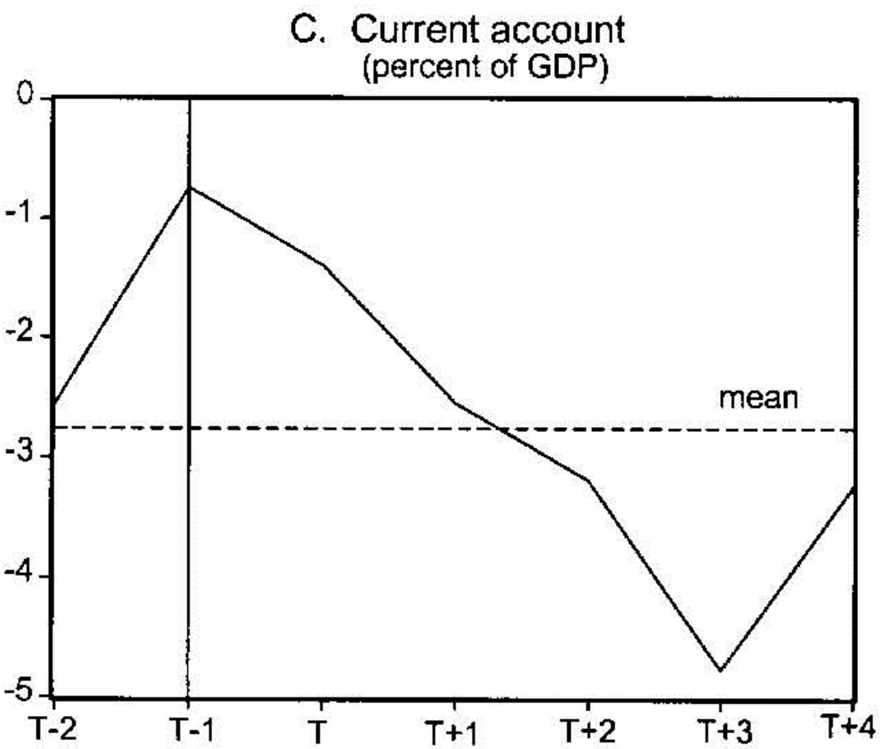
Programs	Beginning and Ending Dates	Exchange Rate Arrangement	Inflation Rate 1/		
			initial 2/	Lowest	Date achieved
Brazil 1964	March 1964-August 1968	Fixed exchange rate, with periodic devaluations	93.6	18.9	May 1968
Argentina 1967	March 1967-May 1970	Fixed exchange rate	26.4	5.7	Feb. 1969
Uruguay 1968	June 1968-December 1971	Fixed exchange rate	182.9	9.5	June 1969
Chilean tablita	February 1978-June 1982	Feb. 1978-June 1979: pre-announced crawling peg June 1979-June 1982: fixed exchange rate	52.1	3.7	May 1982
Uruguayan tablita	October 1978-November 1982	Pre-announced crawling	41.2	11.0	Nov. 1982
Argentine tablita	December 1978-February 1981	Pre-announced crawling peg	169.9	81.6	Feb. 1981
Israel 1985	July 1985-present	Exchange rate policy had four stages 3/	445.4	7.8	Nov. 1995
Austral (Argentina)	June 1985-September 1986	June 1985-March 1986: fixed exchange rate March 1986-Sept. 1986: crawling peg	1,128.9	50.1	June 1986
Cruzado (Brazil)	February 1986-November 1986	Fixed exchange rate	286.0	76.2	Nov. 1986
Mexico 1987	December 1987-December 1994	Feb. 1988-Dec. 1988: fixed exchange rate 4/ Jan. 1989-Nov. 1991: preannounced crawling peg Nov. 1991-Dec. 1994: exchange rate band	159.0	6.7	Sept. 1994
Uruguay 1990	December 1990-present	Exchange rate band with a declining rate of devaluation	133.7	24.4	Dec. 1996
Convertibility (Argentina)	April 1991-present	Currency board with a one-to-one parity to the U.S. dollar.	267.0	-0.3	May 1996

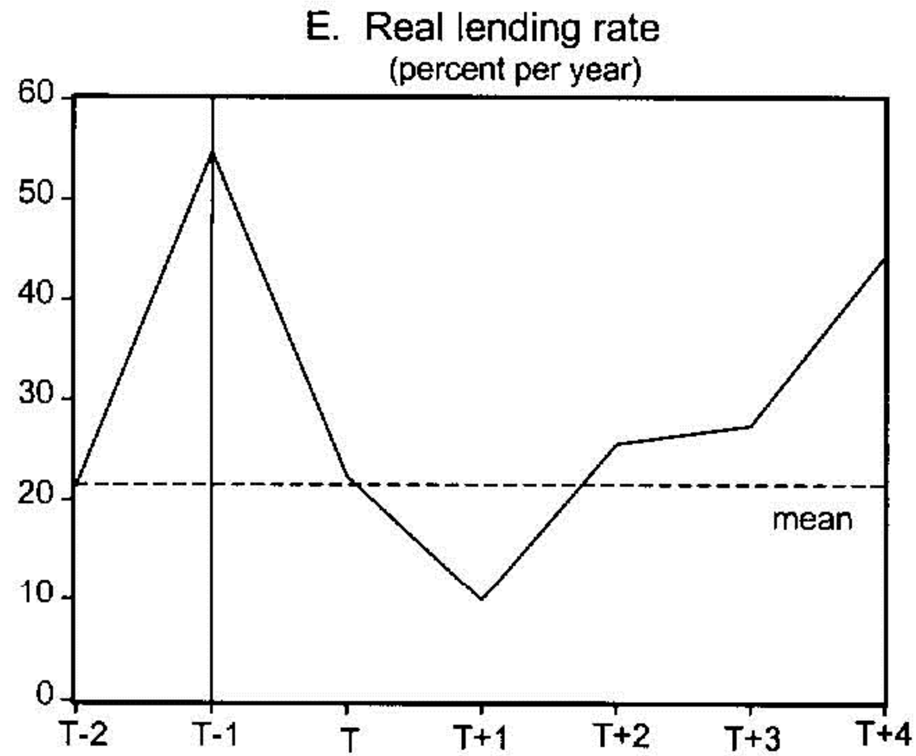
ERBS Event analysis

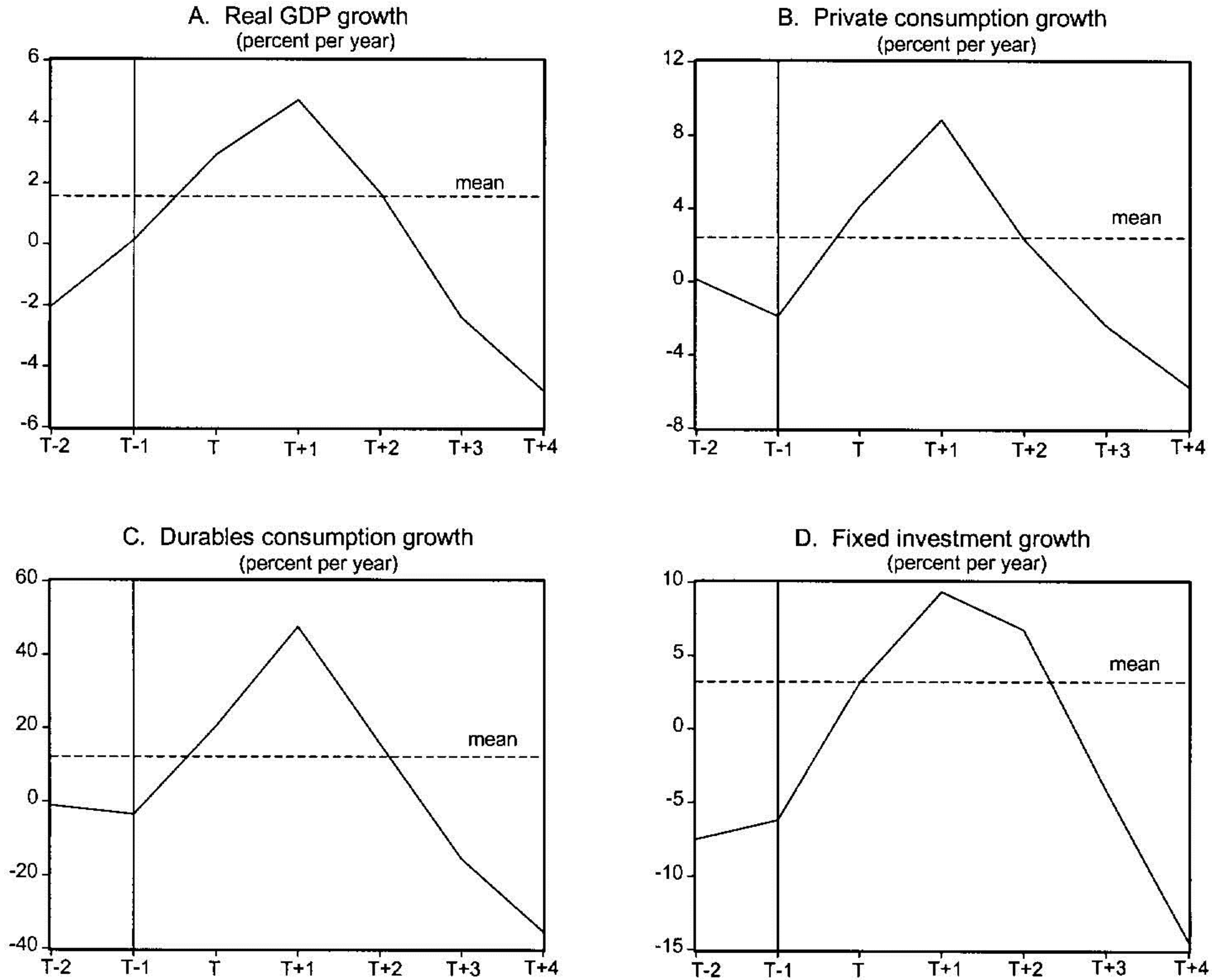
(Calvo & Vegh (1998))





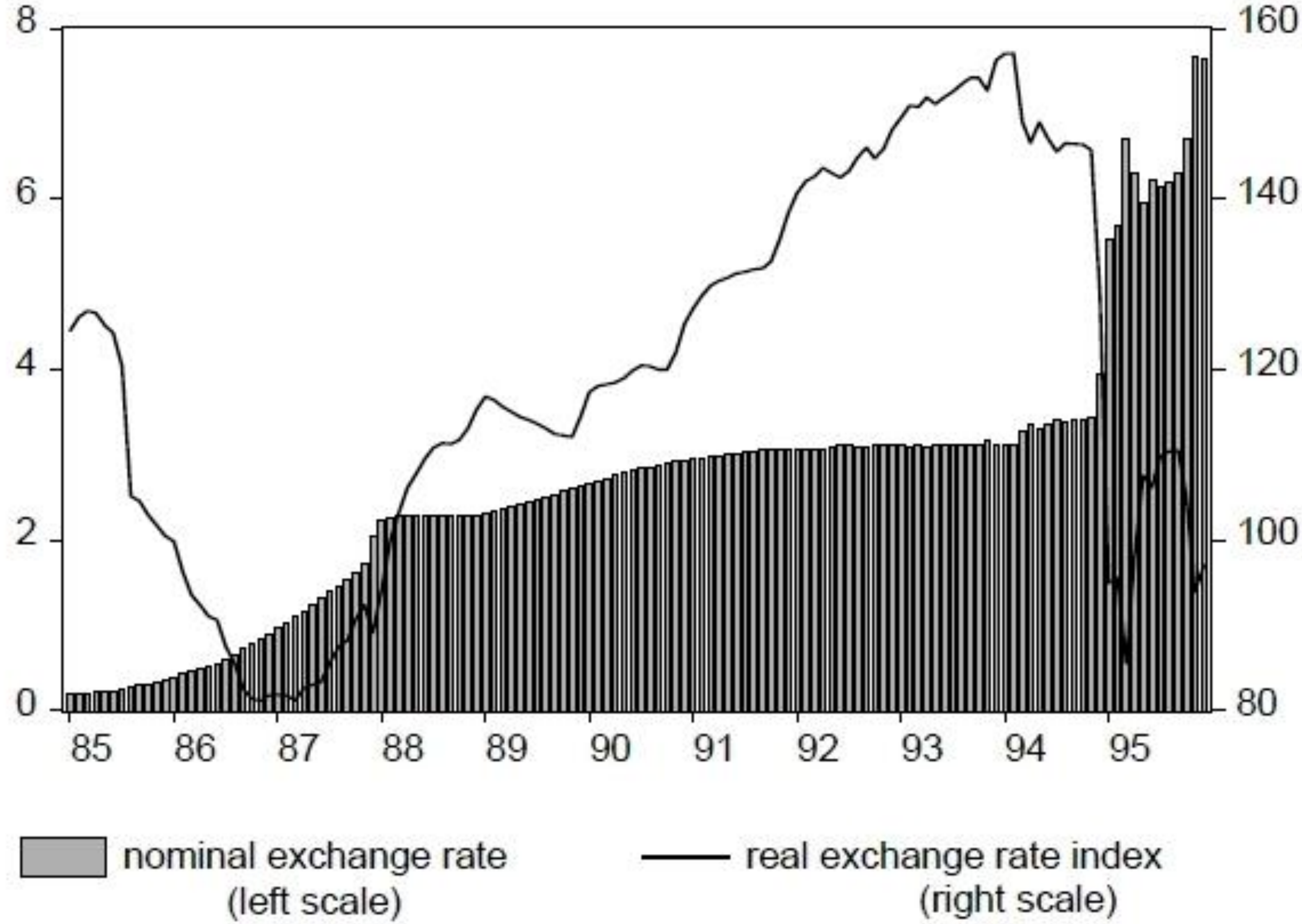

C. Current account
(percent of GDP)
0
-1
-2
-3
-4
-5
mean
T-2
T-1
T
T+1
T+2
T+3
T+4


E. Real lending rate
(percent per year)
60
50
40
30
20
10
0
mean
T-2
T-1
T
T+1
T+2
T+3
T+4

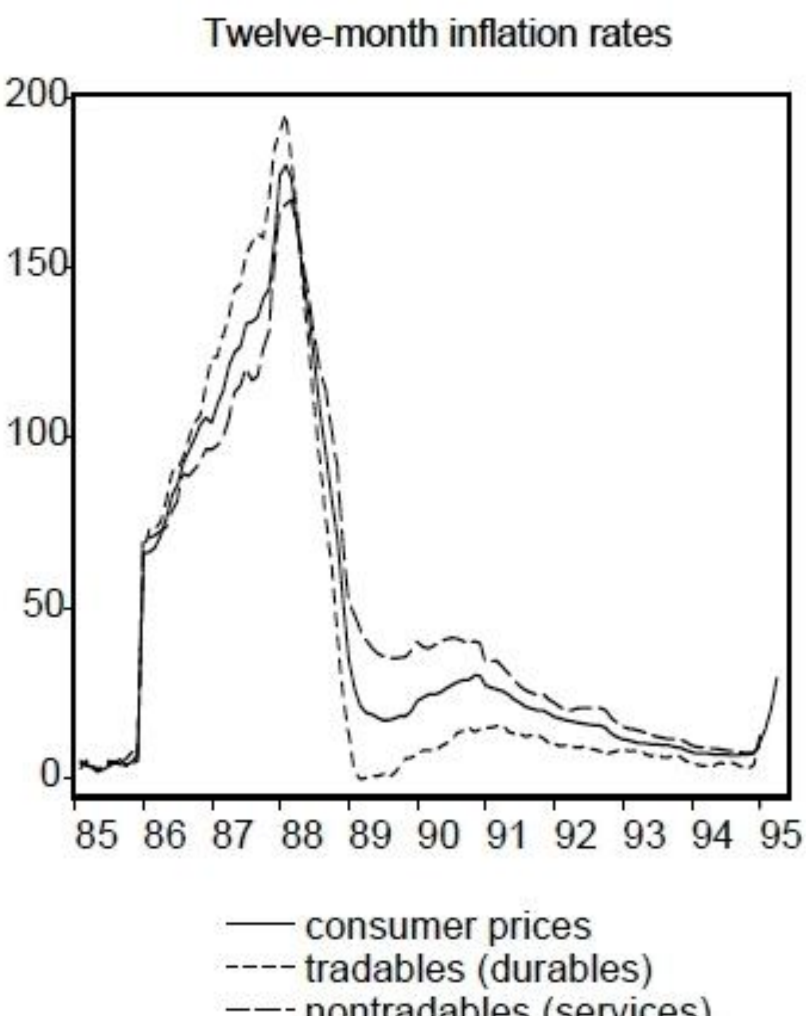


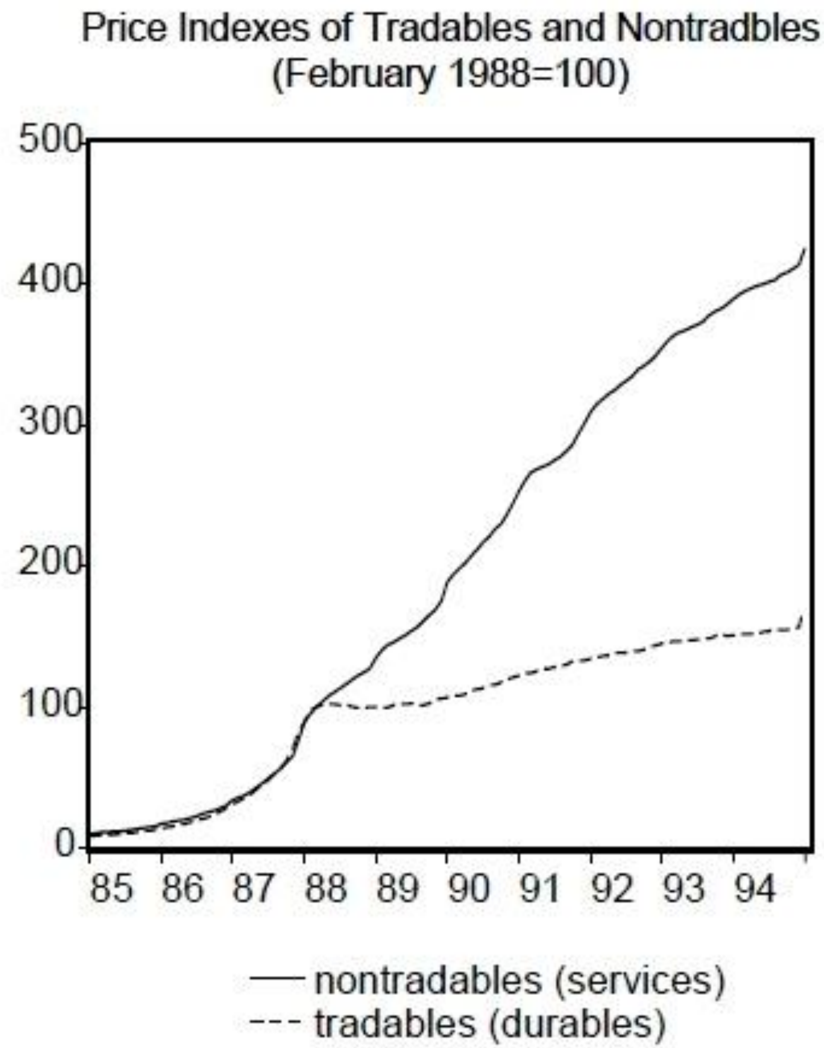
A. Real GDP growth
(percent per year)
6
4
2
0
-2
-4
-6
mean
T-2
T-1
T
T+1
T+2
T+3
T+4
B. Private consumption growth
(percent per year)
12
8
4
0
-4
-8
mean
T-2
T-1
T
T+1
T+2
T+3
T+4
C. Durables consumption growth
(percent per year)
60
40
20
0
-20
-40
mean
T-2
T-1
T
T+1
T+2
T+3
T+4
D. Fixed investment growth
(percent per year)
10
5
0
-5
-10
-15
mean
T-2
T-1
T
T+1
T+2
T+3
T+4

Mexico's 1987-1994 ERBS

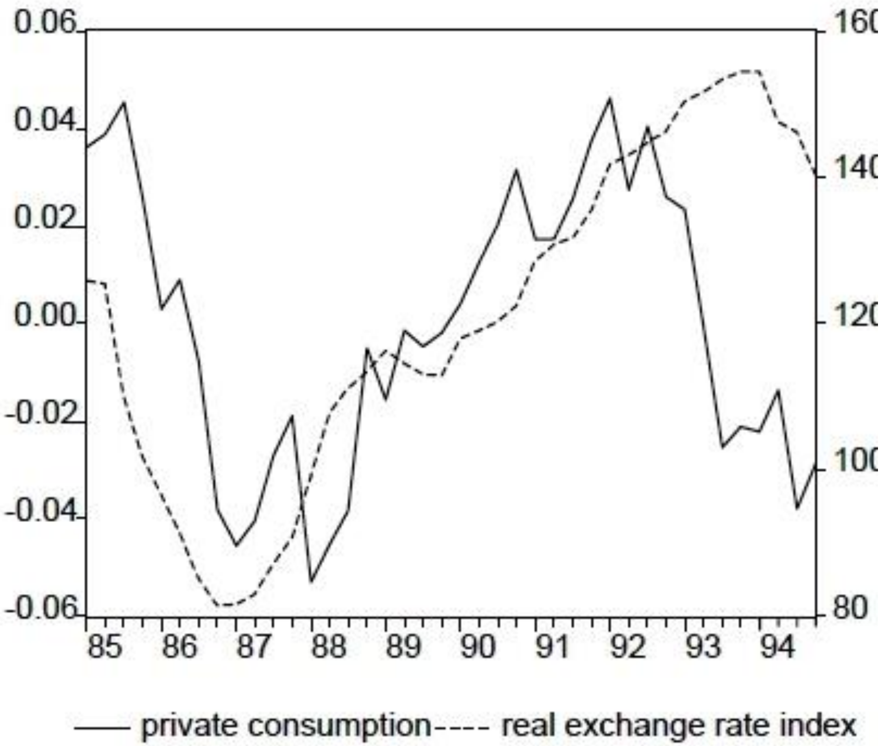


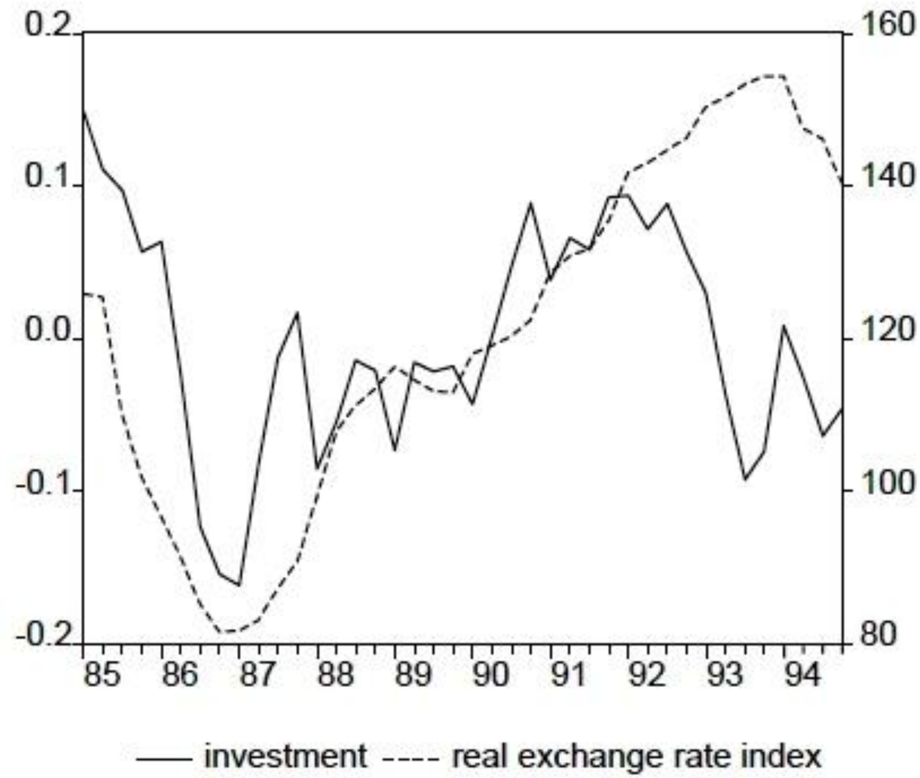
Mexico's 1987-1994 ERBS



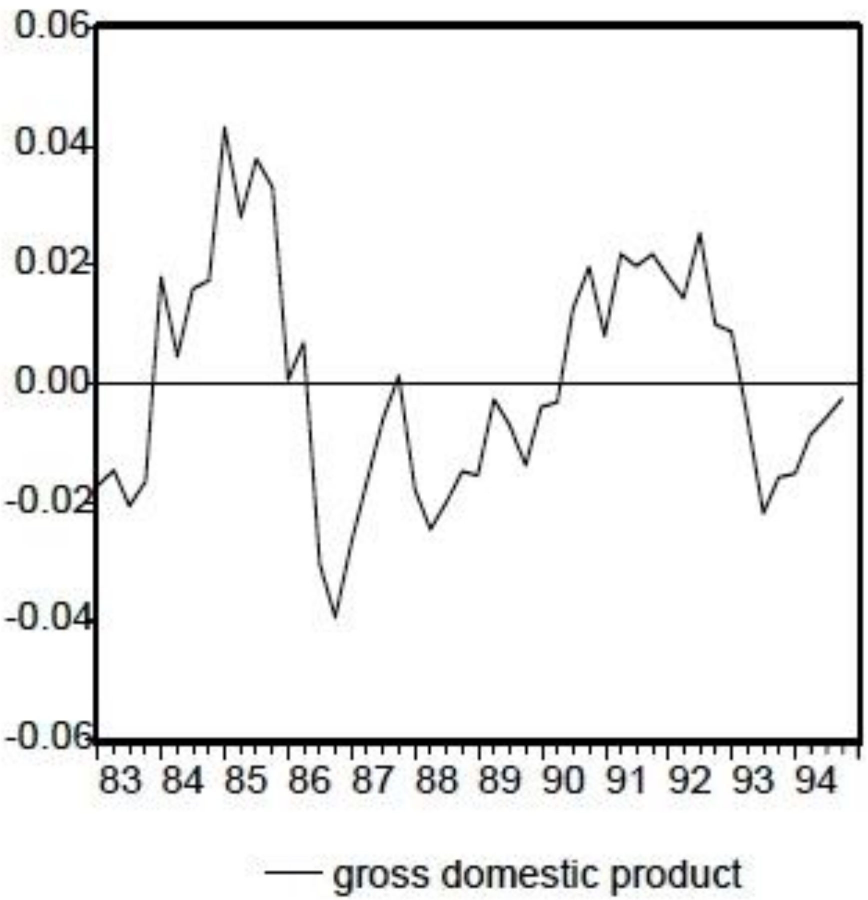


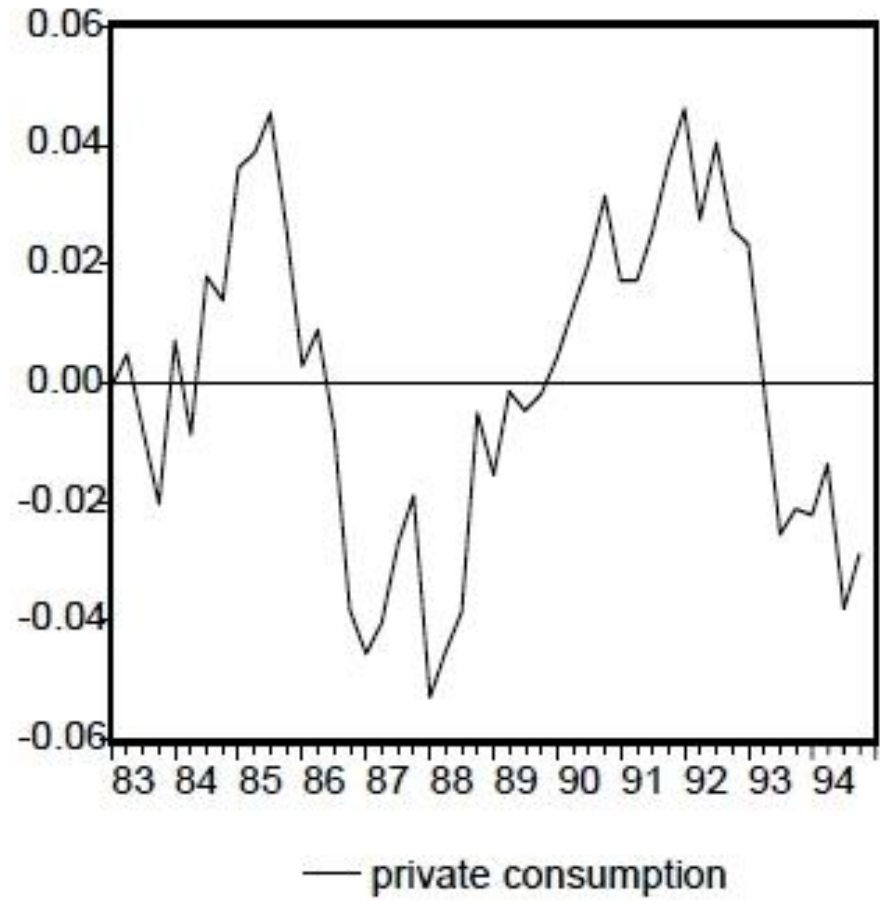
Mexico's 1987-1994 ERBS: Domestic Expenditures & Real Exchange Rate



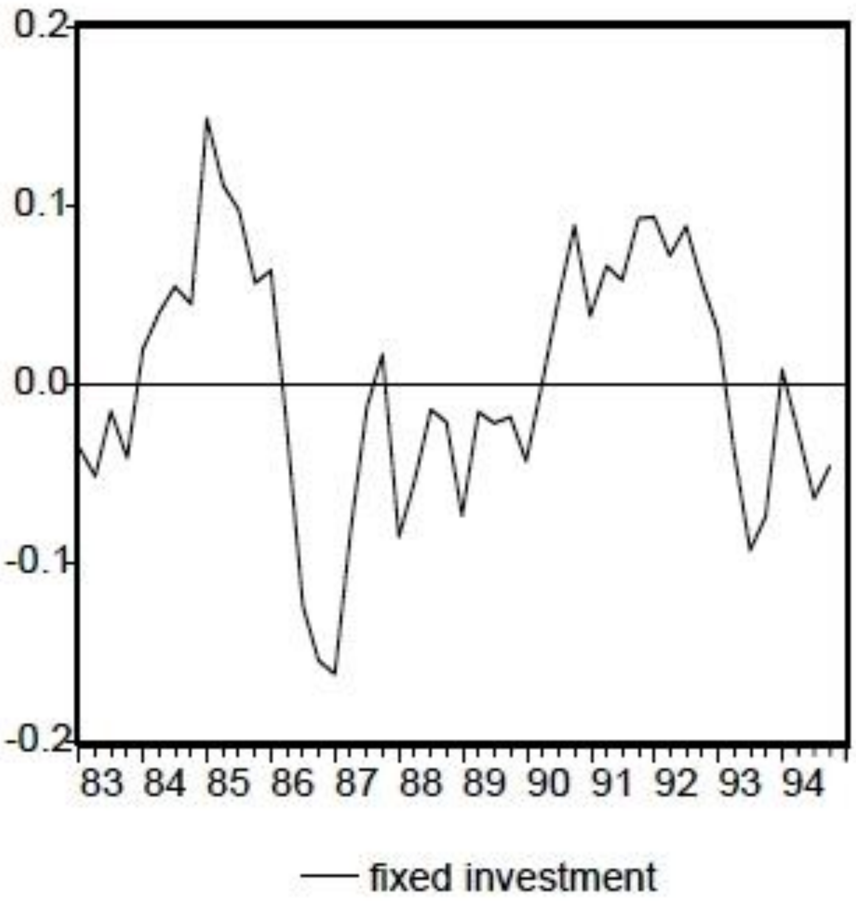


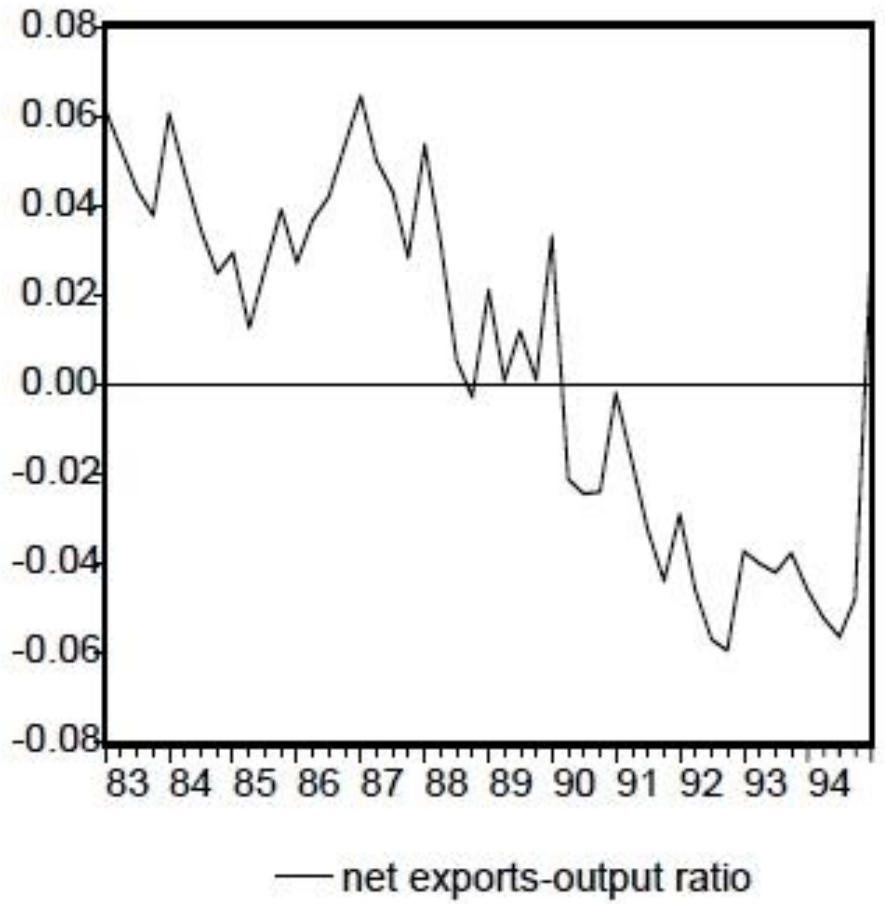
Mexico’s 1987-1994 ERBS: Cyclical Components of Macro Aggregates





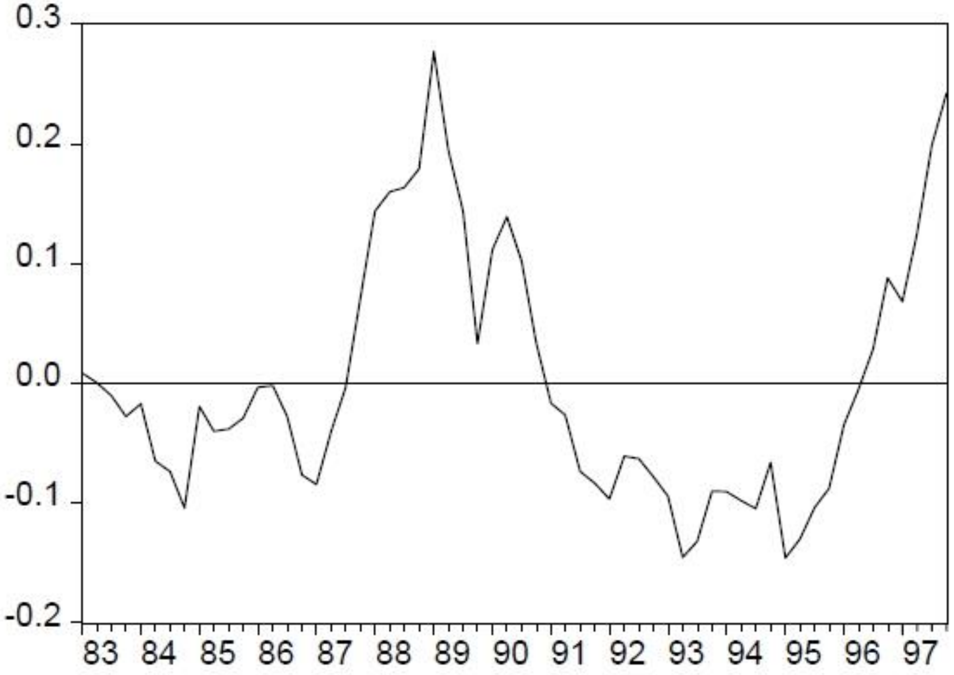
Mexico's 1987-1994 ERBS: Cyclical Components of Macro-aggregates



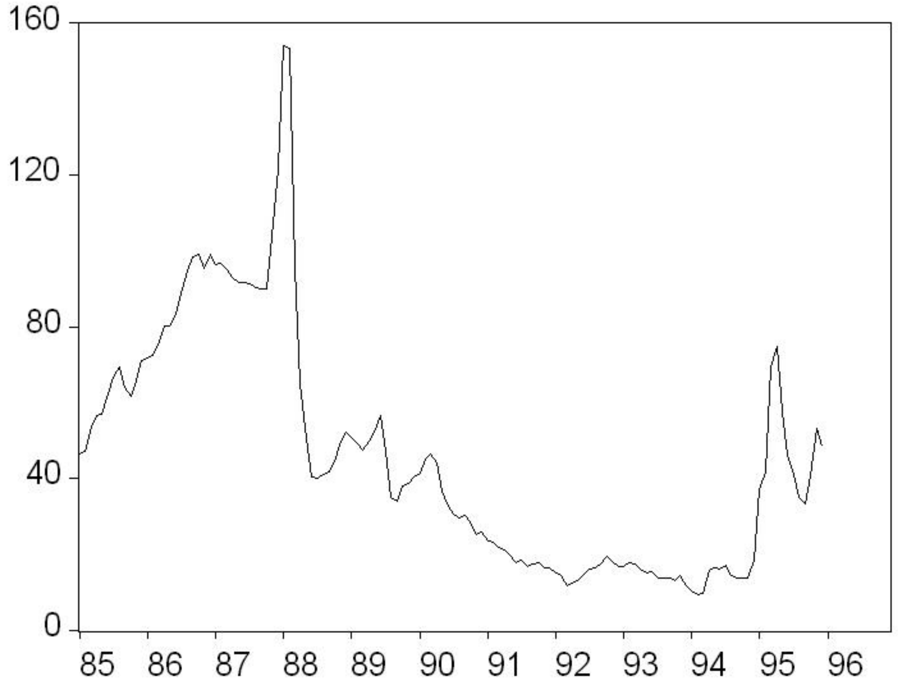


Mexico's 1987-1994 ERBS: Expenditure Velocity and Nominal Interest Rate

Figure 5. Mexico: Expenditure Velocity of M2



Nominal Interest Rate on 28-day Treasury Certificates



Literature review

- *Existing models yield qualitative predictions consistent with facts, but have important drawbacks:*
  a) Poor quantitative performance (Rebelo-Végh (96)): Max. real appreciation about 5%, modest booms, and counterfactual decline in nontradables sector
  b) Under uncertainty, incomplete markets and fiscal-induced wealth effects are required to explain gradual booms (Calvo & Drazen (98)): Complete markets yield constant consumption. Incomplete markets without wealth effects yield falling consumption.
  c) Price-consumption puzzle: positive corr. of *RER* & *C* is theoretically implausible (Uribe (99)): With strict interest parity, non-state-contingent wealth, and CES utility, *C* rises when *RER* falls.

Literature review (continued)

- *Controversy on "early warning" indicators of currency crises (Kaminsky and Reinhart (99)):*
  a) Is evidence on *statistical* causality evidence of *economic* causality?
  b) Should a "flag" in one or more indicators trigger policy action (i.e., are they a signal that crisis is imminent?)

ANALYTICAL FRAMEWORK

SOE Business Cycle Model with Incomplete Markets and Aggregate Devaluation Risk

I. Money economizes transactions costs incurred in acquiring consumption and investment goods

II. Fixed exchange rate regime with exogenous, time-variant devaluation probabilities

III. Incomplete markets (non-contingent real bonds are the only internationally-traded asset)

IV. Fiscal-induced wealth effects: sudden surge in inflation tax revenue associated with currency collapse allocated to unproductive government absorption

V. Sector-specific factors of production that increase the curvature of the sectoral PPF accommodate large real appreciations

Households

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left[C_t (1-L_t)^{\rho}\right]^{1-\sigma}}{1-\sigma} \qquad (1)$$

$$C_t = \left[\omega\left(C_t^T\right)^{-\mu} + (1-\omega)\left(C_t^N\right)^{-\mu}\right]^{-\frac{1}{\mu}} \qquad (2)$$

$$\left(1+S\left(V_t\right)\right)\left(C_t^T + p_t^N C_t^N + I_t\right)$$

$$= r_t K_t + w_t L_t + \frac{m_{t-1}}{1+e_t} - m_t - B_{t+1} + \left(1+r^*\right) B_t + T_t \qquad (3)$$

$$K_{t+1} = (1-\delta)K_t + \varphi\left(\frac{I_t}{K_t}\right)K_t \quad (4)$$

$$V_t = \frac{C_t^T + p_t^N C_t^N + I_t}{m_t} \quad (5)$$

$$\lim_{j \to \infty} E_t \left[\frac{B_{t+j+1} + m_{t+j}}{(1+r^*)^j}\right] = 0 \quad (6)$$

Firms

$$Y_t^i = A^i \left(K_t^i \right)^{\alpha i} \left(L_t^i \right)^{1-\alpha i} \; for \;\; i = T, N \tag{7}$$

$$K_t = \kappa\left(K_t^T, K_t^N \right) \qquad\qquad L_t = L_t^T + L_t^N \tag{8}$$

$$w_t L_t + r_t K_t = Y_t^T + p_t^N Y_t^N \tag{9}$$

Government and market clearing

$$G_t + T_t = m_t - \frac{m_{t-1}}{1+e_t} \qquad with$$

$$\sum_{t=0}^{\infty} \frac{G_t}{\left(1+r^*\right)^t} = \eta \sum_{t=0}^{\infty} \frac{m_{t-1}}{\left(1+r^*\right)^t}\left(\frac{e_t}{1+e_t}\right) \qquad 0 \leq \eta \leq 1$$

$$C_t^N = A^N (K_t^N)^{\alpha N} (L_t^N)^{1-\alpha N}$$

$$C_t^T + I_t + G_t = A^T (K_t^T)^{\alpha T} (L_t^T)^{1-\alpha T} - B_{t+1} + (1+r^*)\, B_t - m_t V_t S(V_t)$$

Exchange Rate Regime

- At *t=0*, $e_0 = 0$ but policy lacks credibility or there is "uncertain duration" (Calvo & Drazen (98)):
- *Z(t)* is the "hazard rate" function:

$$z_t = \Pr[e_{t+1} > 0 \mid e_t = 0]$$

with:

a) $\Pr[e_{t+1} > 0 \mid e_t > 0] = 1$

b) $e_t = 0$ or > 0

c) At $t = J < \infty$ policy uncertainty ends

Optimality conditions

$$\lambda_t h(i_t) = \beta^t \omega \left(\frac{C_t^T}{C_t} \right)^{-(1+\mu)} C_t^{-\sigma} \left(1 - L_t^N - L_t^T \right)^{\rho(1-\sigma)} \qquad (10)$$

$$p_t^N = \frac{1-\omega}{\omega} \left(\frac{C_t^N}{C_t^T} \right)^{-(1+\mu)} \qquad (11)$$

$$\frac{\rho \left(C_t^T + p_t^N C_t^N \right) h(i_t)}{(1 - L_t^N - L_t^T)} = \left(1 - \alpha T \right) A^T \left(\frac{K_t^T}{L_t^T} \right)^{\alpha T} \qquad (12)$$

Define marginal transactions costs as *h(i) = 1 + S(V(i)) + V(i)S'(V(i))*

$$\lambda_t\left[1-S'\left(V_t\right)V_t^2\right]=E_t\frac{\lambda_{t+1}}{1+e_{t+1}} \tag{13}$$

$$\lambda_t=E_t\lambda_{t+1}\left(1+r^*\right) \tag{14}$$

$$\frac{\lambda_t h(i_t)}{\varphi'\left(\frac{I_t}{K_t}\right)}=E_t\lambda_{t+1}\left[\frac{\alpha TA^T}{\kappa_1\left(K_{t+1}^T,K_{t+1}^N\right)}\left(\frac{K_{t+1}^T}{L_{t+1}^T}\right)^{-(1-\alpha T)}+\frac{h(i_{t+1})}{\varphi'\left(\frac{I_{t+1}}{K_{t+1}}\right)}\left[(1-\delta)+\varphi\left(\frac{I_{t+1}}{K_{t+1}}\right)-\varphi'\left(\frac{I_{t+1}}{K_{t+1}}\right)\frac{I_{t+1}}{K_{t+1}}\right]\right] \tag{15}$$

$$\left(1-\alpha T\right)A^{T}\left(\frac{K_t^T}{L_t^T}\right)^{\alpha T}=\left(1-\alpha N\right)A^{N}\left(\frac{K_t^N}{L_t^N}\right)^{\alpha N}p_t^N \qquad (16)$$

$$\alpha TA^{T}\left(\frac{K_t^T}{L_t^T}\right)^{-(1-\alpha T)}=\alpha NA^{N}\left(\frac{K_t^N}{L_t^N}\right)^{-(1-\alpha N)}p_t^N\left[\frac{\kappa_1\left(K_t^T,K_t^N\right)}{\kappa_2\left(K_t^T,K_t^N\right)}\right] \qquad (17)$$

Transmission Mechanism

I. Velocity is increasing in nominal interest rate:

$$S'(V_t)V_t^2 = \frac{i_t}{1+i_t} \Rightarrow \text{in equilibrium} \quad V(i_t) \text{ with } V' > 0$$

II. Currency risk induces state-contingent premium on opp. cost of holding money:

$$S'(V_t^L)\left(V_t^L\right)^2 = \frac{r^*}{1+r^*} + \left[\frac{\lambda_{t+1}^H}{E_t\left[\lambda_{t+1} \mid e_t = 0\right]}\right]\left[\frac{z_t e^h}{\left(1+e^h\right)\left(1+r^*\right)}\right]$$

a) Expected rate of currency depreciation (UIP)

b) Time-varying risk premium (Calvo-Drazen effect)

$$\frac{\lambda^H{}_{t+1}}{E\left[\lambda_{t+1} \mid e_t = 0\right]} > 1$$

Transmission Mechanism

III. Saving distortion:

$$U_{C^T}\left(C_t^T, C_t^N, \ell_t\right) = \beta(1+r^*)E_t\left[U_{C^T}\left(C_{t+1}^T, C_{t+1}^N, \ell_{t+1}\right)\left(\frac{h(i_t)}{h(i_{t+1})}\right)\right]$$

where *h(i)* is the marginal cost of transactions.

IV. Investment distortion:

$$U_{C^T}\left(C_t^T, C_t^N, \ell_t\right) =$$

$$E_t\left[\frac{U_{C^T}\left(C_{t+1}^T, C_{t+1}^N, \ell_{t+1}\right)}{h(i_{t+1})}\left(\frac{\alpha T A^T}{\kappa_1(K_{t+1}^T, K_{t+1}^N)}\left(\frac{K_{t+1}^T}{L_{t+1}^T}\right)^{-(1-\alpha T)} + h(i_{t+1})(1-\delta)\right)\right]$$

Transmission Mechanism

V. Labor supply distortion:

$$\frac{U_{\ell}\left(C_t^T, C_t^N, \ell_t\right)}{U_{C^T}\left(C_t^T, C_t^N, \ell_t\right)} = \frac{(1-\alpha T)A^T}{h(i_t)}\left(\frac{K_t^T}{L_t^T}\right)^{\alpha T}$$

VI. Role of sector specific capital

$$Ln\left(p_t^N\right) = C + (\alpha T - \alpha N) Ln\left(\frac{K_t^N}{L_t^N}\right) - \frac{\alpha T}{\xi} Ln\left(\frac{K_t^N}{K_t^T}\right)$$

CALIBRATION

Calibration: Mexico 1987-1994

a) Transactions costs

$1/(1+\gamma) = 0.16 \Rightarrow$ Calvo & Mendoza (96)

$A = 0.548 \Rightarrow$ match end 87- expenditures velocity

b) Preferences $\beta = (1+r^*)^{-1}$

$\sigma = 5 \Rightarrow$ Reinhart and Vegh (94), lower bound

$1/(1+\mu) = 0.76 \Rightarrow$ Ostry and Reinhart (92)

$\omega = 0.56 \Rightarrow$ average sectoral consumption shares

$\rho = 1.5433 \Rightarrow$ steady-state leisure allocation of 0.2

Calibration: Mexico 1987-1994

c) Technology

$1-\alpha^T = 0.26$ ⇒ 1988-1996 average

$1-\alpha^N = 0.36$ ⇒ 1988-1996 average

$\delta = 0.01$ ⇒ match average gross investment rate

$\varphi''(\delta) = -1.8$ ⇒ match investment boom

$\xi = -0.1$ ⇒ match Δp^N due to currency risk in VAR

$r^* = 0.065$ ⇒ Cooley and Prescott (95)

d) Government Policy

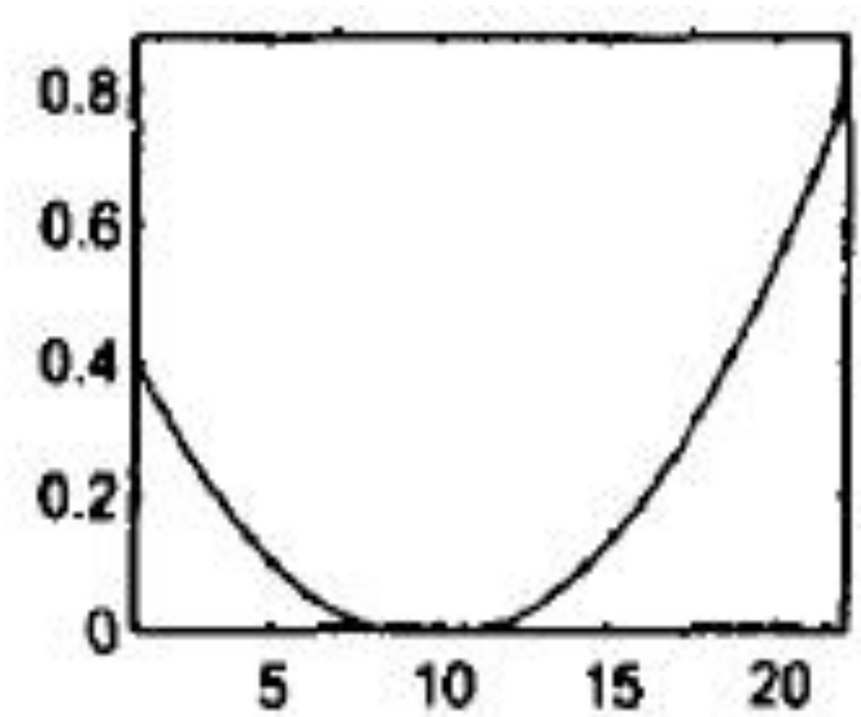
$\eta = 0.66$ match 1987 government absorption/GDP ratio

$e = 170$ ⇒ end-87 annualized tradables inflation rate

Calibration: Mexico 1987-1994

e) Hazard rate function

Set to mimic econometric evidence on “J-shaped” devaluation probabilities (Blanco and Garber (86), Klein and Marion (97))



BASELINE CALIBRATION RESULTS

Main Results

I. Booms in *GDP*, *C* and *I* with recessions before devaluation. Amplitudes of *GDP* and *C* in line with data.

II. *C* and *RER* are highly correlated (state-contingent, time-varying monetary distortion and marginal utility of wealth).

III. With $\xi = -0.1$, model yields sharp rise in *RER* of 18% in first 2 years. *RER* then stabilizes and depreciates slightly, but ends appreciated by 13% at “maximum duration.”

IV. Model mimics qualitative pattern of sectoral expansion and contraction, with faster growth in *CT* than in *CN* in early stages of peg

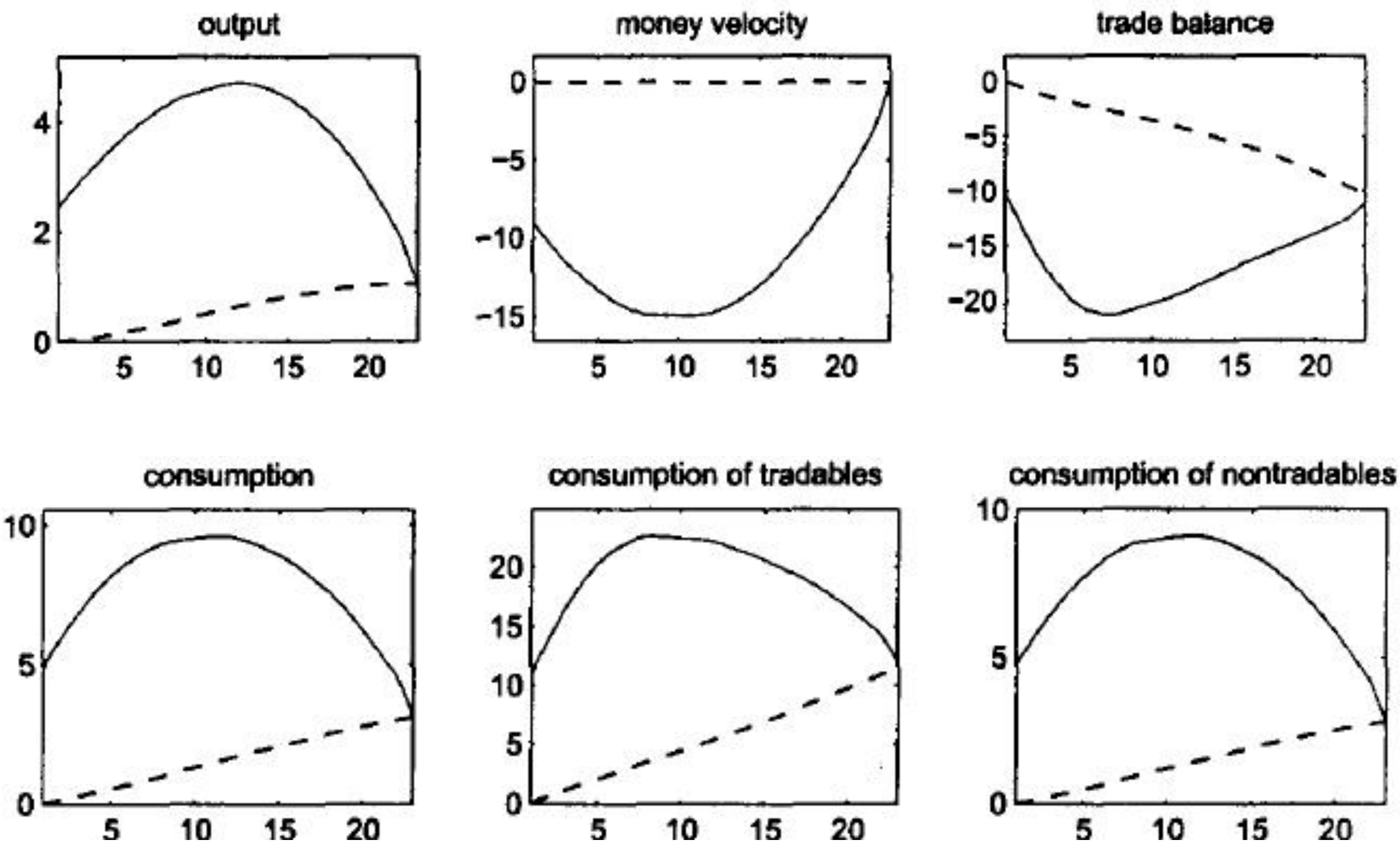
V. Private *TB* (*net exports* - *public absorption*) falls markedly on impact, continues to fall for the first 2 years and then rises slowly. At "maximum duration," *TB* falls by 12%.

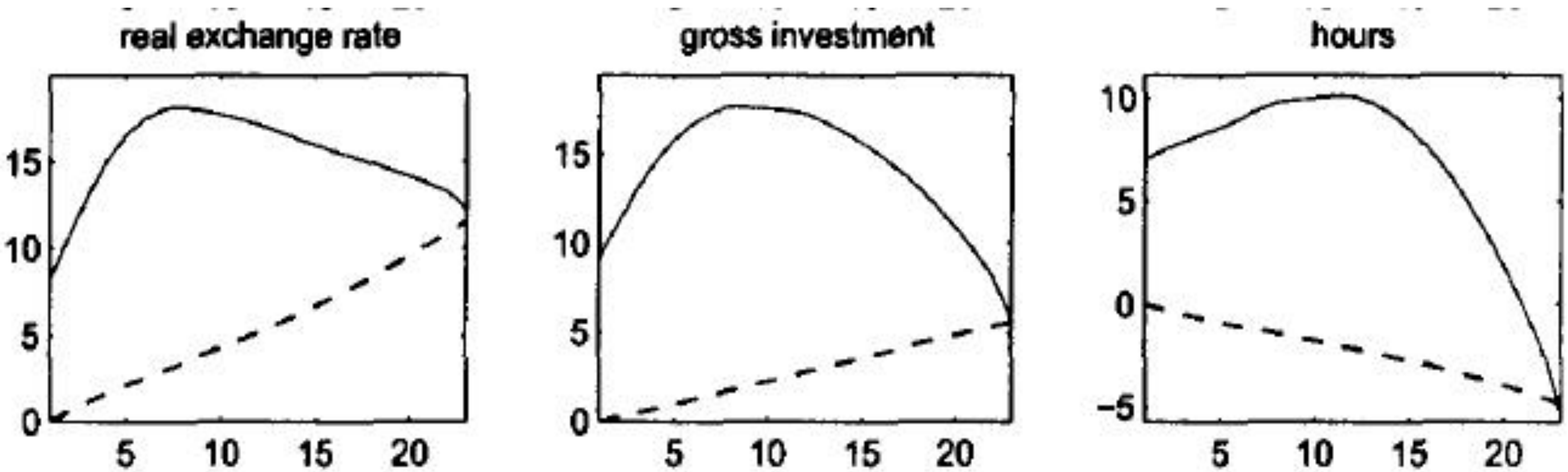
VI. *V* falls by 10% when the peg begins, then falls gradually for the first 10 quarters before it begins to rise gradually. Amplitude is smaller than in data.

Amplitude of ERBS Business Cycle

	Mexican Data	Model Simulations		
		Benchmark (J-shaped hazard rate)	Flat Hazard rate	Perfect foresight
Gross domestic product (peak 88:2, trough 92:3)	5.01	4.73	3.93	5.81
Private consumption (peak 88:1, trough 92:1)	9.91	9.57	8.55	10.93
Fixed investment (peak 88:1, trough 92:1)	17.92	17.69	15.06	19.60
Net exports/GDP ratio (trough 88:1, peak 92:4)	11.31	6.00	5.47	7.38
Money Velocity (trough 88:1, peak 93:1)	28.92	14.93	10.93	14.93
Real exchange rate	41.50	18.15	18.81	22.42

Baseline simulation results





real exchange rate
gross investment
hours
15
10
5
0
5
10
15
20
15
10
5
0
5
10
15
20
10
5
0
-5
5
10
15
20

Comparison with Existing Work

I. Reinhart & Vegh (95) simulated Calvo's (86) deterministic, endowment economy model.
   - Mimicking *C* boom required huge interest rate cuts.
   - *C* jumps on impact as peg begins, and remains constant until it falls when the peg is abandoned (cyclical dynamics and price-consumption puzzle are unexplained).

Comparison with Existing Work

II. Rebelo & Végh (96) simulated variants of a deterministic 2-sector, GE framework (including Calvo-Végh (93) sticky-price model).

- Booms and real appreciations still small (best case with staggered prices yields 5% real appreciation).
- *CT* (*CN*) rises on impact by 5% and then rises (falls) gradually until it collapses with the devaluation.
- Real appreciation driven by counterfactual fall in Y^N.
- Price-consumption puzzle remains unresolved.
- *I* and *m* still display sudden jumps.
- *L* falls if GHH utility is replaced with standard utility.

Why are results different?

- Results differ because of uncertainty, incomplete markets (preferences & technology are similar):

I. Time-varying interest rate during the peg driven by expectations of devaluation and currency risk

  - in deterministic models $e=0$ implies $i=i^*$

II. Wealth effects due to fiscal adjustment and distortions on savings and investment

  - Deterministic models rebate fiscal revenue, but even if they did not, they don't produce cyclical dynamics (once-and-for-all change in wealth).
  - Assumption that stabilization featured fiscal cuts of uncertain duration is in line Mexican case.

Accounting for Different Results

III. Differences relative to Calvo & Drazen (98) trade reform of uncertain duration:

- "Uncertain duration" of currency peg yields a distortion that depends on probability of reversal
- General-equilibrium setting yields "slope" of equilibrium dynamics that depends on path of z_t.

SENSITIVITY ANALYSIS

Sensitivity Analysis Experiments

1) Flat, linear hazard rate $z_t = 0.28$ for all $0 \leq t < J$ (same unconditional expectation of devaluation implicit in J-shaped hazard rate)

2) Perfect foresight ($z_t = 0$ for $0 \leq t < J$ and $z_t = 1$ for $J\text{-}1=23$)

3) Full rebate of the inflation tax revenue ($\eta = 0$)

4) Extended maximum duration ($J=36$)

5) Unitary elasticity of substitution between C^T and C^N ($\mu=0$)

6) Low elasticity of substitution between K^T and K^N ($\xi = -0.0001$)

7) Homogeneous capital ($\xi = -1$)

8) Positive long-run probability of “success” ($\Pi = 1/10$ *and* ½)

9) Production with intermediate inputs

10) M1 velocity ($V = 15.4$ per year before peg)

11) Logarithmic utility ($\sigma = 1$)

12) Inelastic labor supply ($\rho = 0$).

Sensitivity Analysis: Findings

- *Results of benchmark simulation hinge on four key elements:*

I. Uncertainty and a J-Shaped hazard rate are critical for matching observed cyclical dynamics.

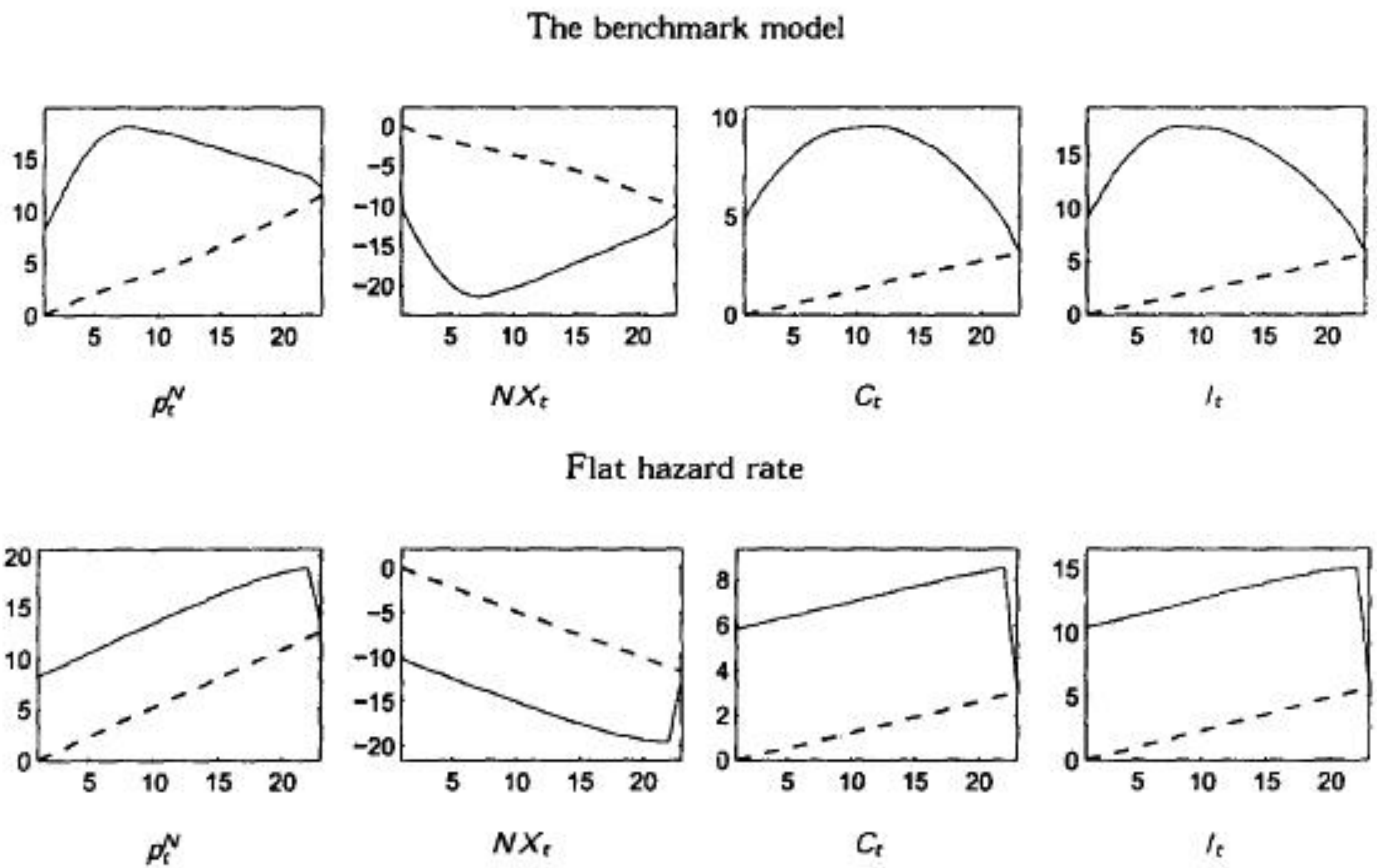
II. Endogenous wealth effects induced by market incompleteness and short-lived fiscal adjustment are critical for explaining magnitude of booms and large real appreciations

Sensitivity Analysis: Findings

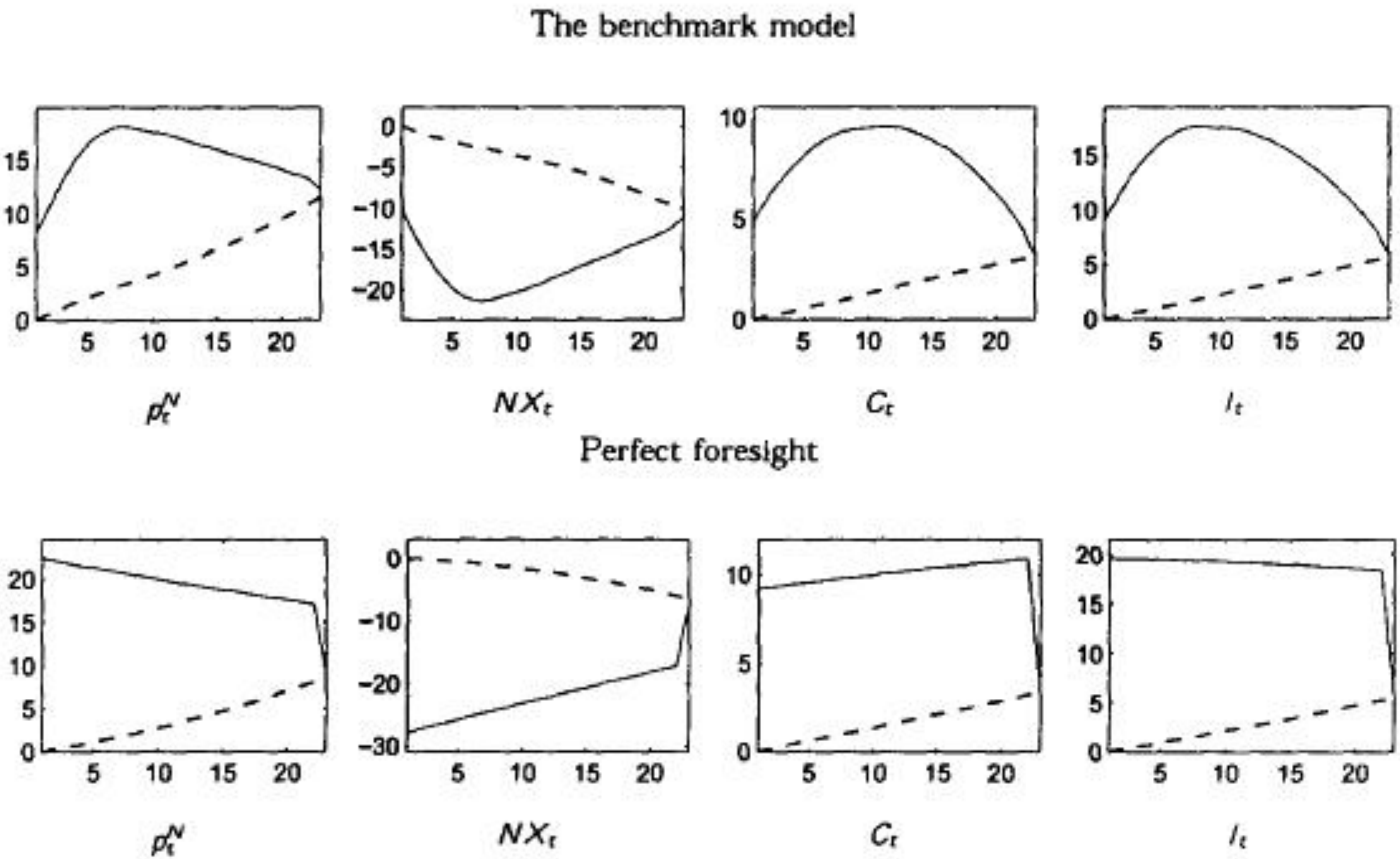
III. Sector-specific factors of production are important to increase curvature of sectoral PPF and allow Cobb-Douglas technologies (with nearly-identical factor intensities) to produce large relative price changes.

IV. Devaluation-risk distortions on investment and labor supply are key for realistic cyclical dynamics (recessions in production and consumption of traded and nontraded goods that predate currency crises).

Sensitivity Analysis

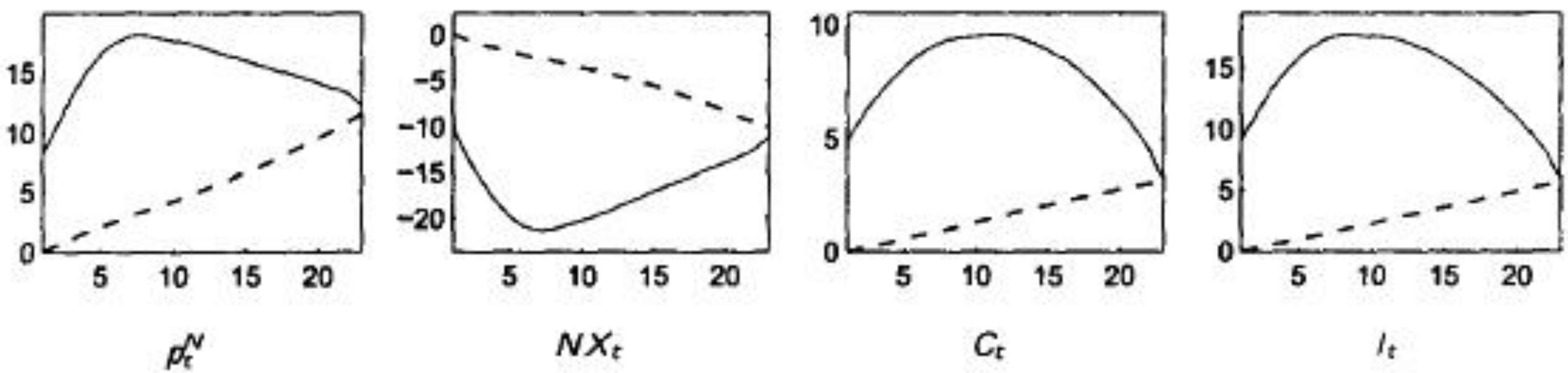


Sensitivity Analysis

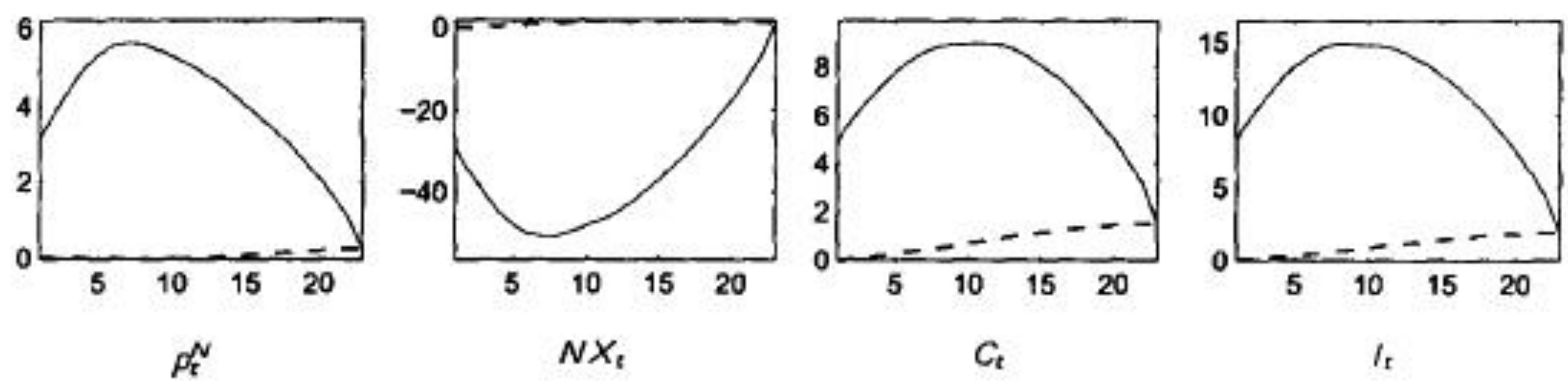


Sensitivity Analysis

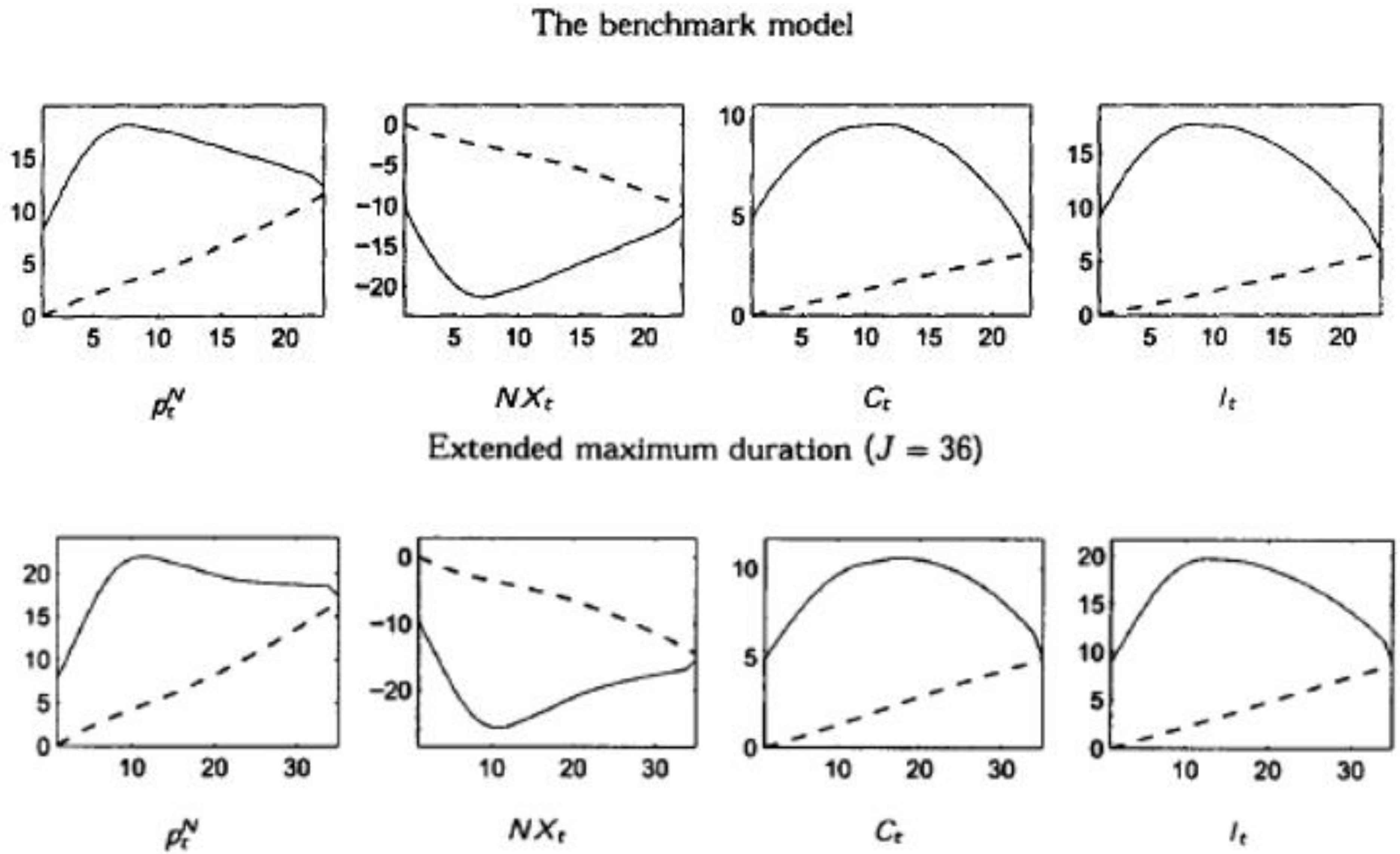
The benchmark model



Full rebate of the inflation tax ($\eta = 0$)

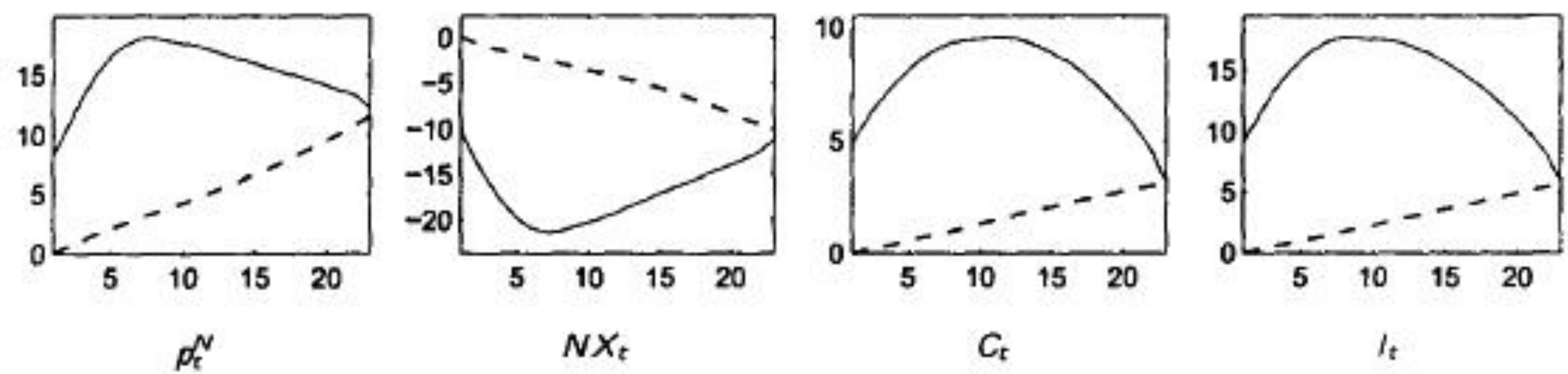


Sensitivity Analysis

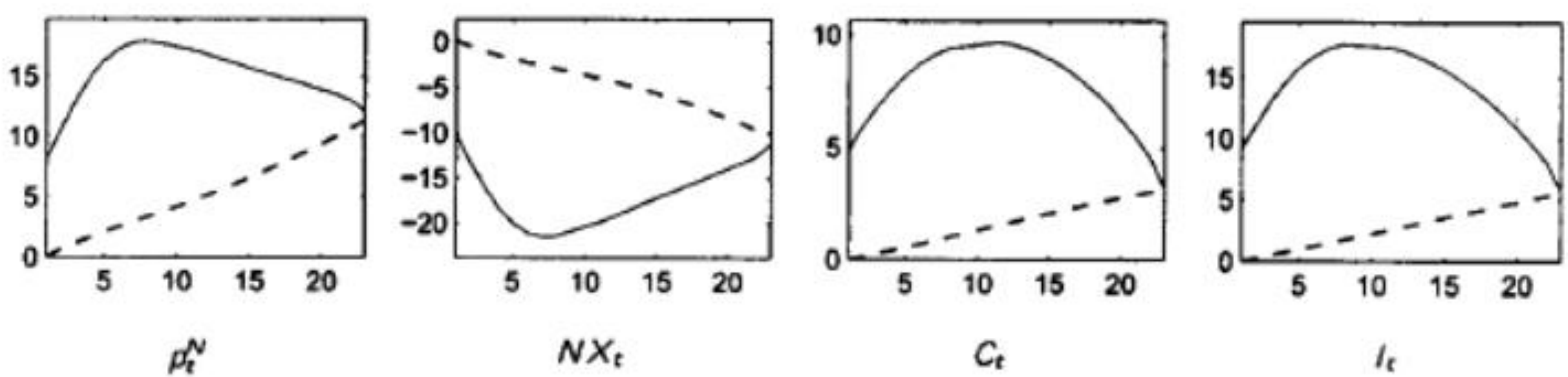


Sensitivity Analysis

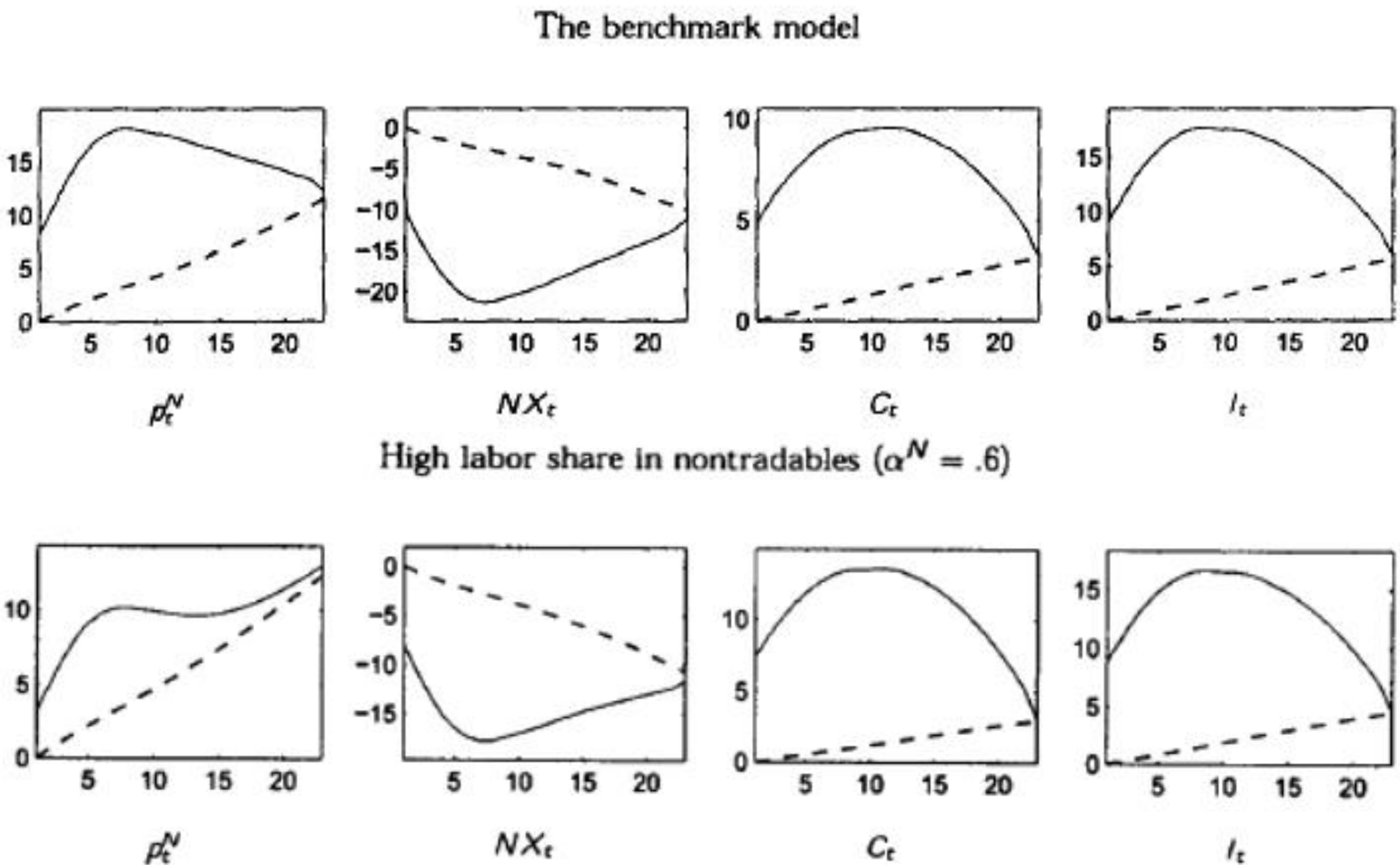
The benchmark model



Cobb-Douglas aggregator function ($\mu = 0$)

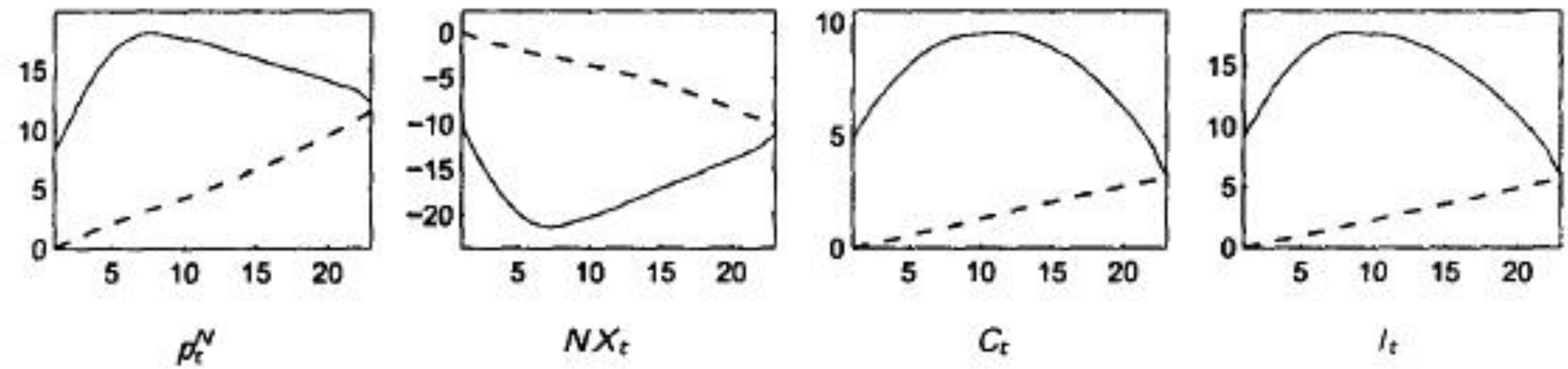


Sensitivity Analysis

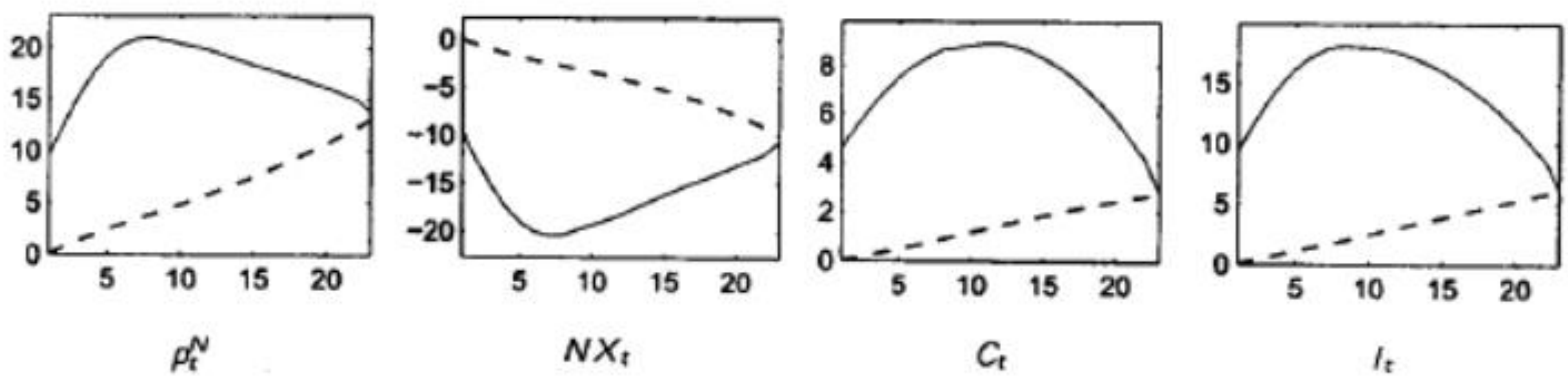


Sensitivity Analysis

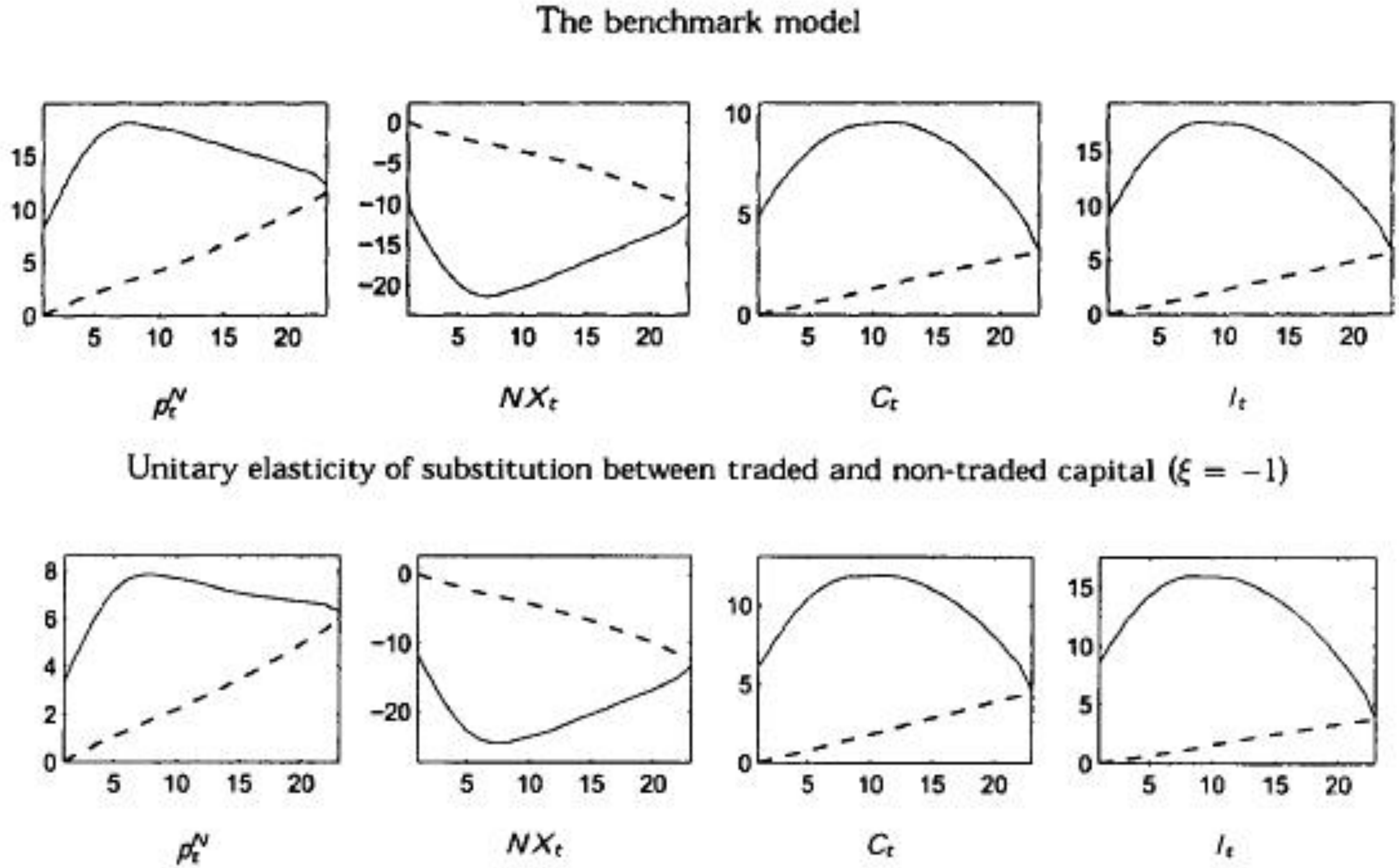
The benchmark model



Low elasticity of substitution between traded and non-traded capital ($\xi = -10^{-5}$)

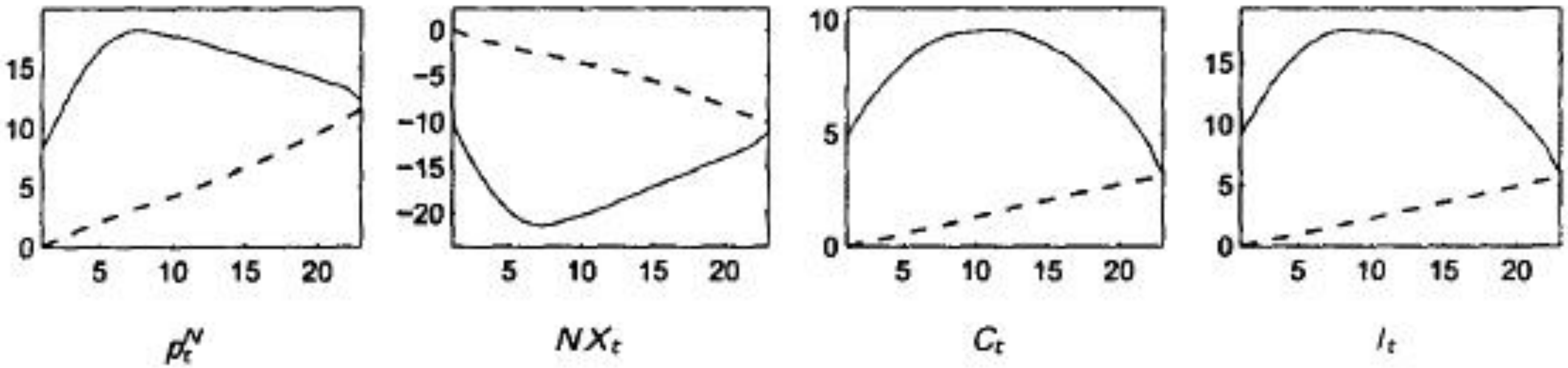


Sensitivity Analysis



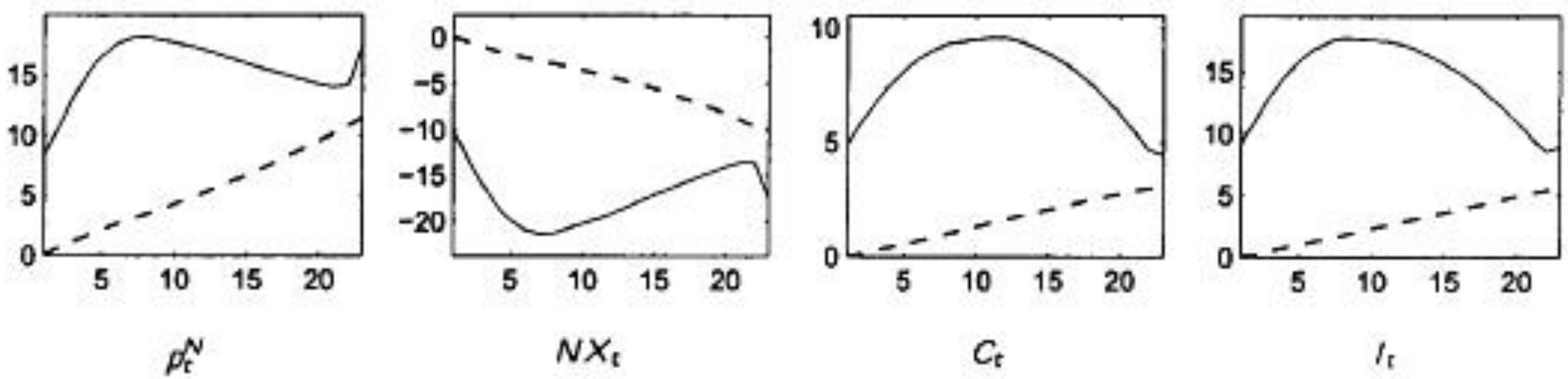
Sensitivity Analysis

The benchmark model



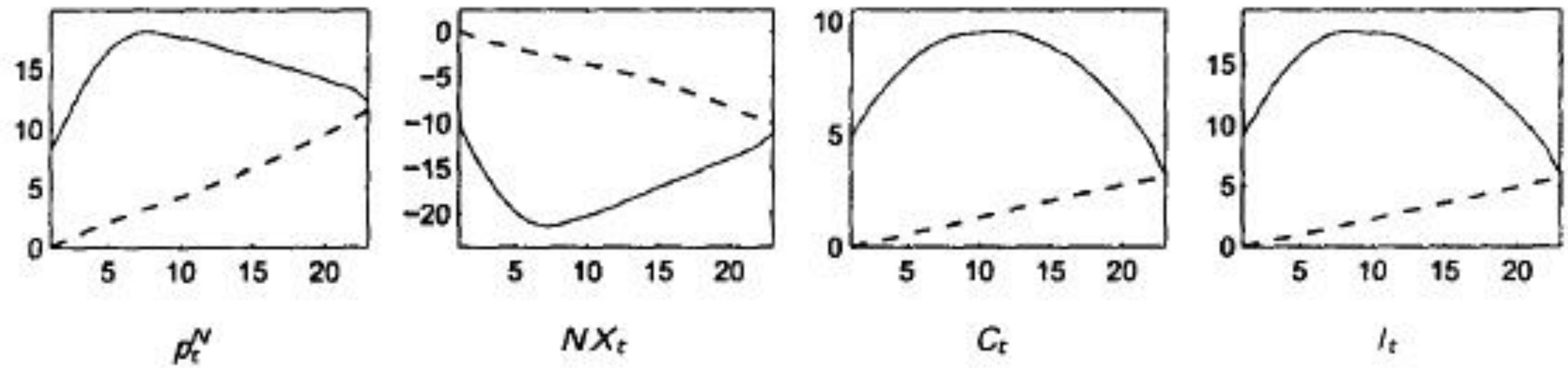
Non-zero probability of long-run success

$$Pr(e_J = e^H / e_{J-1} = e^L) = .9 \text{ and } Pr(e_{J+j} = e^i / e_J = e^i) = 1 \text{ for } i = H, L \text{ and } j > 1$$

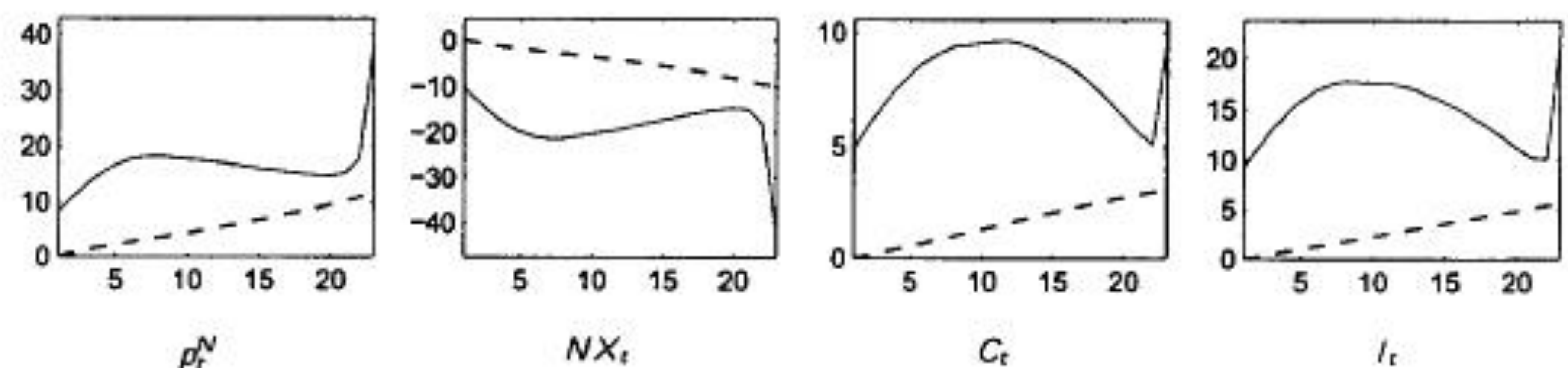


Sensitivity Analysis

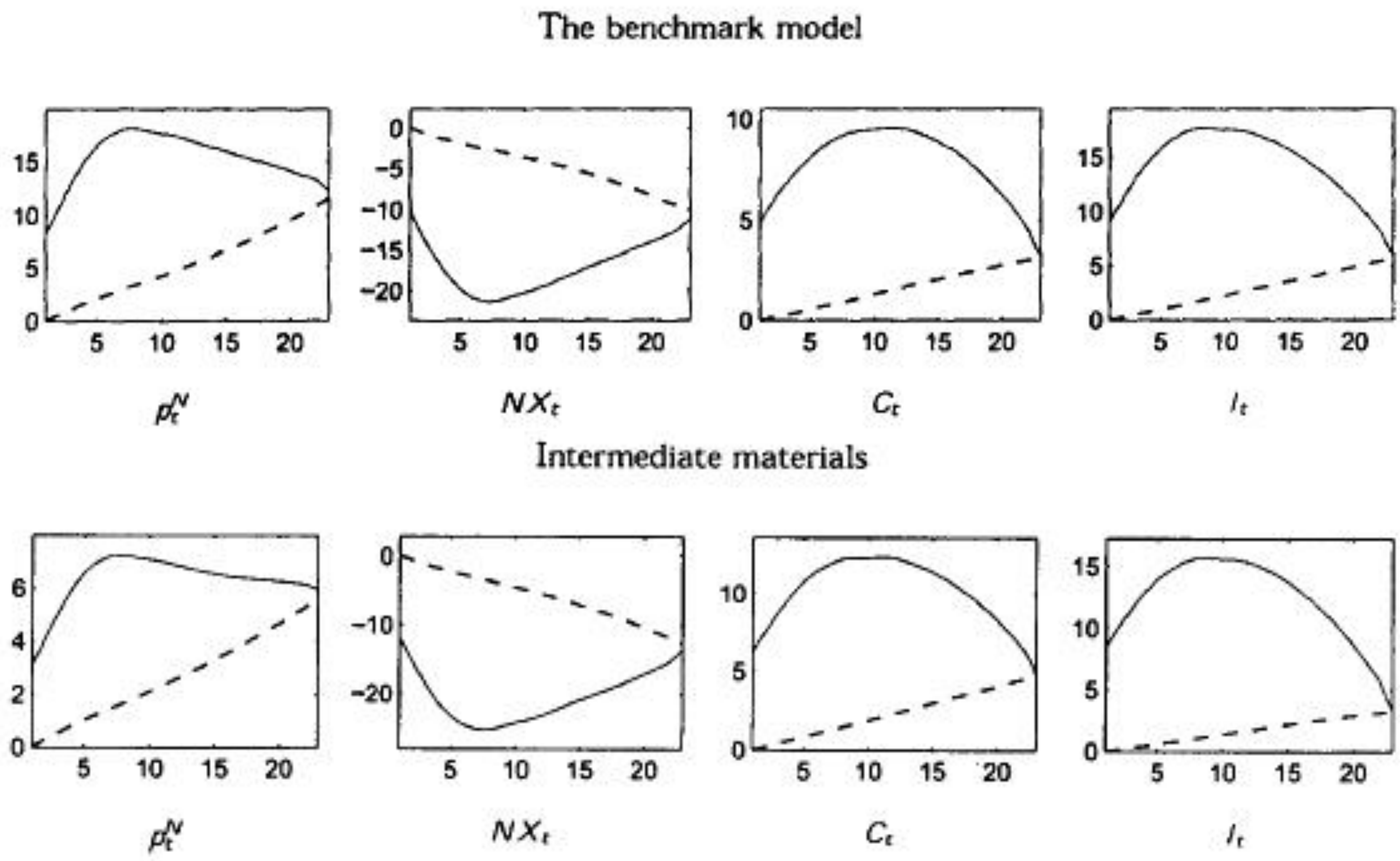
The benchmark model



$Pr(e_J = e^H / e_{J-1} = e^L) = .5$ and $Pr(e_{J+j} = e^i / e_J = e^i) = 1$ for $i = H, L$ and $j > 1$

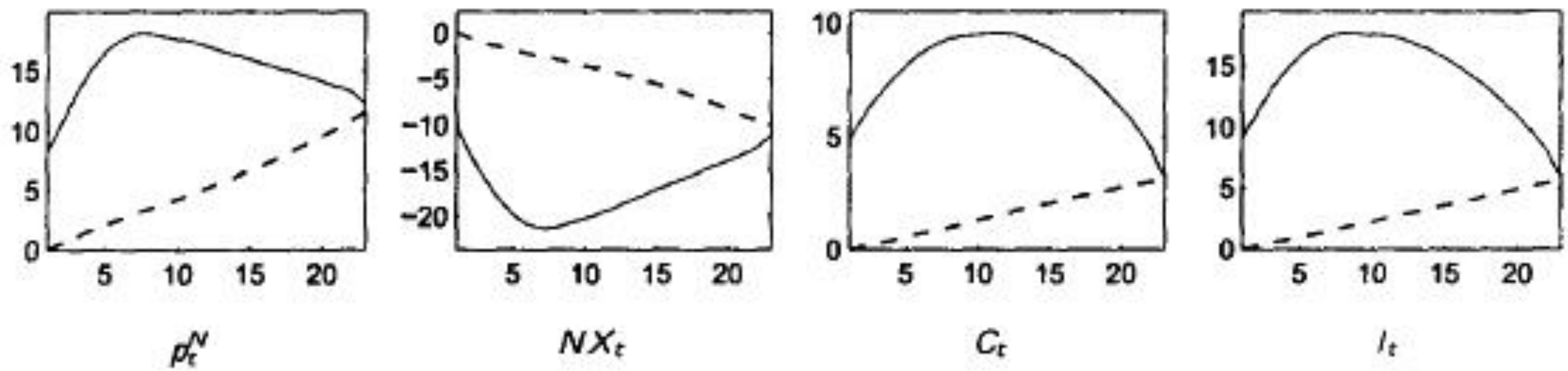


Sensitivity Analysis

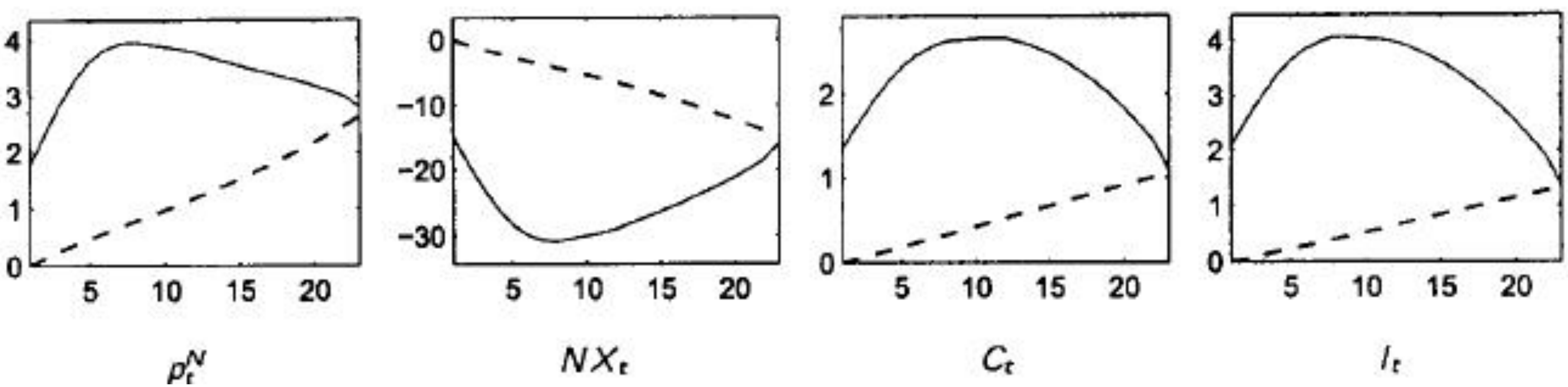


Sensitivity Analysis

The benchmark model

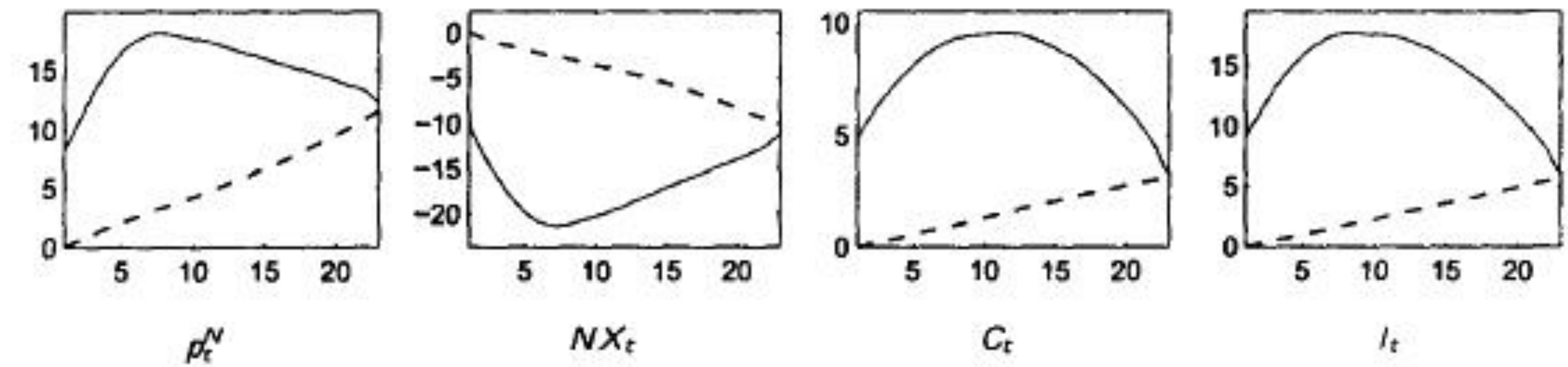


High money velocity (V^H = 15.4 per year)

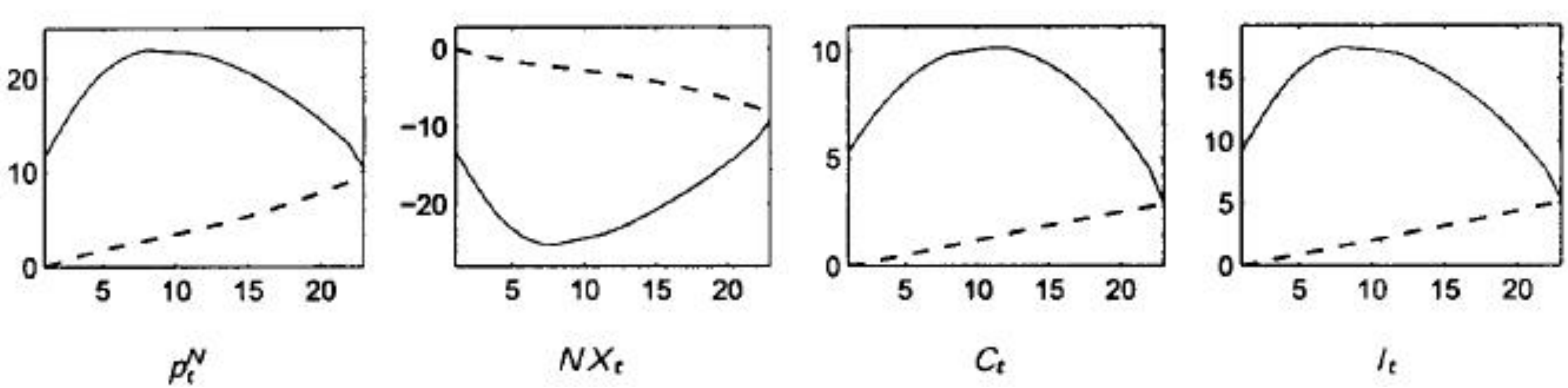


Sensitivity Analysis

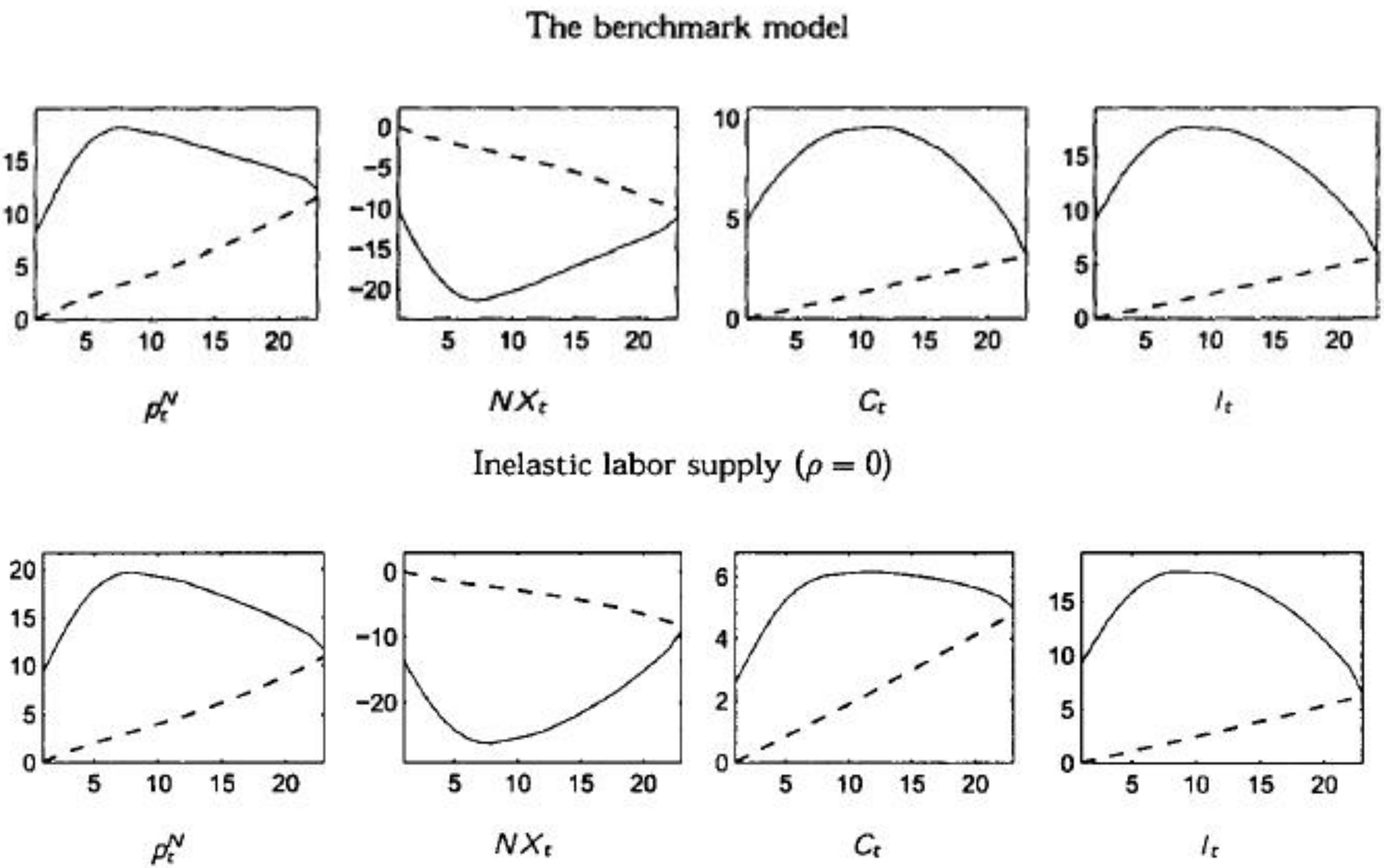
The benchmark model



Log period utility ($\sigma = 1$)



Sensitivity Analysis



WELFARE ANALYSIS

Stabilization policy trade-off (when policy lacks credibility):

- Desirable: High-inflation steady state features high nominal interest rate, with corresponding distortions
- Undesirable: Devaluation risk causes stochastic distortions on saving, investment and labor and large wealth effects
- Need quantitative analysis to examine welfare gain/loss of stabilization with devaluation risk

Welfare Analysis: Key Findings

I. Noncredible stabilization increases welfare:

- Gains range from 0.25% to 9.1% (very large compared to Lucas (87) and Calvo (88)).
- Even with rebated inflation tax, short-lived stabilization increases welfare because of investment-driven wealth effects.

Welfare Analysis: Key Findings

II. <u>Devaluation risk entails large welfare costs</u>

- With fiscal wealth effects, a peg that lasts 24 quarters with full certainty increases welfare by 5.6%, but with J-shaped *Z* the gain falls to 1.27% (with flat *Z* gain is lower at 0.95%)

Welfare Analysis: Key Findings

III. Devaluation risk is costly even without fiscal wealth effects

- If inflation tax is rebated, gain under perfect foresight is 2.5%, but gains with dev. risk are much smaller (0.5% with J-shaped *Z* and 0.3% with flat *Z*).

Welfare Analysis

Model	Rebate of 1/3 of inflation tax			Full rebate of inflation tax		
	J-shaped Hazard	Flat Hazard	Perfect Foresight	J-shaped Hazard	Flat Hazard	Perfect Foresight
Benchmark	1.27	0.95	5.56	0.51	0.34	2.53
$J = 36$	1.11	0.98	7.94	0.43	0.36	3.65
$\mu = 0$	1.24	0.92	5.40	0.51	0.34	2.53
$s_{HN} = .6$	1.21	0.90	5.25	0.50	0.34	2.46
$\xi = -10^{-5}$	1.14	0.85	5.00	0.50	0.34	2.52
$\xi = -1$	1.76	1.34	7.78	0.51	0.35	2.56
$z_{J-1} = .5$	1.27	0.95		0.51	0.34	
$z_{J-1} = .9$	1.28	0.95		0.51	0.34	
Materials	1.87	1.42	8.28	0.51	0.35	2.56
High money velocity	2.02	1.54	9.11	0.51	0.34	2.53
Log preferences	1.32	0.96	5.56	0.50	0.33	2.47
Inelastic labor supply	1.30	0.97	5.70	0.42	0.28	2.13

POLICY LESSONS & CONCLUSIONS

Policy Lessons and Conclusions

1) *Policy risk can cause large price & wealth distortions affecting business cycles, welfare.*
   - This occurs whether ex-post a devaluation occurs or not ("lack of credibility")
2) *Price distortions are akin to stochastic taxes. Hence, tax policy can be used to counter them.*
   - Depends on whether Z is known or not, and whether tax policy is "more credible."

Policy Lessons and Conclusions

3) *In a more general setting, managing an unsustainable peg involves choosing among inflation tax, other taxes and changes in gov. purchases (Drazen & Helpman (88))*
   - In 1987-94 Mexican tax rates fell, in part as a result of economic reforms (sequencing?)

4) *Further work on unifying ERBS & currency crises models.*
   - Endogenize *Z* using findings on "early-warning indicators" to specify variables.
   - Endogenous currency crises emerge given limited ability to borrow reserves (Mendoza & Uribe (99)).

Policy Lessons and Conclusions

5) *Early-warning indicators may be misleading*

- Regardless of whether a currency collapses or not in the long run, and even under perfect capital mobility, flexible prices, and fiscal discipline, early stages of ERBS plans feature overvalued RERs and large external deficits.