Lumpy Trade and Large Devaluations

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Our goal:

Understand Δs in imports & prices after large devaluations

- Devaluation: large increase in relative price of imports at dock
    - Slow increase in import prices at retail level
    - Large nx reversals caused by large drop in imports
    - Large drop in extensive margin of trade: # varieties imported

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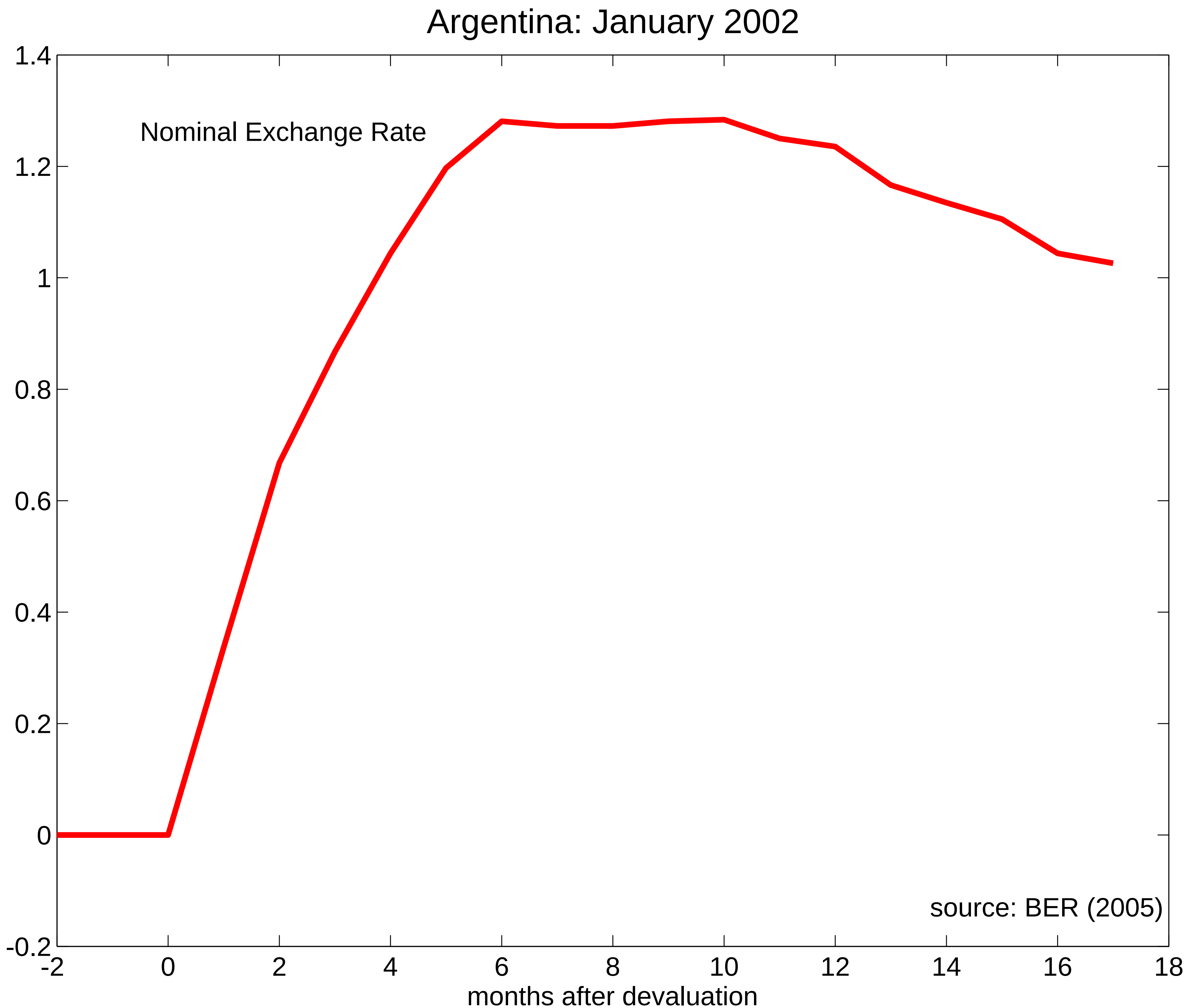
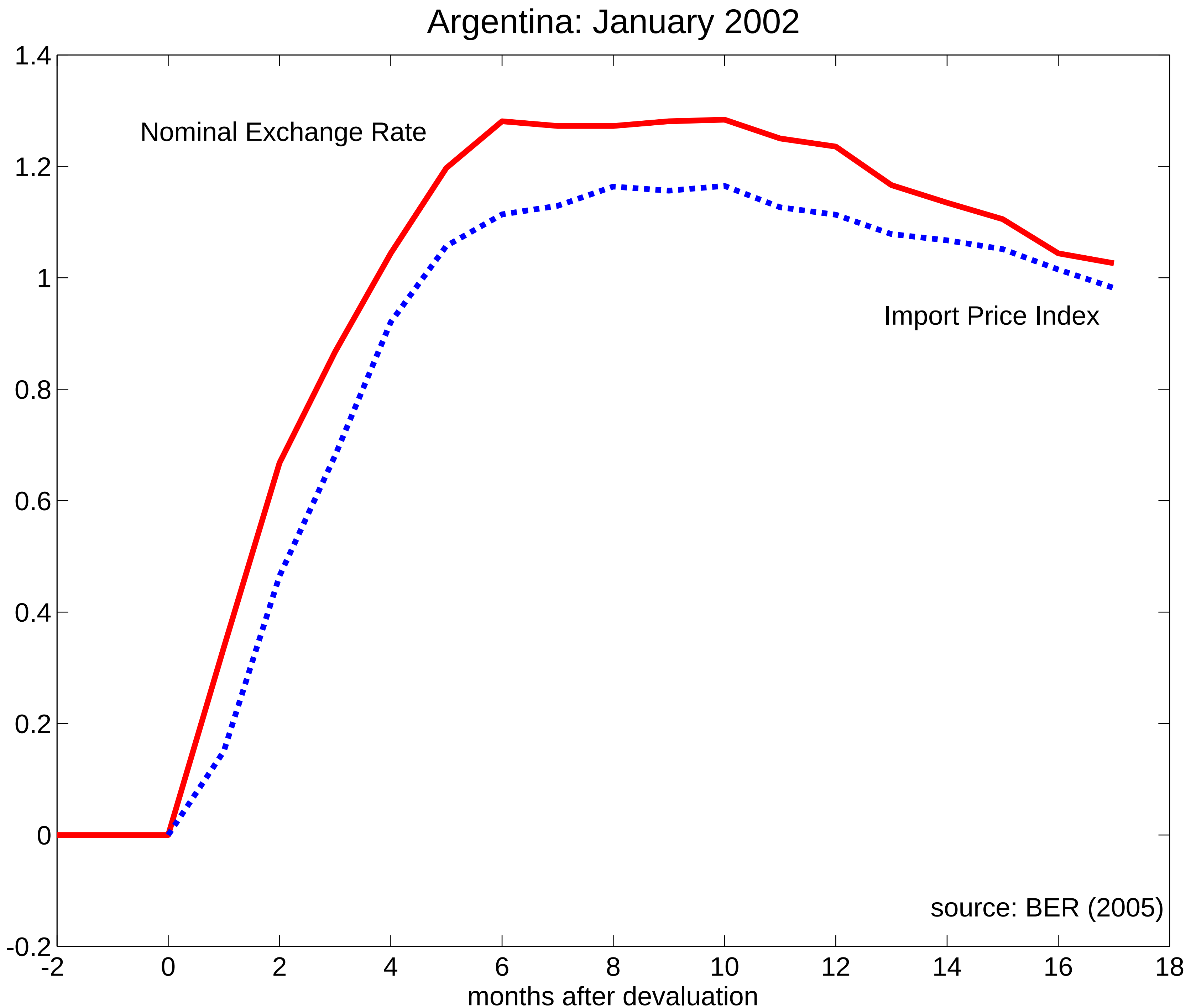


Argentina: January 2002
Nominal Exchange Rate
source: BER (2005)
months after devaluation
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-2
0
2
4
6
8
10
12
14
16
18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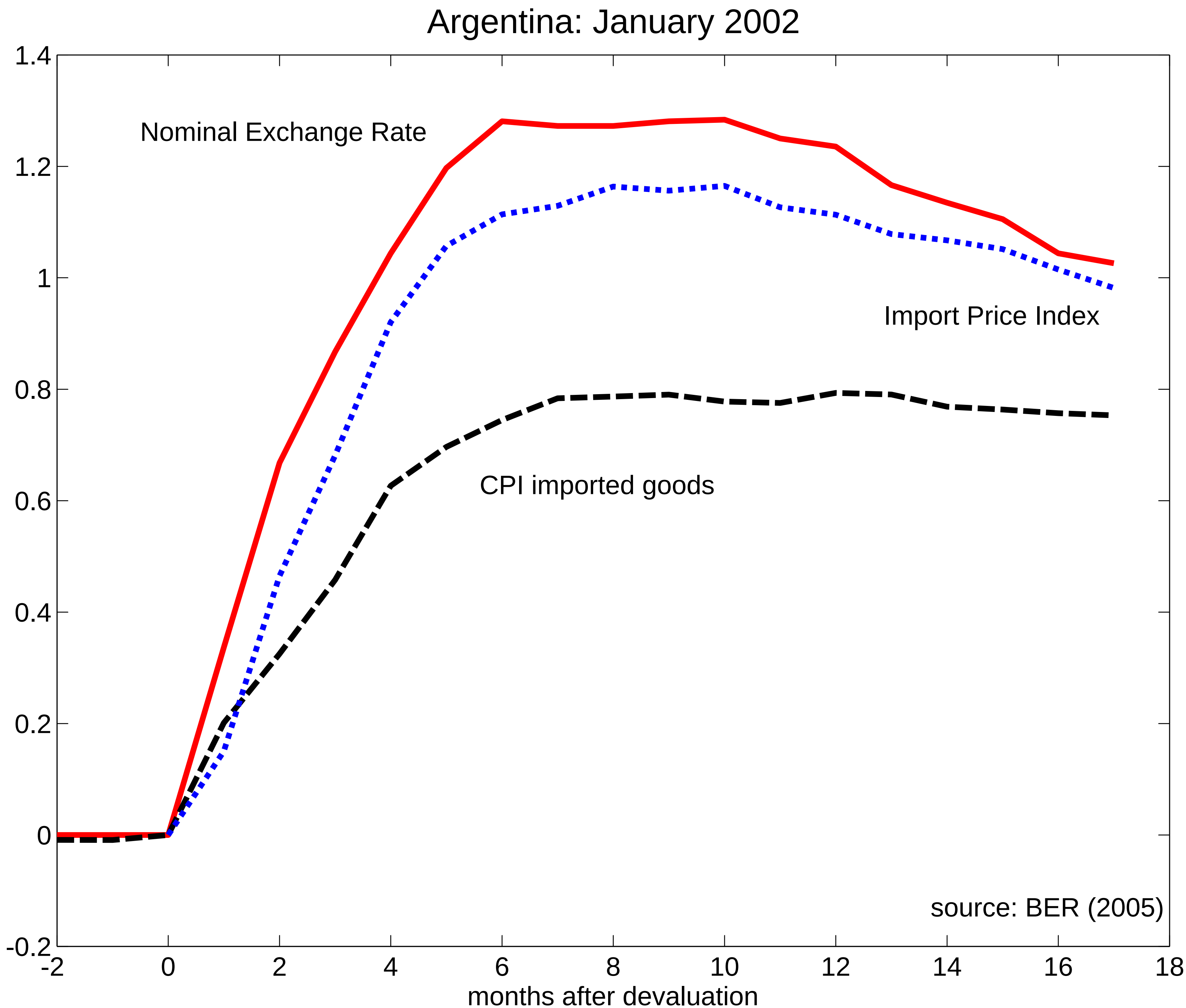
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Nominal Exchange Rate
Import Price Index
CPI imported goods
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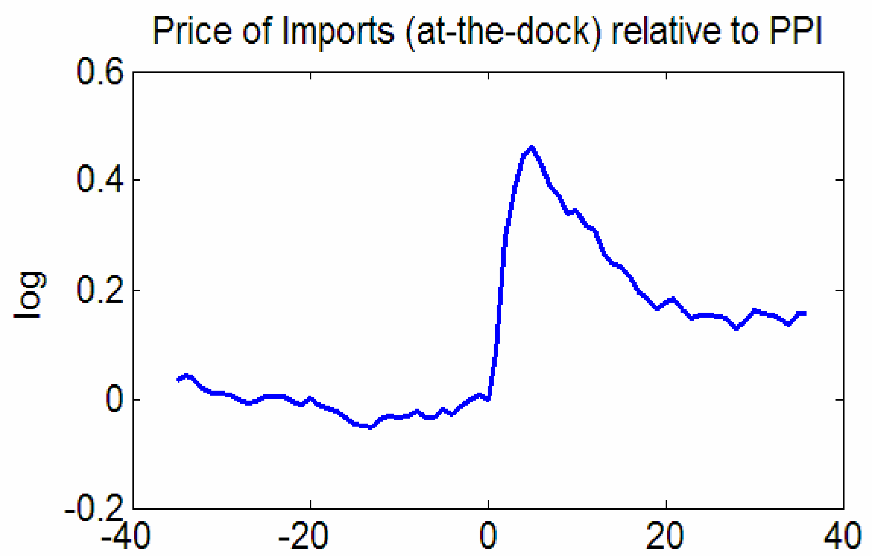

Months after devaluation

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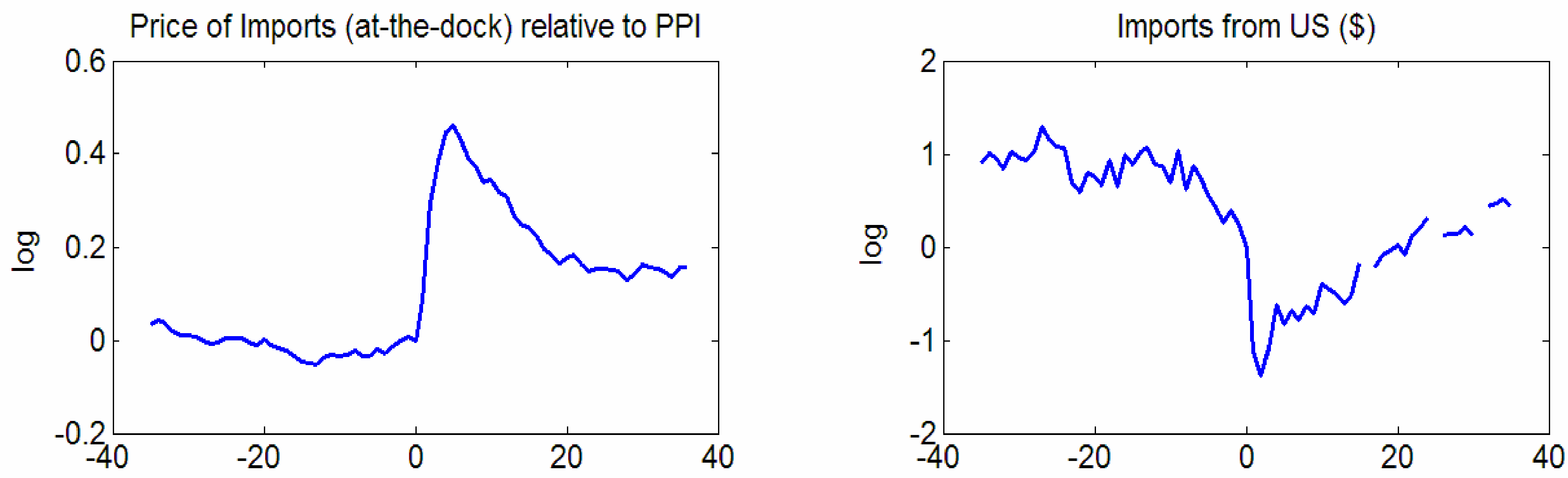

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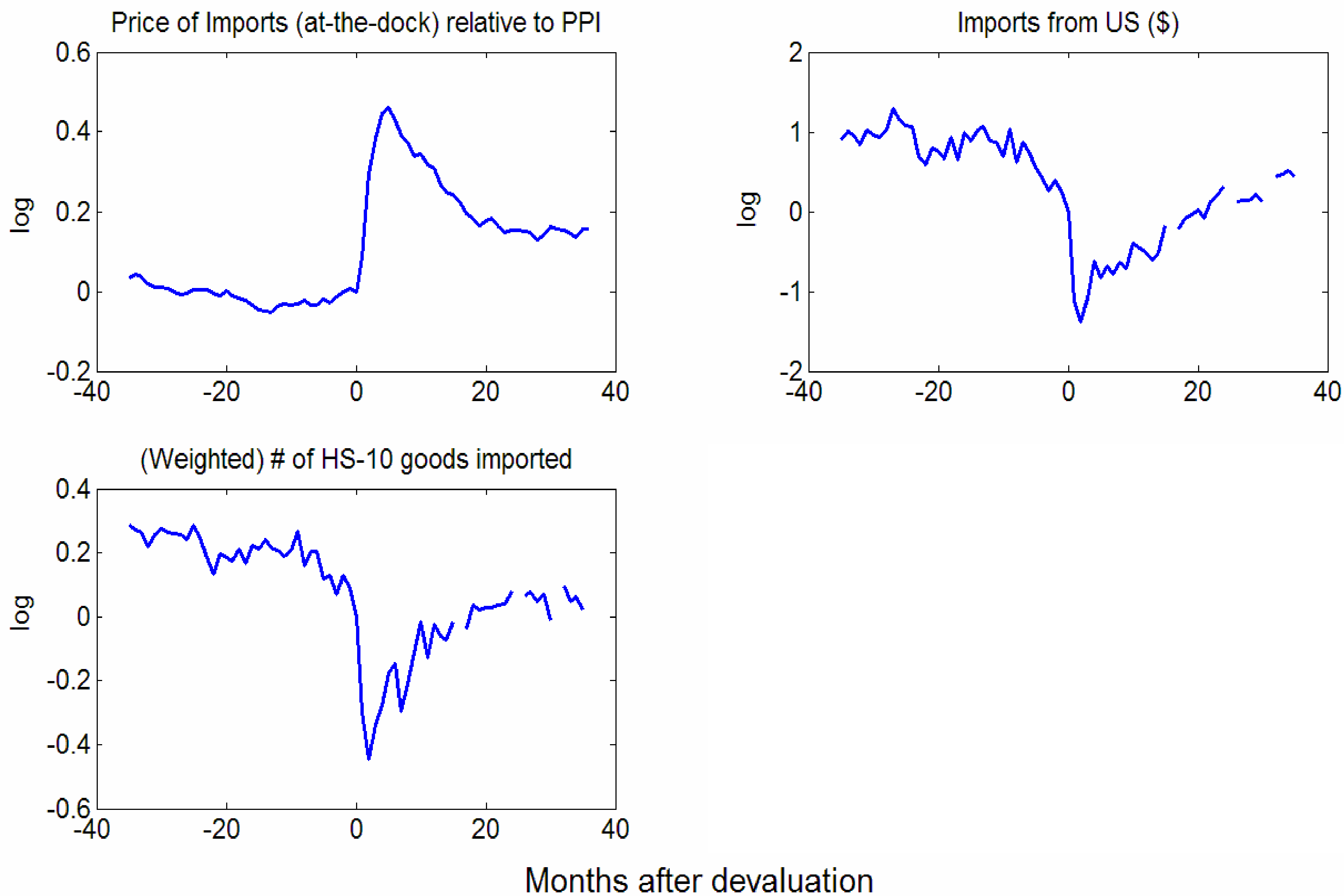

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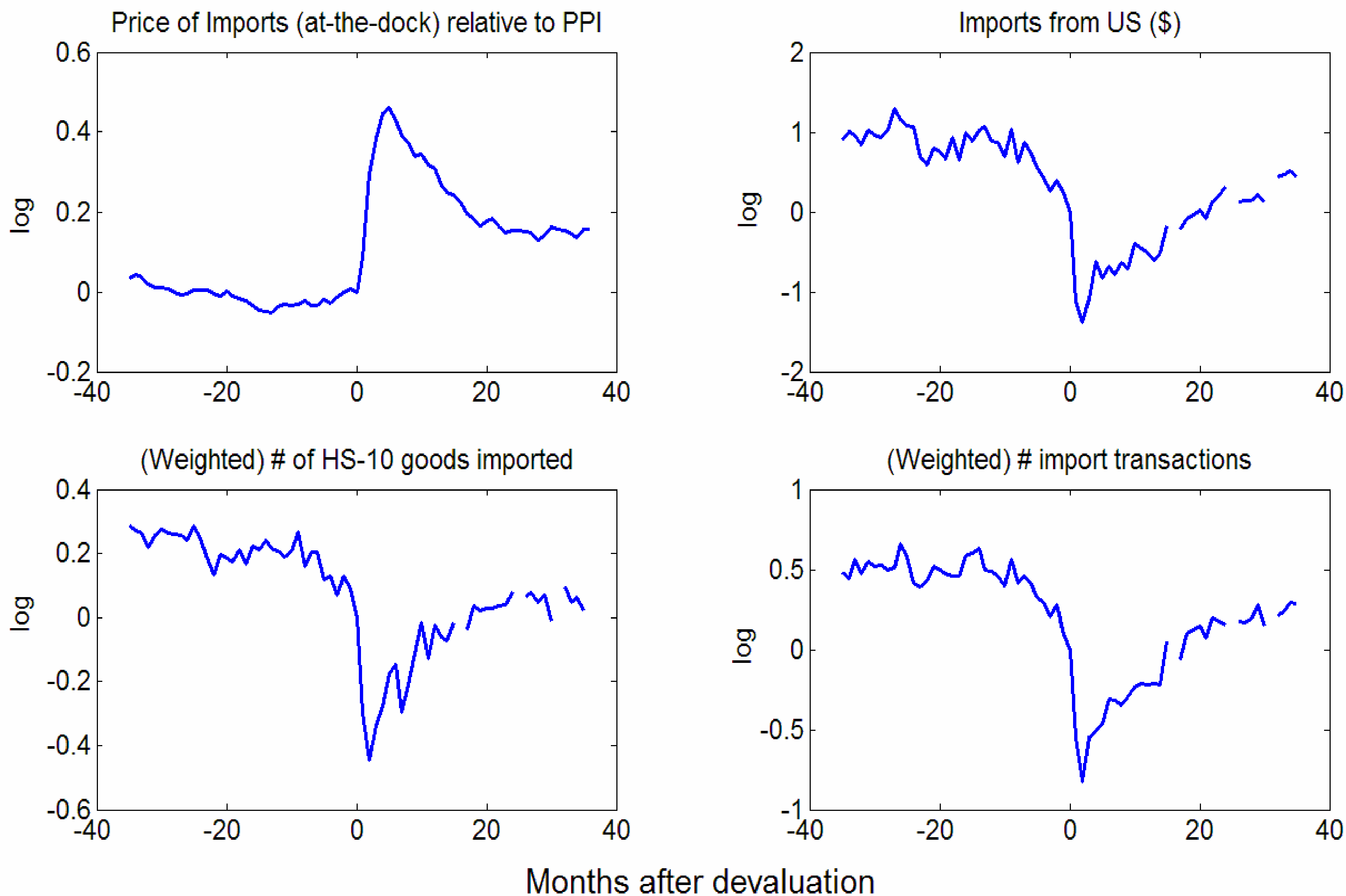

Our story:

Trade lags & fixed costs: inventory-management problem

- Problem more severe in large devaluations
- Optimal to disinvest in inventories
    1. Stop importing
    2. Keep retail prices low

Document 2 trade fictions

- Lags btw orders and delivery: 6-8 weeks
  - Hummels '99: documents shipping lags
    - 2-6 weeks by vessel, 1 day by air
    - most trade with developing countries by vessel: $\approx$ 70%
  - World Bank survey:
    - Customs/paperwork: 2-5 weeks
- Fixed costs of international trade
  - World Bank survey: 7-17 % of median shipment

Direct evidence of importer inventory problem

- Trade is lumpy and infrequent
  - Using monthly US export data at HS-10 level:
    - Goods imported every 2 months
    - Typical good: top month accounts $\frac{1}{2}$ yearly imports
    - Not due to seasonalities
  - Using micro-data on purchases of US steel center (Hall-Rust)
    - Imported goods 2× larger/infrequent than domestic goods
- Importers hold larger inventories
  - Using Chilean plant level data (Roberts-Tybout)
    - Non-importer holds 2 mos., 100 % importer holds 4.2 mos

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Model

- Partial equilibrium problem of monopolistic importer
- Good is storable, depreciates at rate δ
- Fixed cost f to import $i > 0$ units of good
- One period lag between orders and delivery
- One unit of imports costs ω
- Consumer demands $q(p) = vp^{-\theta}$ if charge price p
- v: taste shock

Importer's problem

- State variables: s: stock of inventory, v: taste shock
- Static gross profit: $py - \omega i - f$
- Firm sells $y = \min\left(vp^{-\theta}, s\right)$
- Law of motion for states:
  - $s' = \left(s - \min\left(vp^{-\theta}, s\right) + i\right)(1-\delta)$
  - $log(v') \sim iid\ N(0, \sigma_v^2)$

Firm's dynamic program

$$V(s,v) = \max(V^a - f, V^n)$$

- Adjust inventory (import)

$$V^a(s,v) = \max_{i>0,p} \left\{ p \min\left(vp^{-\theta}, s\right) - \omega i + \beta EV\left(s', v'\right) \right\}$$

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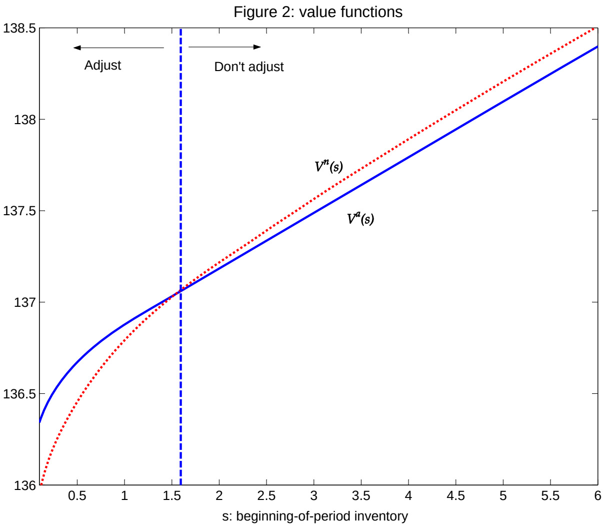
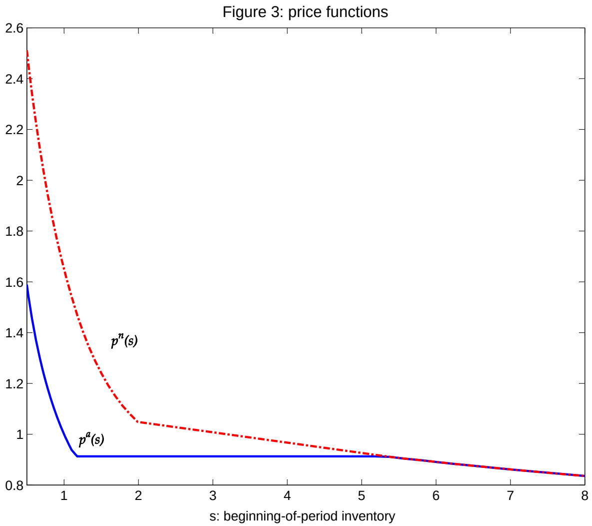
Value functions



Optimal policy rules: prices



Our question

- Can model account for patterns of trade after devaluations?

- Aggregate importer decision rules

  - according to ergodic SS distribution of (s, v)

Parameterization

- Moments in data and model

	Data	Model
Hirschmann-Herfindhal ratio	0.44	0.45
Inventory turnover ratio	0.36	0.35

- Parameter values

Fixed cost, % of shipment value	4.9%
Std. dev. of v	1.1

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How does model economy respond to devaluation?

- Devaluation:
  - Permanent 50% increase in wholesale price of imports
    - $\omega = 1 \rightarrow \omega = 1.5$
  - Permanent drop in discount factor
    - $\beta = 0.94 \rightarrow \beta = 0.7$
- Compare decision rules in pre- and post-crisis steady-states
- Compute transitions

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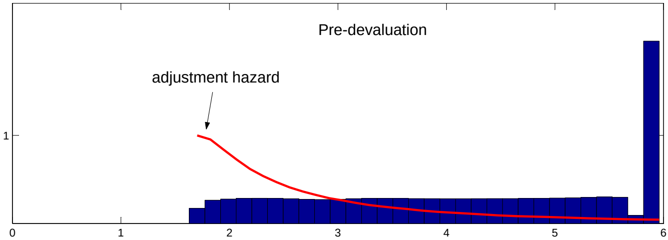
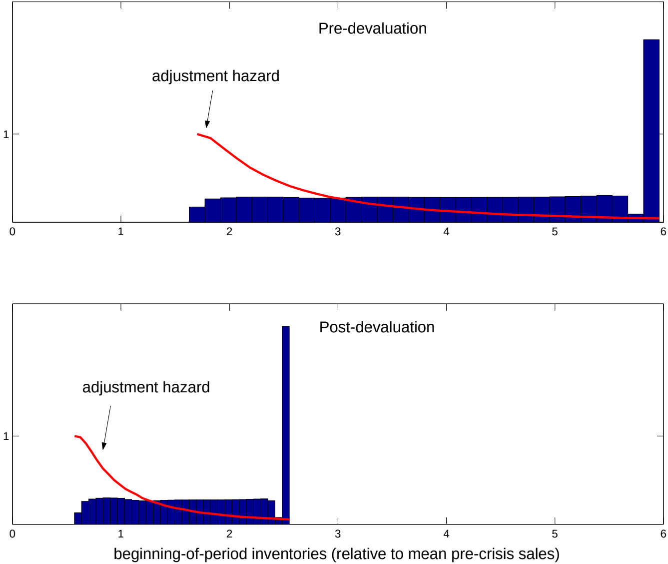
Inventory holdings and adjustment hazards



beginning-of-period inventories (relative to mean pre-crisis sales)

Inventory holdings and adjustment hazards



Prices

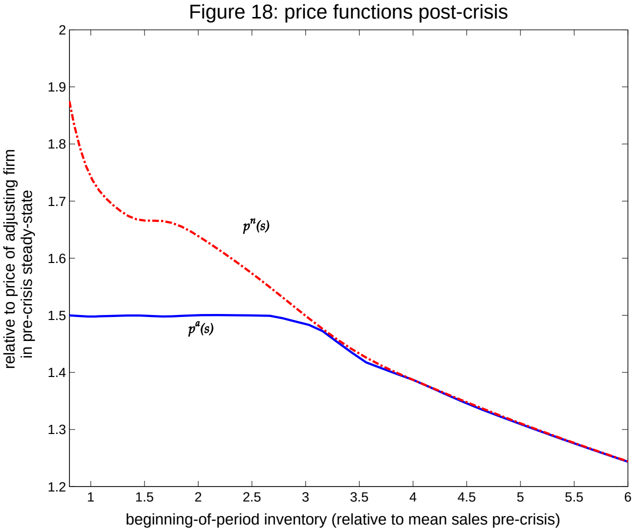
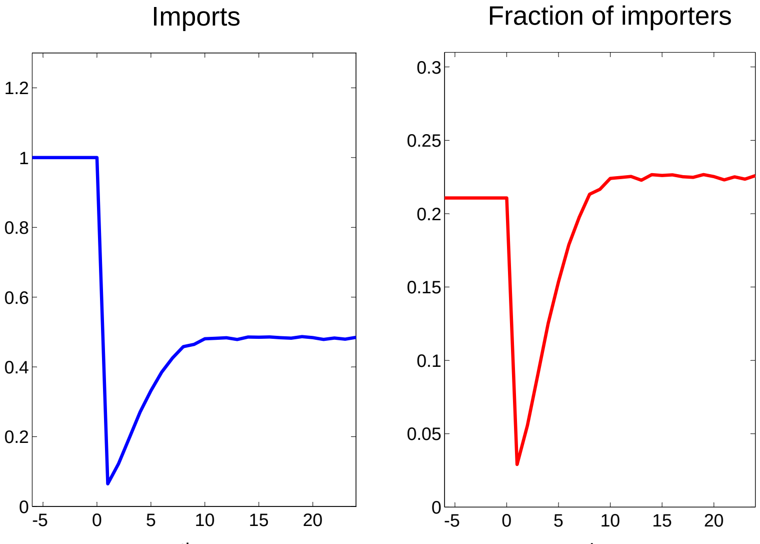


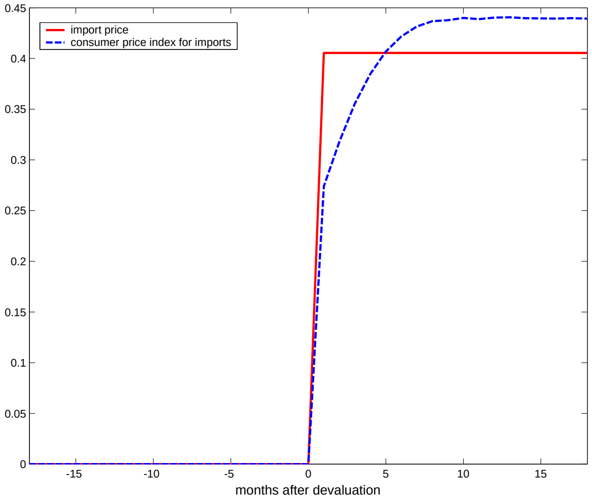
Figure 18: price functions post-crisis
relative to price of adjusting firm
in pre-crisis steady-state
beginning-of-period inventory (relative to mean sales pre-crisis)
$p^n(s)$
$p^a(s)$
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6

Transition


Imports
1.2
1
0.8
0.6
0.4
0.2
0
-5
0
5
10
15
20
Fraction of importers
0.3
0.25
0.2
0.15
0.1
0.05
0
-5
0
5
10
15
20

Transition

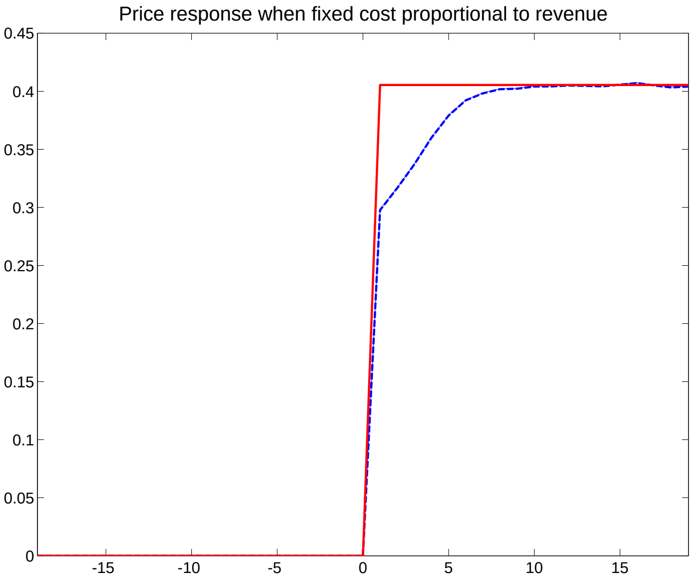
Figure 20: Mean price charged by importers



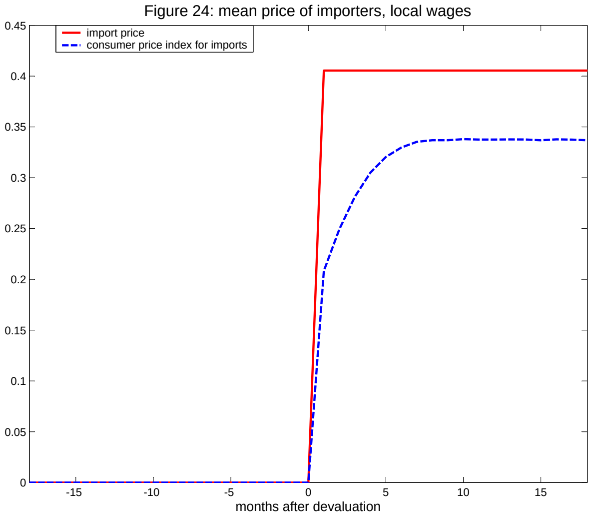
Conclusions

- We document 2 types of trade costs:
  - Lags btw orders and delivery (depreciation)
  - Fixed costs of importing
- Develop model where lumpy trade optimal response to these costs
- Dynamics very different from iceberg trade cost model
  - Consistent with trade/price dynamics after devaluations

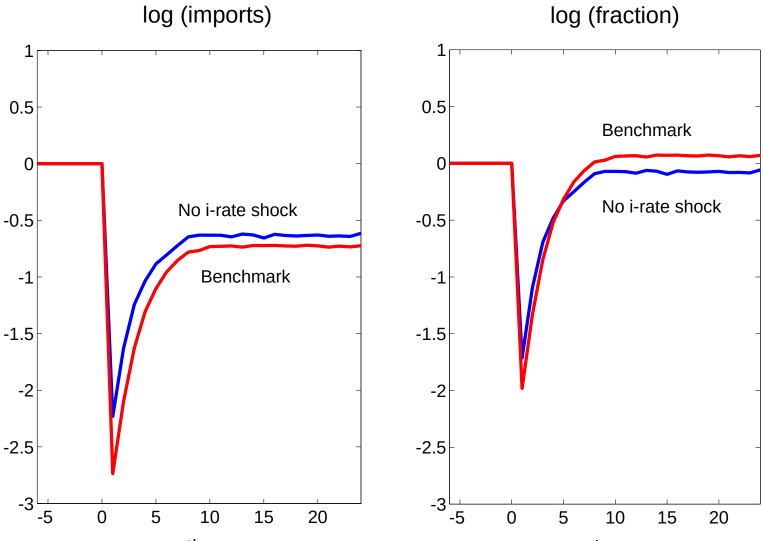
Price response when fixed costs proportional to revenues



Alternatively: price response when 25 % labor share



No change in discount factor



High elasticity experiment

$$q(p) = v\left(\frac{p}{P_m}\right)^{-\gamma} P_m^{-\theta}$$

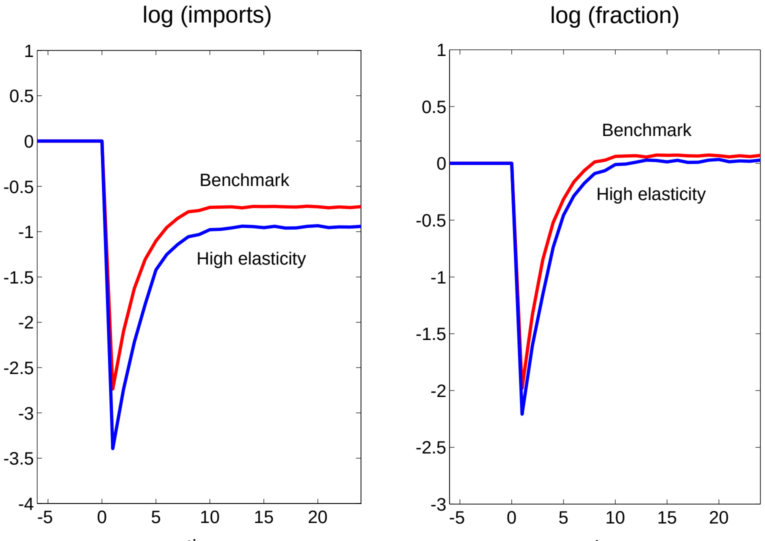
- P_m: aggregate import price
- Keep θ=1.5, set γ =4
- Hummels '01, Gallaway '03, Broda & Weinstein '05
- Recalibrate to match moments in data

High elasticity

- Parameter values

	Benchmark	High elast.
Fixed cost, % of shipment value	4.9%	2.5%
Std. dev. of v	1.1	1.7

High elasticity

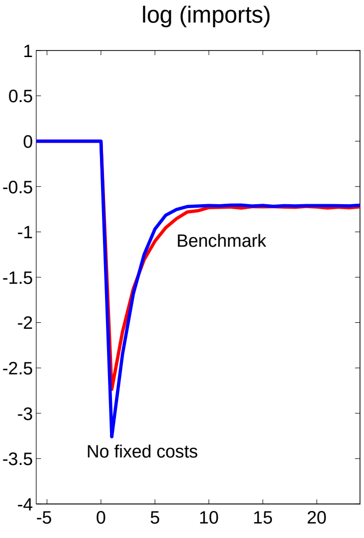


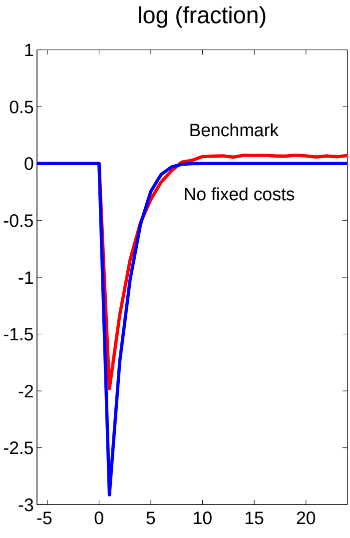
Fixed costs vs. time-to-ship

- Isolate role of two frictions
- Set $f = 0$, keep same variance of demand

	Benchmark	No fixed cost
Hirschmann-Herfindhal ratio	0.45	0.14
Inventory turnover ratio	0.35	0.30

Economy with no fixed cost





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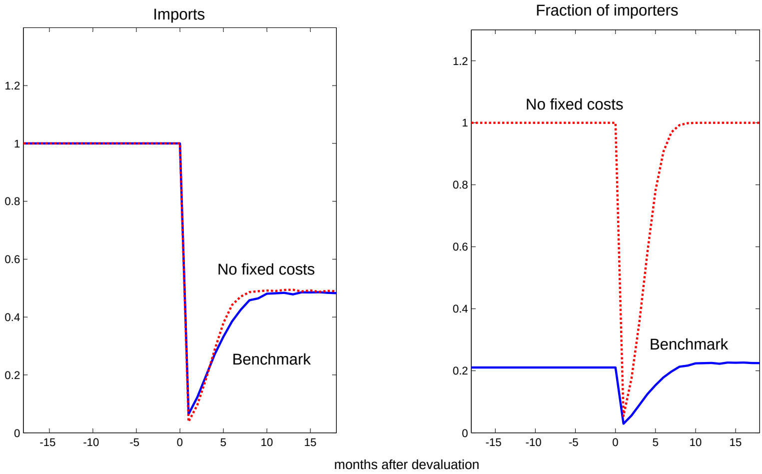

Economy with no lags in shipping

- No lag between orders and delivery
- $y = \min\left(vp^{-\theta}, s + i\right)$
- Same variance of demand
- Calibrate f to match HH

No lags

- Moments in data and model

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