Exchange Rates, Prices, and Trade: Theory and Microdata

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Exchange Rate Passthrough: Theory

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RER, PPP, and LOP

- Real Exchange Rate (RER) between home and foreign (*):
  \[ Q_t = \frac{P_t}{E_t P_t^*}, \]
  and \( Q_t = 1 \) under purchasing power parity (PPP).

- Separating Traded (T) and Non-Traded (N) Sectors:
  \[ Q_t = \left( \frac{P_t^T}{E_t P_t^{T,*}} \right)^\alpha \left( \frac{P_t^N}{E_t P_t^{N,*}} \right)^{1-\alpha}, \]
  where \( P_t = (P_t^T)^\alpha (P_t^N)^{1-\alpha} \) and same for foreign price index.

- If Law of One Price (LOP) holds, the traded term won’t matter. But it does.
Exchange Rate Passthrough (ERPT)

- Imagine country $i$ imports $z$ from country $j$. LOP requires: $P_{i,t}(z) = E_t P_{j,t}(z)$

- This motivates ERPT regression:

$$\Delta p_{i,t} = \beta \Delta e_t + \gamma \Delta p_{j,t} + \epsilon_{i,j,t},$$

where $x = \ln X$ and $\Delta p_{j,t}$ sometimes set to 0 or proxied with price index.

- LOP implies "complete" passthrough, i.e. $\hat{\beta} = 1$ (and $\hat{\gamma} = 1$). But often, $\hat{\beta} < 1$. 
Why Do We Care?

- Shock transmission in open-economy models
- Optimal policy (monetary, trade)
- Globalization, competition, and productivity
- Inflation dynamics
Consider first-order condition for foreign exporter setting (dollar) price in U.S.:

\[ P = \frac{\varepsilon}{\varepsilon - 1} (MC \times E), \]

with elasticity of demand \( \varepsilon = -\frac{dQ}{Q} \frac{dP}{P} \) and foreign-currency marginal cost \( MC \).

In log-differences, we have:

\[ \Delta p = \Delta \mu + \Delta (mc) + \Delta e, \]

where log markup \( \mu = \ln \left( \frac{\varepsilon}{\varepsilon - 1} \right) \). Think:

\[ \frac{dp}{de} = 1 + \frac{d\mu}{de} + \frac{d(mc)}{de}. \]

\( ERPT \neq 1 \) if there is change in markups (\( \Delta \mu \neq 0 \)) or marginal costs (\( \Delta mc \neq 0 \)).
Demand Systems to Generate Variable Markups

▶ Constant elasticity of substitution (CES) does not generate variable markups:

\[ C = \left( \int_v (C_v)^{\frac{\sigma-1}{\sigma}} \, dv \right)^{\frac{\sigma}{\sigma-1}} \implies \varepsilon = \sigma, \ \Delta \mu = 0 \]

▶ Nested CES does generate variable markups

\[ C = \left( \int_v (C_v)^{\frac{\sigma-1}{\sigma}} \, dv \right)^{\frac{\sigma}{\sigma-1}}, \ C_v = \left( \sum_z (C_z)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}} \]

▶ Price competition: \( \varepsilon = s_z \sigma + (1 - s_z) \eta, \ \Delta \mu \neq 0 \)

▶ Quantity competition: \( \varepsilon = \left( s_z \frac{1}{\sigma} + (1 - s_z) \frac{1}{\eta} \right)^{-1}, \ \Delta \mu \neq 0 \)

See Atkeson and Burstein (2008)
Demand Systems to Generate Variable Markups

- Linear demand does generate variable markups:
  \[ C = C_0 + \alpha \int q_z dz - \frac{\gamma}{2} \int (q_z)^2 dz - \frac{\eta}{2} \left( \int q_z dz \right)^2 \implies \varepsilon = \left( \frac{p_{\text{max}}}{p_z} - 1 \right)^{-1}, \Delta \mu \neq 0 \]
  See Melitz and Ottaviano (2008)

- (Symmetric) Translog demand does generate variable markups:
  \[ p \cdot c = c + \alpha_0 + \sum_z \alpha_z p_z + \frac{1}{2} \sum_z \sum_y b_{yz} p_y p_z \implies \varepsilon = 1 + b_{yz} \frac{N - 1}{s_z}, \Delta \mu \neq 0 \]
  See Bergin and Feenstra (2009)

- Klenow and Willis (2006) demand does generate variable markups
  \[ D_z = (1 - \eta (p_z - p))^{\frac{\sigma}{\eta}} \implies \varepsilon = \sigma / (1 - \eta (p_z - p)), \Delta \mu \neq 0 \]
  See Gopinath, Istkhoki, and Rigobon (2010)
Production Assumptions that Generate Variable Marginal Cost

- Can have non-constant returns to scale, so $d(MC)/dQ \neq 0$

- Or, some share of costs are due to imports, so $d(MC)/dE \neq 0$:

  $$MC = W^\beta \left( \frac{W^*}{E} \right)^{1-\beta} \implies \frac{d(mc)}{de} = \beta - 1$$

- Note, for instance, that with CES (i.e. $\Delta \mu = 0$), ERPT will be $\beta$
Things are More Interesting in Dynamic Setting: Currency of Invoicing

- Prices are sticky, but in which units?
  - Producer Currency Pricing (PCP)
  - Local Currency Pricing (LCP)
  - Dominant Currency Pricing (DCP)

- In older models with only nominal rigidities and persistent ER shocks, currency only matters (causally) in short-run. But think about selection...

- More complicated with real rigidities and strategic complementarities, etc.
Things are More Interesting in Dynamic Setting: Other Key Features

- Mean-reverting exchange rate shocks
- Investment-style models
- Mean-reverting exchange rate shocks
Some Key Papers for Further Reading


