Imbs’ and Méjean’s

“Elasticity Optimism”

Eaton Comments

IFM Meetings

Summer Institute

July 7, 2008
• The price elasticity of demand for imports

• A venerable topic
papers from my youth:

- Orcutt (1950)
- Kemp (1962)
- Houthakker and Magee (1969)
- Khan (1975)
- Stone (1979)
- Goldstein and Khan (1985)
- Marquez (1990)
• Good thing: place the elasticity in the context of a well-defined demand system with different varieties distinguished by source

• Relate demand elasticities to parameters of the demand system (elasticities of substitution)

Preferences

- upper tier:

\[ C = \left[ \sum_{k \in K} \alpha_k C_k^{(\gamma-1)/\gamma} \right]^{\gamma/(\gamma-1)} \]

- lower tier

\[ C_k = \left[ \sum_{i \in I} \left( \beta_{ki} c_{ki} \right)^{(\sigma_k - 1)/\sigma_k} + \left( \beta_{kd} c_{kd} \right)^{(\sigma_k - 1)/\sigma_k} \right]^{\sigma_k/(\sigma_k - 1)} \]
• Object of interest:

\[ \eta = \frac{\partial \sum_{k \in K} \sum_{i \in I} p_{ki} c_{ki}}{\partial E} \frac{E}{\sum_{k \in K} \sum_{i \in I} p_{ki} c_{ki}} \]

\[ = 1 - \sum_{k \in K} n_k \left[ \sigma_k (w_k^M - 1) + \gamma w_k^M (w_k - 1) \right] \]

where

- \( n_k \): share of good \( k \) in total import expenditure
- \( w_k^M \): share total spending on good \( k \) going to imports
- \( w_k \): share of \( k \) in total spending

• Objective here: learn about \( \sigma_k \) to identify \( \eta \).
The methodology: (double difference: time $t$ and reference country $c$ $\Delta^{t,c}$):

$$
\begin{align*}
\Delta^{t,c} \ln s_{kit} &= -(\sigma_k - 1) \Delta^{t,c} \ln p_{kit} + \varepsilon^c_{kit} \quad (D) \\
\Delta^{t,c} \ln p_{kit} &= \frac{\omega_k}{1 + \omega_k} \Delta^{t,c} \ln s_{kit} + \delta^c_{kit} \quad (S)
\end{align*}
$$

$\varepsilon, \delta$ independent.
- Rewrite as:

\[
\Delta^{t,c} \ln s_{kit} + (\sigma_k - 1) \Delta^{t,c} \ln p_{kit} = \varepsilon^c_{kit} \quad (D)
\]

\[
\Delta^{t,c} \ln p_{kit} - \frac{\omega_k}{1 + \omega_k} \Delta^{t,c} \ln s_{kit} = \delta^c_{kit} \quad (S)
\]
• Multiply the two together and solve to get:
\[
\left(\Delta_t^{t,c} \ln p_{kit}\right)^2 = \theta_1 \left(\Delta_t^{t,c} \ln s_{kit}\right)^2 + \theta_2 \left(\Delta_t^{t,c} \ln p_{kit} \Delta_t^{t,c} \ln s_{kit}\right) + u_{kit}
\]

• Estimate, assuming that for each good \( k \) different varieties have different ratios of variances of demand and supply shocks.

• Parameters of interest \( \sigma_k \) and \( \omega_k \) can be recovered from \( \theta_1 \) and \( \theta_2 \), but a problem emerges is the solution is imaginary.

• Result here: allowing \( \sigma_k \) to vary across goods yields a much higher calculation of \( \eta \) (as foreseen by Orcutt).
• Good thing: bring microevidence and estimation techniques to answer a fundamental macroeconomic question
• But why are we focusing on only the demand side?

• What are we assuming about technology and factor prices?

• Is $\eta$ a structural parameter across exogenous changes?
  – Text talks of a “change in the exchange rate due to a monetary shock”
  – where are the nominal rigidities?
  – Other shocks: technology, transfer (demand)
• Presumed policy question: how much of a change in relative international prices is needed in response to a macroeconomic shock?

• Answer depends on:
  – the shock
  – the extent of internal resource mobility (traded vs. nontraded)
  – the role of the extensive and intensive margins (Ruhl)

• We need a general equilibrium formulation
Ricardian model (but could be MC, etc.) with country $i$ having efficiency $z_i(j)$ making good $j$, so that

$$p_{ni}(j) = \frac{c_id_{ni}}{z_i(j)}.$$ 

where $p_{ni}(j)$ is the cost of good $j$ in $n$ if purchased from $i$.

Distribution of efficiencies:

$$F_i(z) = \Pr[Z \leq z] = e^{-T_iz^{-\theta}}$$

Price

$$p_n(j) = \min_i \{p_{ni}(j)\}.$$
• Continuum [0, 1] of goods

• Fraction $n$ buys from $i$:

$$\pi_{ni} = \frac{T_i (c_id_{ni})^{-\theta}}{\Phi_n}. $$

where:

$$\Phi_n = \sum_{i=1}^{N} T_i (c_id_{ni})^{-\theta}. $$
• Demand:

\[
X_n^M(j) = \left[ \frac{p_n(j)}{p_n} \right]^{-(\sigma-1)} X_n^M,
\]

where:

\[
p_n = \left[ \int_{0}^{\infty} p^{-(\sigma-1)} dG_n(p) \right]^{-1/(\sigma-1)} = \varphi \Phi_n^{-1/\theta}
\]

and \( \varphi \) is a parameter involving \( \theta \) and \( \sigma \) requiring \( \theta > \sigma - 1 \).

• Bilateral trade shares:

\[
\pi_{ni} = \frac{X_{ni}^M}{X_n^M} = \frac{\overline{\pi}_{ni} X_{ni}^M}{\sum_{k=1}^{N} \overline{\pi}_{nk} X_{nk}^M},
\]

where \( \overline{X}_{ni}^M \) is average spending per good in country \( n \) on goods purchased from \( i \).
• Consider a change in $c_i$ to $c'_i$, with $\tilde{c}_i = c'_i / c_i$ caused by a realignment of deficits from $D_n$ to $D'_n$.

• Goods market clearing condition:

$$\hat{w}_i Y_i = \sum_{n=1}^{N} \pi'_{ni} \left( \hat{w}_n Y_n + D'_n \right)$$

(ignoring nontradables and intermediates)
Extensive Margin Inoperative

- Change in import shares:

\[
\left( \pi_{ni}^{SR} \right)' = \frac{\pi_{ni} \hat{c}_i^{-}(\sigma-1)}{\sum_{k=1}^{N} \pi_{nk} \hat{c}_k^{-}(\sigma-1)}.
\]

- Change in prices indices:

\[
\left( p_n^{SR} \right)' = p_n \left[ \sum_{i=1}^{N} \pi_{ni} \hat{c}_i^{-}(\sigma-1) \right]^{-1/(\sigma-1)}.
\]

- Elasticity of substitution in consumption $\sigma - 1$ matters.
Extension Margin Operative

• Change in import shares:

\[ \pi_{ni}' = \frac{\pi_{ni}\hat{c}_i^{\theta}}{\sum_{k=1}^{N} \pi_{nk}\hat{c}_k^{\theta}}. \]

• Change in price indices:

\[ p_n' = \varphi \left[ \sum_{i=1}^{N} T_i (c_i'd_{ni})^{-\theta} \right]^{-1/\theta} = p_n \left[ \sum_{i=1}^{N} \pi_{ni}\hat{c}_i^{-\theta} \right]^{-1/\theta}. \]

• The technology parameter \( \theta \) rather than \( \sigma - 1 \) matters.

• Remember that we need \( \theta > \sigma - 1 \).
Effect of deficit elimination on Relative GDP’s

\[ \theta = 8.28 \]
\[ \sigma = 2 \]

- Labor mobility and immobility between traded and nontraded sectors.

- How much of a change in relative GDP’s is needed?
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All data are in US$ billions. Negative numbers indicate surplus. MA/PHI/SING is a combination of Malaysia, the Philippines, and Singapore.
Figure 1: Change in GDP, Mobile Labor
Figure 3: Change in GDP, Immobile Labor
Figure 5: Change in GDP, Immobile Sourcing
Conclusion

- Disaggregation of the demand side is good.

- But what $\eta$ is depends on context. It is not a structural parameter.

- We need to model the production side too.

- A challenge for future research: reconciling short and long runs.