The Role of Expectations in Sudden Stops

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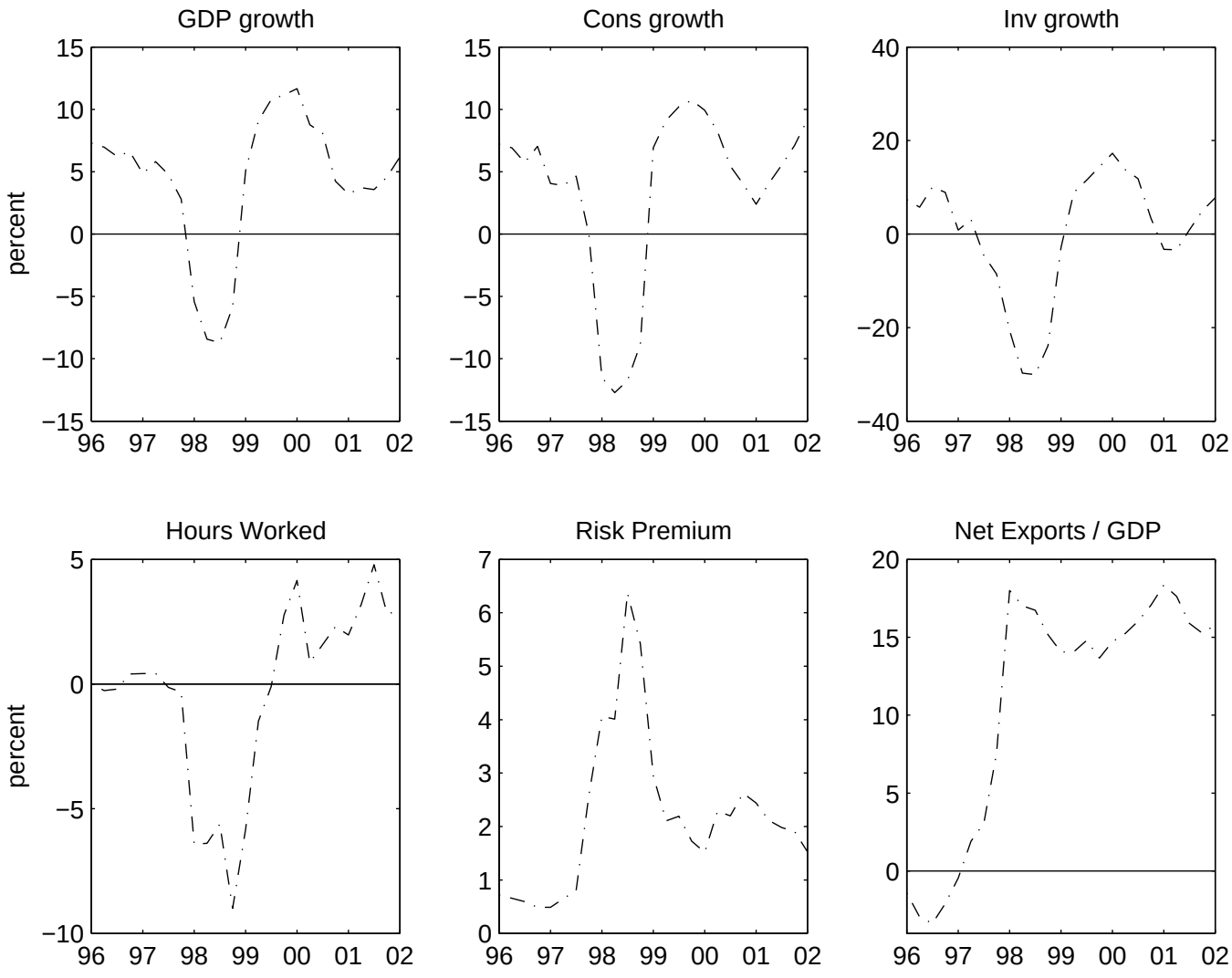
The '98 Korean Crisis



Facts about the Korean Sudden Stop

1. Dramatic increase in net exports.
2. Dramatic increase in interest rate on sovereign bonds.
3. Large contractions in Y, hours, C and I.
4. 2 and 3 were short-lived and the crisis was followed by strong growth in Y,C,I.

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At the same time

- No significant fiscal deficits, substantial foreign reserves
- Historically, low foreign debt-to-GDP

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- Regular shocks drive economy to high-debt region and collateral constraint becomes suddenly binding (Mendoza 2006)
- Exogenous tightening of binding collateral constraint (Christiano, Gust and Roldos 2004)
- Exogenous increase in country risk premium (Gertler, Gilchrist and Natalucci 2003)

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- Expectations about future fundamentals, not current fundamentals (CPR 1999; BER 2001), but
  - no perfect foresight
  - future event does not necessarily materialize
- Many crisis models focus on adverse shocks to expectations, but
  - no self-fulfilling prophecy, no equilibrium indeterminacy
  - dynamic general equilibrium with focus on transmission

Contribution of this paper

Can a reasonable bad news shock, under full rationality, lead to

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- Qualitatively robust across models (Rebelo and Jaimovic 2007)
- Explains strong recovery

The Model

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  - Imprecise news signal about future productivity growth
- 3 Amplification Mechanisms:
  1. Variable Capacity Utilization
  2. Predetermined Labor Input
  3. Working Capital Constraint/Expectation-Elastic Country Risk Premium

News and States of Technology

- Technology growth g_t is a Markov chain with support $\mu = [\mu_B, \mu_G]$ and transition matrix

$$P = \begin{bmatrix} p_{BB} & 1 - p_{GG} \\ 1 - p_{BB} & p_{GG} \end{bmatrix},$$

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  where the ij-th entry is $P_{ij} = \Pr(g_{t+1} = \mu_i | g_t = \mu_j)$.
- Agents receive news n_t about g_t N periods in advance.
- The agents' perception of the news accuracy is

$$Q = \begin{bmatrix} q & 1 - q \\ 1 - q & q \end{bmatrix},$$

  where the ij-th element of the first row is $Q_{ij} = \Pr(n_t = \mu_i | g_{t+N} = \mu_j)$.

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Non-standard parameters:

q: accuracy of the news signal

p_{GG}: persistence of the good state

p_{BB}: persistence of the bad state

Firms and Technology

Representative firm rents capital services k^s and hires labor h_t to produce y_t:

$$\begin{aligned} y_t &= (k_t^s)^{\alpha} (\Gamma_t h_t)^{1-\alpha} \quad , 0 < \alpha < 1 \ , \\ \Gamma_t &= g_t \Gamma_{t-1} \ , \end{aligned}$$

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- Firms must finance $w_t h_t$ in advance by issuing bonds at rate R_{t-1} (working capital constraint)
- Firms must set h_t prior to the realization of period t uncertainty (predetermined labor)

Households and Preferences

$$E_0 \sum_{t=0}^{\infty} \exp\left(-\sum_{\tau=0}^{t-1} \beta\left(c_\tau, l_\tau\right)\right) \left[\frac{\left(c_t - \Gamma_{t-1}\zeta \frac{l_t^{1+\psi}}{1+\psi}\right)^{1-\gamma} \Gamma_{t-1}^{\gamma}}{1-\gamma}\right] ,$$

where

$$\begin{aligned} \beta(c_\tau, l_\tau) &= \xi \ln\left(1 + \Gamma_{\tau-1}^{-1} c_\tau - \zeta \frac{l_\tau^{1+\psi}}{1+\psi}\right) , \\ & \psi > 0 \ , \ \gamma > 1 \ , \ 0 < \xi \leq \gamma \ , \ \zeta > 0 \ , \end{aligned}$$

$$c_t + x_t + R_{t-1} d_t \leq d_{t+1} + w_t l_t + r_t u_t k_t \ , \ \phi > 0 \ , \ \mu > 1 \ ,$$

$$k_{t+1} = x_t + \left(1 - \delta - \eta \frac{u_t^{1+\omega}}{1+\omega}\right) k_t - \frac{\phi}{2}\left(\frac{k_{t+1}}{k_t} - \mu\right)^2 k_t \ , \ 0 < \eta < 1 \ , \ \omega > 0$$

Variable capacity utilization: $k_t^s = u_t k_t$

The Interest Rate

- Elastic Country Risk Premium following Neumeyer and Perri (2005)

$$\begin{aligned} R_t &= R^* D_t \ , \\ D_t &= G\left(E_t\left[g_{t+1}\right]\right) \end{aligned}$$

$$G(\cdot) = \chi_1 \left(1 + E_t\left[g_{t+1}\right] - \mu\right)^{-\chi_2} \ , \ \chi_1 > 1 \ , \ \chi_2 \geq 0 \ .$$

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- Equivalently, think of changes in R_t as an exogenous shock

Equilibrium

- Given initial conditions k_0 and d_0 and a sequence for productivity growth g_t and news n_t, an *equilibrium* is a sequence of allocations $\{k_{t+1},\ h_t,\ l_t,\ d_{t+1},\ c_t,\ x_t,\ u_t\}_{t=0}^{\infty}$ and prices $\{w_t,\ r_t,\ R_t\}_{t=0}^{\infty}$ such that the allocations solve the firms' and households' problems at the equilibrium prices and all markets clear.
- A *balanced growth equilibrium* is an equilibrium where $[k_{t+1},\ d_{t+1},\ c_t,\ x_t]/\Gamma_{t-1}$ are stationary variables.

Model Calibration to Korea

- Model period equals 6 months
- News arrives 2 periods in advance (N=2).
- I need $N > 1$ for predetermined labor to have an impact.
- Higher N increases computational burden (7 state variables)

Model Calibration to Korea

Technology		
α	0.36	standard
δ	-0.026	depreciation is 0.1
η	0.078	utilization is 1
ϕ	2.5	standard
μ	1.019	to match I/GDP
ω	0.05	Baxter and Farr 2001
Household Preferences		
ψ	0.45	Mendoza 1991
ξ	0.061	to match Debt/GDP
γ	2	standard
Interest Rate		
R^*	$1.05^{0.5}$	US 3m Tbill
χ_1	$1.01^{0.5}$	Korea EMBI spread
χ_2	0.76	to match crisis premium

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- **Peso Problem**:
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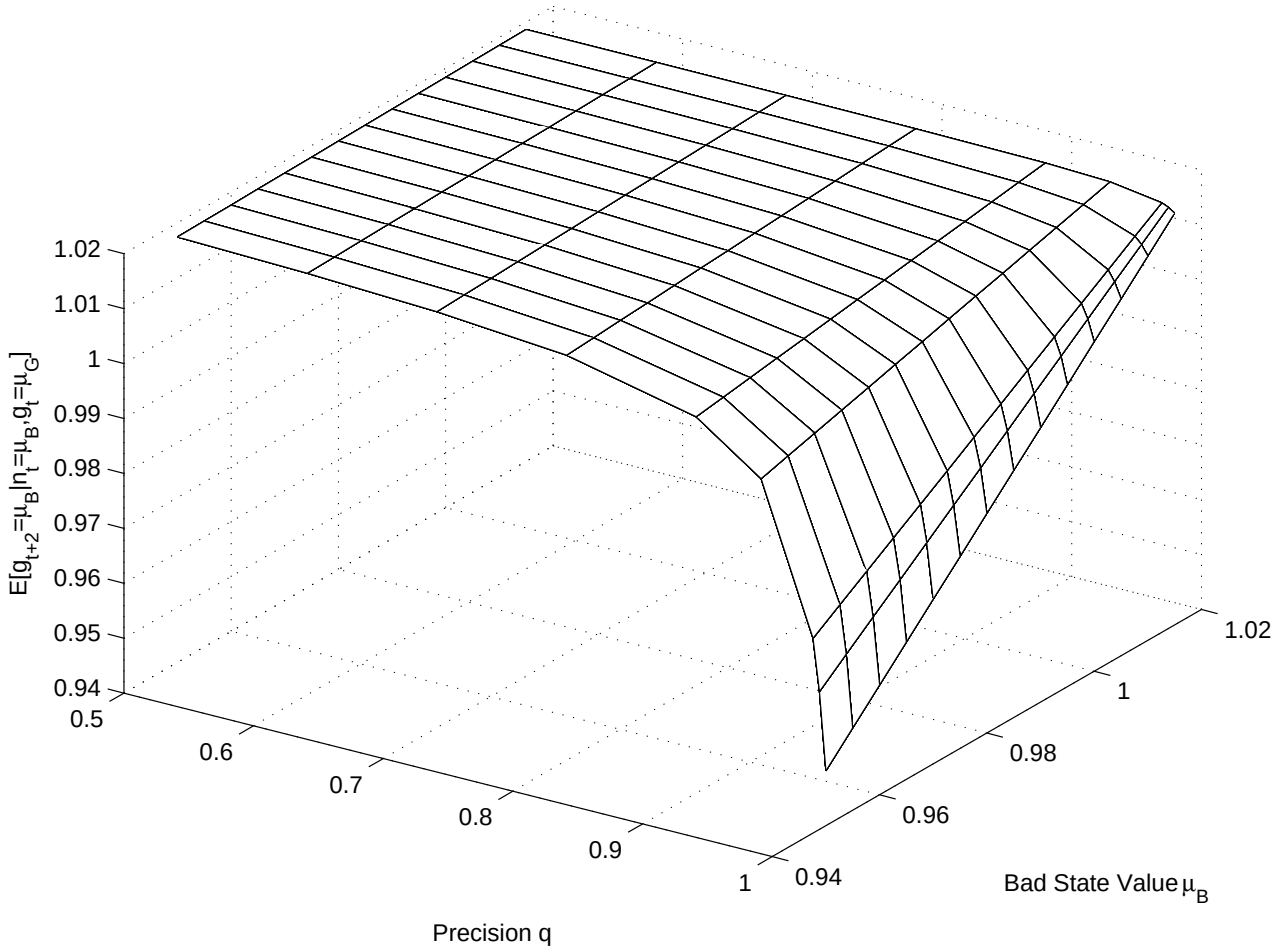
  i.e. the expected duration of the Good state is 50 years.
- Given p_{GG} and μ_G, what is the expectation of g_{t+2} when Bad news arrives?

Expected Productivity Growth in $t+2$ conditional on time t Bad news and current Good technology state.



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- Finally, let $p_{BB} = 0.25$ as a benchmark.
- Bad news arrives every 23 years.

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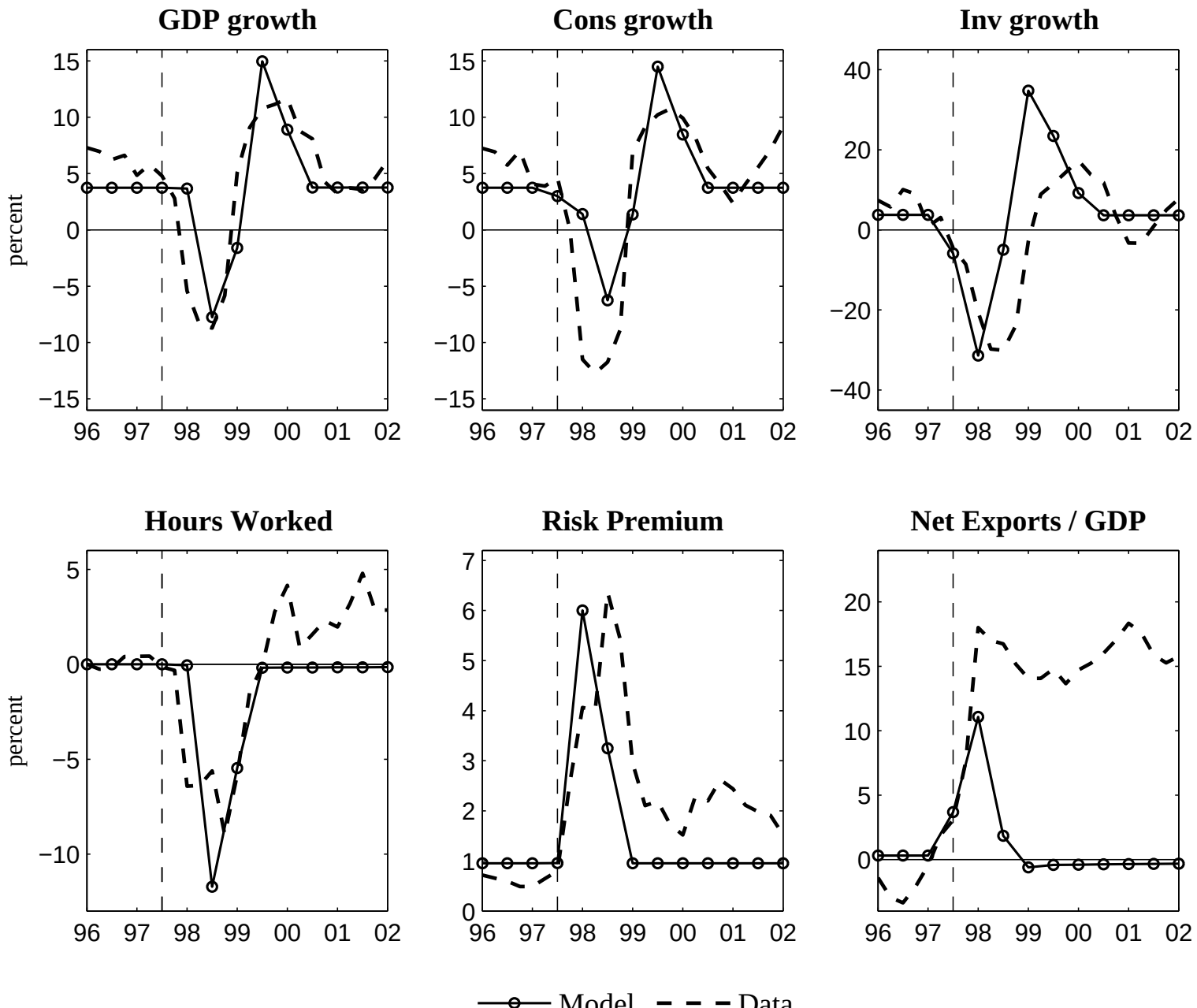
- In period 1998:1, bad news persists (period 1999:1 will be Bad)
- In period 1998:2, economy remains in Good State, news signal switches back to Good.
- Never any change in productivity growth.

Implied Dynamics of Expectations of Productivity Growth

Period		Expected
$t = 1997{:}2$	$\ln g_{t+1}$	1.9%
	$\ln g_{t+2}$	0.0%
$t + 1 = 1998{:}1$	$\ln g_{t+2}$	-1.3%
	$\ln g_{t+3}$	0.0%
$t + 2 = 1998{:}2$	$\ln g_{t+3}$	0.4%
	$\ln g_{t+4}$	1.9%


GDP growth
Cons growth
Inv growth
Hours Worked
Risk Premium
Net Exports / GDP
percent
percent
96 97 98 99 00 01 02
Model
Data

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- Large decline in hours and output
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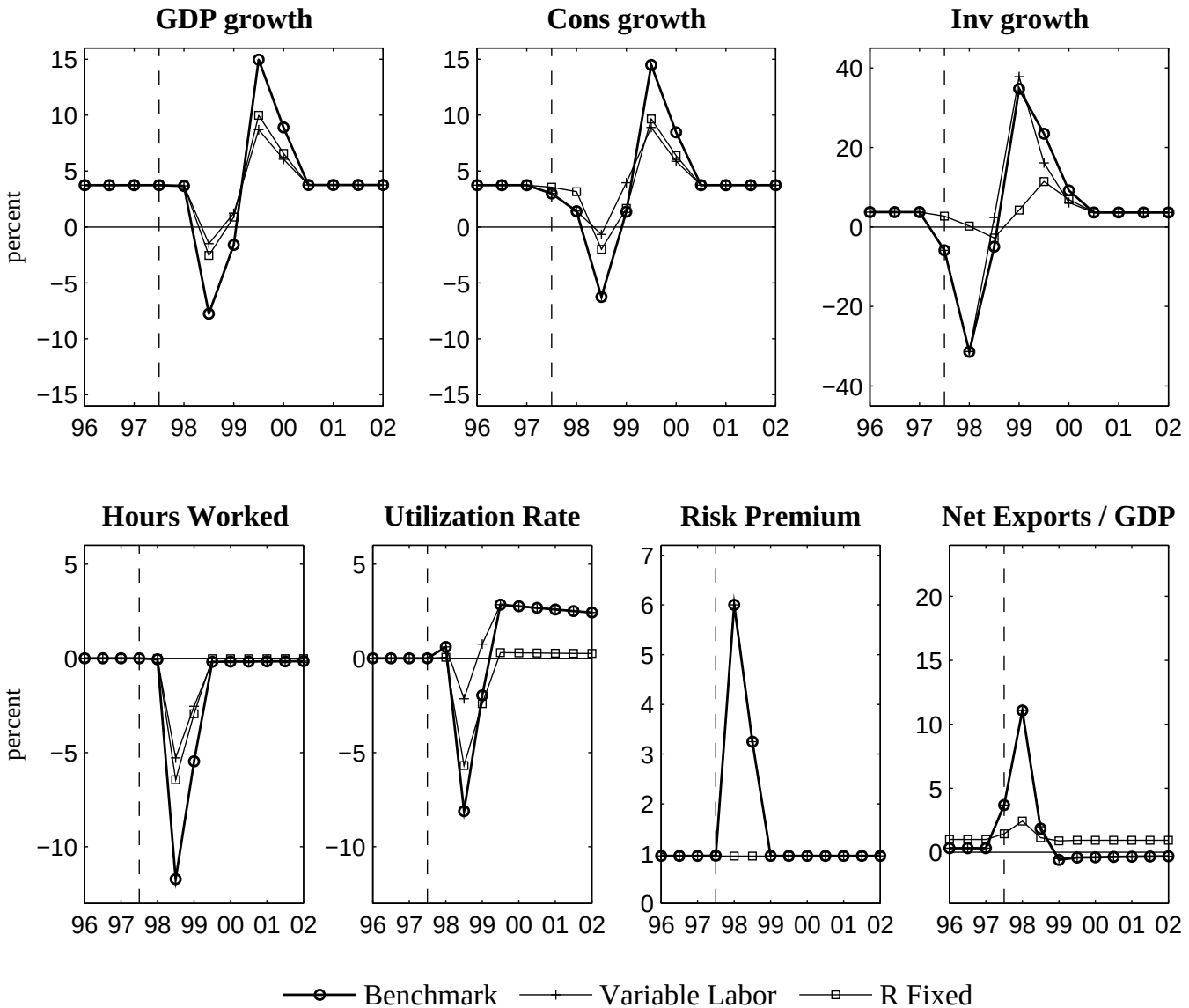
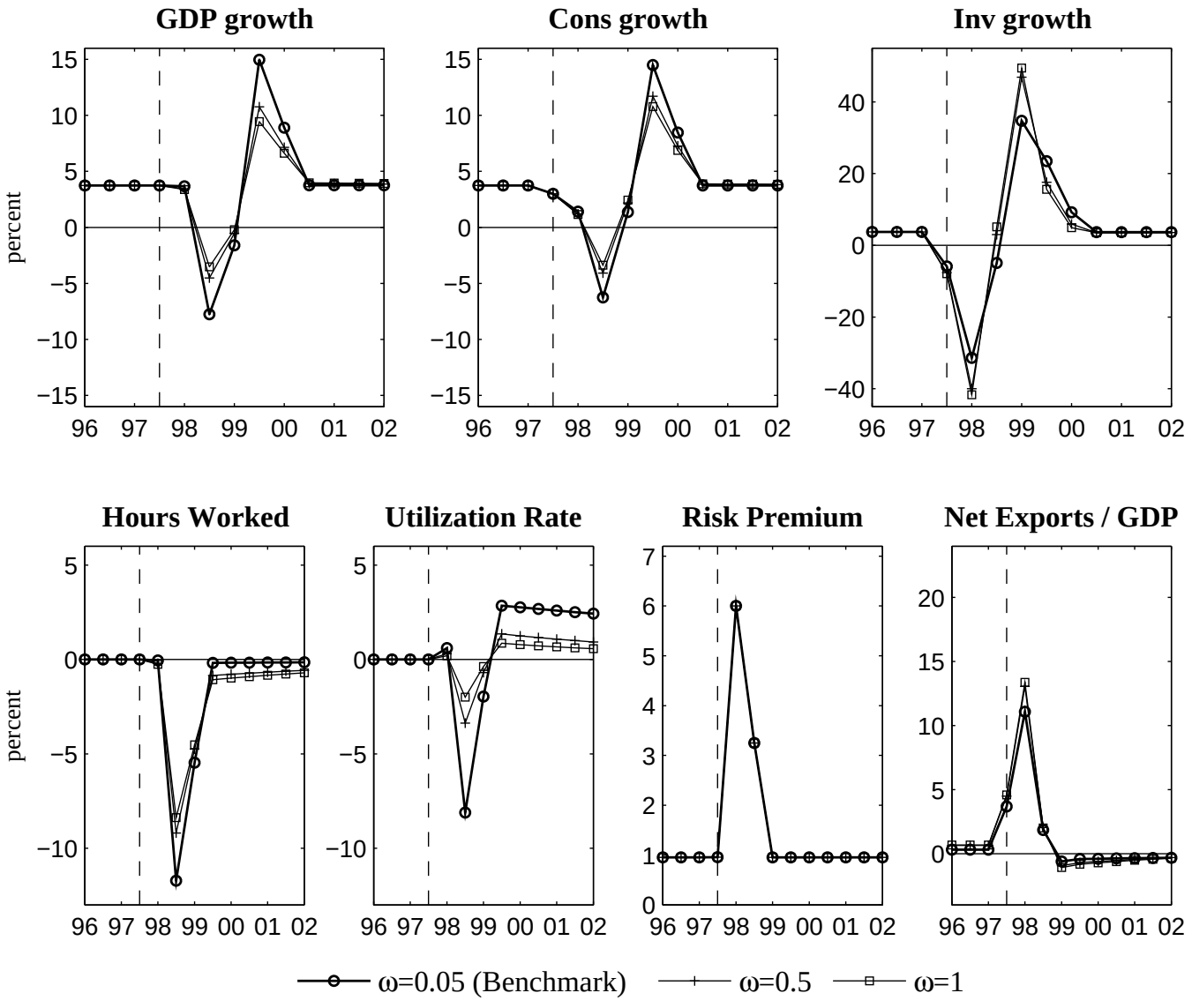
- Large decline in investment
  - Lower rental rate of capital (hours and productivity decrease)
  - Bond interest rate increase
  - Wealth effects

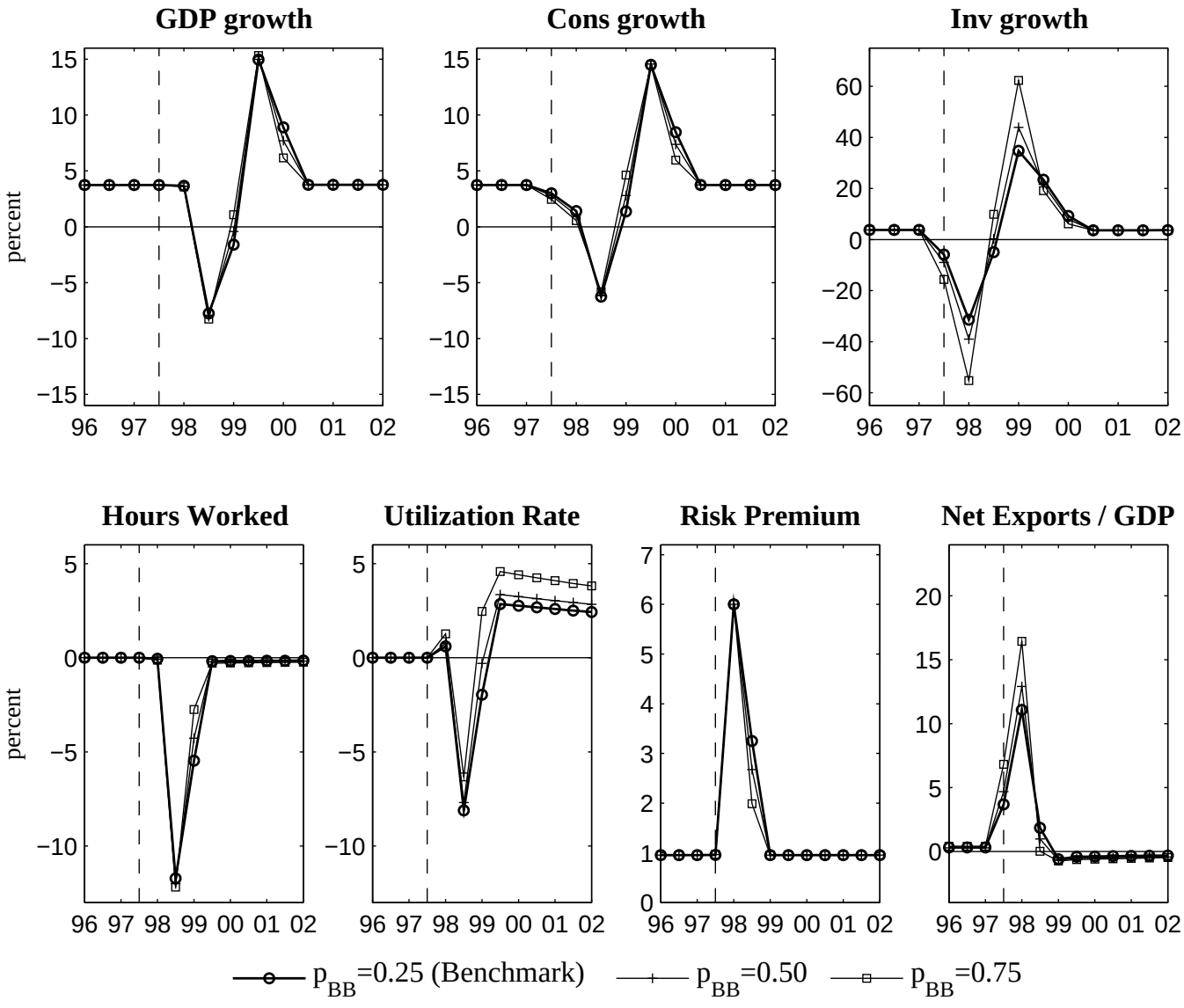
Relative Importance of Amplification Mechanisms



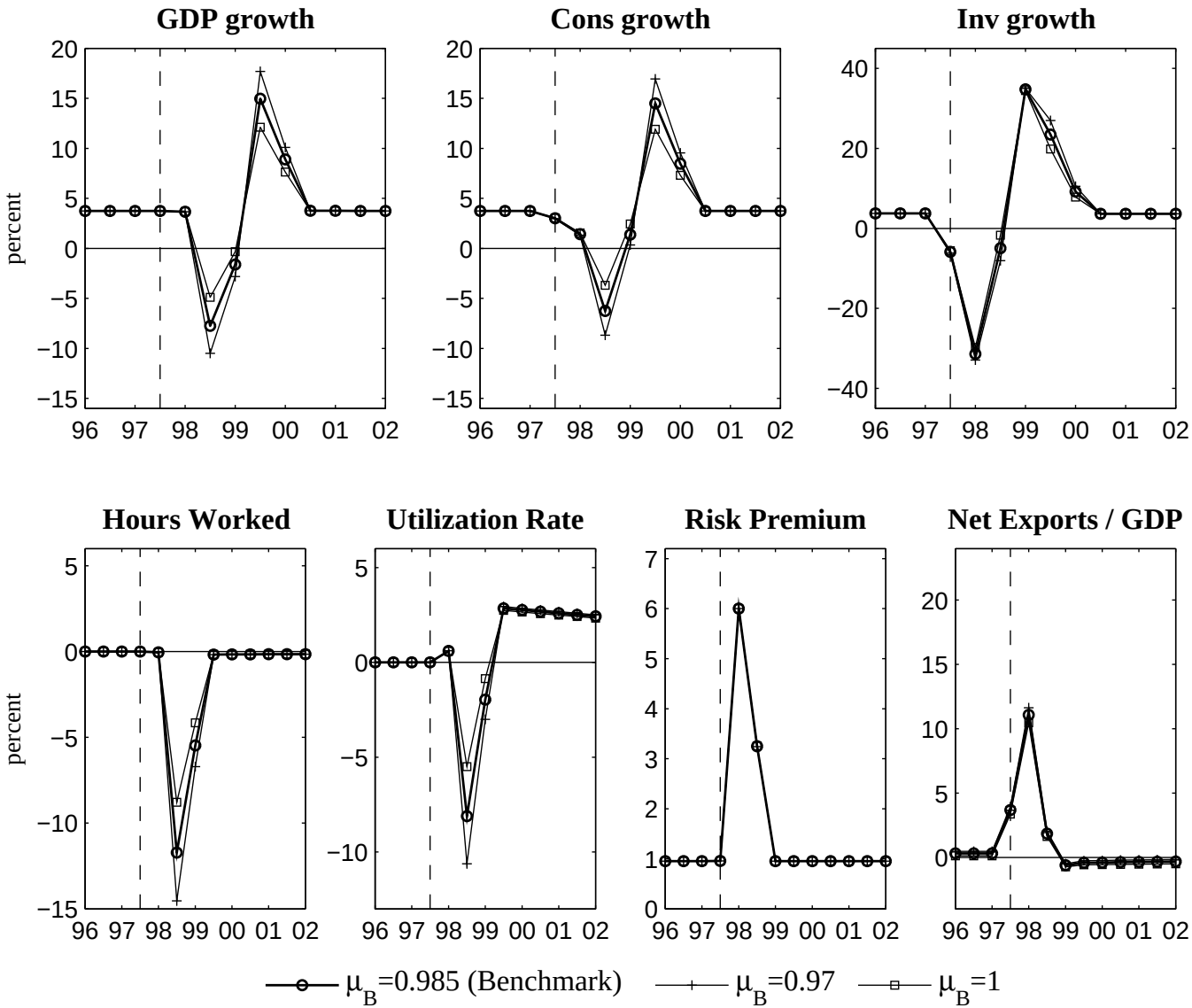
Role of Variable Capacity Utilization



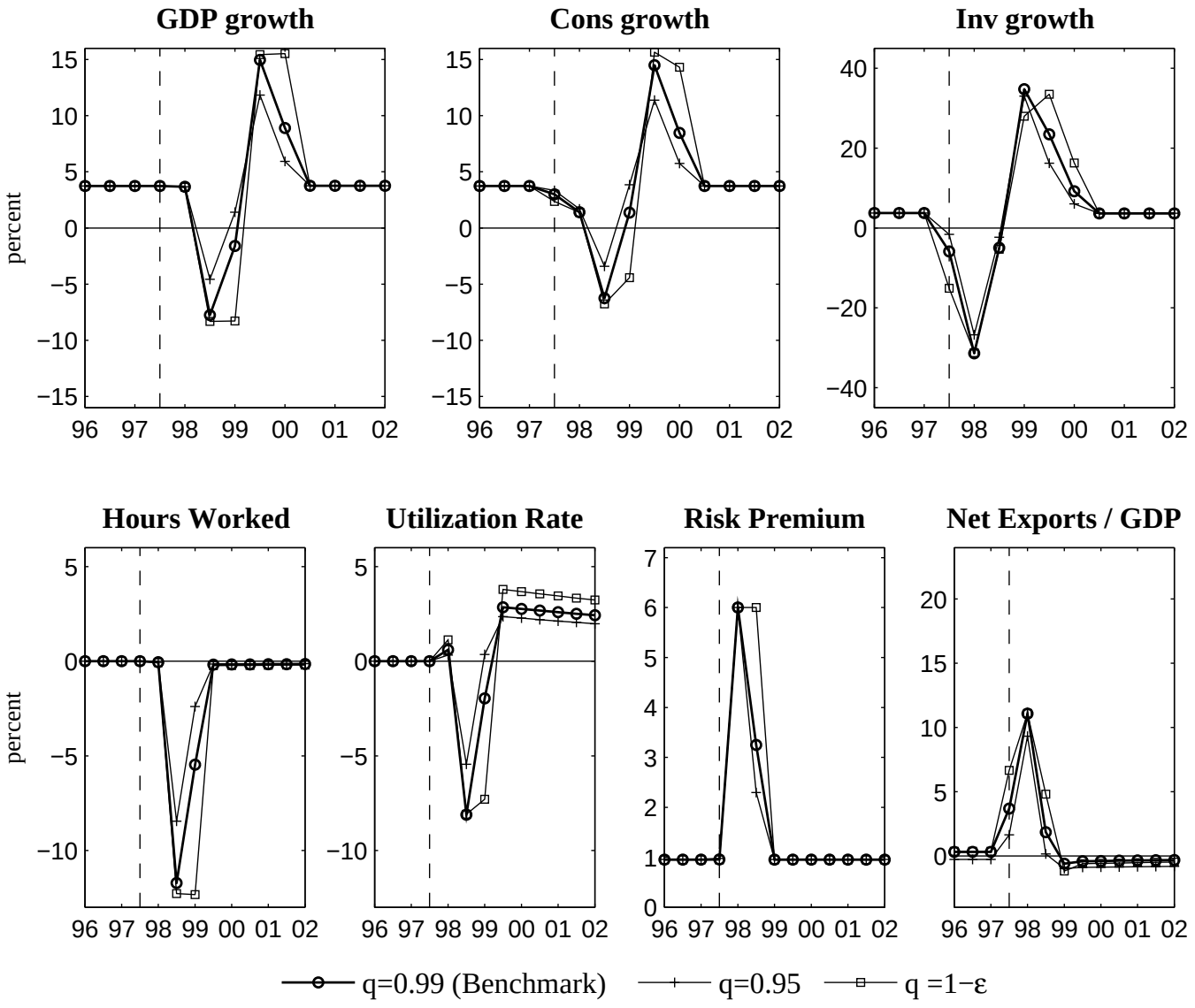
Robustness on p_{BB}



Robustness on μ_B



Robustness on q



Conclusion

- **Bad News Shock**: Relatively straightforward to get increase in net exports, decrease in output, hours, consumption and investment (Rebelo and Jaimovic 2007).
- To be quantitatively successful, I need all of the amplification mechanisms.
- Some issues of timing.
- Cannot explain persistence of net exports.