Lumpy Trade and Large Devaluations

George Alessandria       Joe Kaboski       Virgiliu Midrigan

FRB Philadelphia       Ohio State       NYU

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Our goal:

Understand $\Delta$s 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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Nominal Exchange Rate

months after devaluation

Argentina: January 2002

source: BER (2005)
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Nominal Exchange Rate

Import Price Index

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CPI imported goods

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Argentina, January 2002

Price of Imports (at-the-dock) relative to PPI

log

Months after devaluation
Argentina, January 2002

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Imports from US ($)

Months after devaluation
Argentina, January 2002

Price of Imports (at-the-dock) relative to PPI

Imports from US ($)

(Weighted) # of HS-10 goods imported

Months after devaluation
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 $2 \times$ 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 $\delta$
- Fixed cost $f$ to import $i > 0$ units of good
- One period lag between orders and delivery
- One unit of imports costs $\omega$
- 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:
  - $s' = (s - \min\left( vp^{-\theta}, s \right) + i) (1 - \delta)$
  - $\log(v') \sim iid \ N(0, \sigma_v^2)$
Firm’s dynamic program

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

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

- Not adjust inventory
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Figure 2: Value functions

Value functions $V^a(s)$ and $V^i(s)$, where $s$ represents the beginning-of-period inventory.

- **$V^a(s)$**: Adjust inventory.
- **$V^i(s)$**: Don't adjust inventory.

The graph shows the value functions for different inventory levels, illustrating the impact of adjusting versus not adjusting inventory.
Optimal policy rules: prices

Figure 3: price functions

\( p^n(s) \)
\( p^d(s) \)

\( s: \) beginning-of-period inventory
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

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• Parameter values

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- **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

Pre-devaluation

adjustment hazard

beginning-of-period inventories (relative to mean pre-crisis sales)
Inventory holdings and adjustment hazards

Pre-devaluation

Post-devaluation

beginning-of-period inventories (relative to mean pre-crisis sales)
Figure 18: price functions post-crisis

Beginning-of-period inventory (relative to mean sales pre-crisis)

Relative to price of adjusting firm in pre-crisis steady-state

$p^n(s)$

$p^a(s)$
Transition

Imports

Fraction of importers
Figure 20: Mean price charged by importers

- **import price**
- **consumer price index for imports**

(months after devaluation)
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

log (imports)

log (fraction)
High elasticity experiment

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

- \( P_m \): aggregate import price
- Keep \( \theta = 1.5 \), set \( \gamma = 4 \)
- Hummels ’01, Gallaway ’03, Broda & Weinstein ’05
- Recalibrate to match moments in data
## High elasticity

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High elasticity
Fixed costs vs. time-to-ship

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

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Economy with no fixed cost

log (imports)

log (fraction)

Benchmark

No fixed costs
Economy with no fixed cost

Imports

Fraction of importers

months after devaluation
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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