Monopolistic Competition and Trade
Empirical phenomenon of intra-industry trade

- Neoclassical trade theory predicts *inter-industry* trade based on differences in technology and/or factor endowments.

- Empirical analysis of European Economic Community (EEC) found evidence for *intra-industry trade* (IIT).

- Early work focused on measurement, Balassa (1965), Grubel and Lloyd (1975).

- Overlap in trade flows, i.e., Grubel and Lloyd index:

\[
GL^j = 1 - \frac{|X^j - M^j|}{(X^j + M^j)} \quad 0 \leq GL^j \leq 1
\]
Monopolistic competition and trade

- Observed IIT a key challenge to neoclassical orthodoxy (Leamer, 1992)

- Monopolistic competition has become standard model for rationalizing IIT

- Different models based on preference structure:
  - Krugman (1979;1980) uses Dixit and Stiglitz’s (1977) “love of variety” approach to preferences
  - Helpman (1981) uses Lancaster’s (1977) “characteristics” approach to preferences

- General equilibrium version of model developed by Helpman and Krugman (1985)
Monopolistic competition and trade

- Assume two countries $j$ and $k$, two factors, $K$ and $L$, two industries: competitive $Z$ producing homogeneous good under constant returns, and monopolistically competitive $X$ producing $n_x$ varieties under increasing returns.

- Figure 1 shows combined factor endowments of $j$ and $k$, where with full employment, $\bar{F}$ is fully utilized, $OQ$ of resources used in $X$, and $OQ^*$ used in $Z$, and vector $OO^*$ can be interpreted as world GDP, $Y^w$.

- Define $OQQ^*Q^*$ as factor-price equalization set (FPE), if endowment is $E$, country $j$ devotes $On^j_x$ resources to $X$ and $OZ$ to $Z$. 
Figure 1: Trade Equilibrium
Monopolistic competition and trade

- $BB$ through $E$, with slope of $w/r$ gives income levels of $Y^j=OC$ and $Y^k=CO^*$ on diagonal $OO^*$, all income going to factors and spent on consumption.

- $C_x$ and $C_z$ are consumption of $X$ and $Z$ by country $j$, and there is simultaneous inter and intra-industry trade:
  
  - $j$ imports $Z$ from $k$, and is net-exporter $(n^j_x - C_x)$ of $X$.
  
  - $k$ exports $Z$ to $j$, and is net-importer $(C_x^* - n^k_x)$ of $X$.
  
  - Net trade flows in $X$ occur because $n^j_x > n^k_x$.

- Capital-abundant country $j$ is net-exporter of capital-intensive good, and labor-abundant country $k$ exports labor-intensive good (H-O model).
Monopolistic competition and trade

- **Key empirical prediction**: share of IIT larger between countries that are similar in terms of factor endowments and relative size

- Helpman’s (1987) results support prediction using 4-digit SITC data for 14 OECD countries over period 1970-81:

\[
GL_{jk} = \alpha + \beta_1 \log \left( \frac{Y_j}{N_j} \right) - \left( \frac{Y_k}{N_k} \right) + \beta_2 \min(\log Y_j, \log Y_k) \\
+ \beta_3 \max(\log Y_j, \log Y_k) + \mu_{jk}, \quad \beta_1 < 0, \beta_2 > 0, \beta_3 < 0
\]

- Hummels and Levinsohn (1995) re-ran (1) for 1962-83 with GDP/worker – replicated Helpman
Monopolistic competition and trade

- **Key empirical prediction**: volume of trade as share of GDP increases as countries become more similar in size – assuming structure of monopolistic competition

- Helpman’s (1987) results support prediction with data for 14 OECD countries over period 1956-81:

\[
\frac{V^A}{Y^A} = e_A \left[ 1 - \sum_{j \in A} (e^j_A)^2 \right]
\]

where for country group $A$, $V^A$ is volume of trade, $Y^A$ is aggregate GDP, $e^A$ is share of world GDP, and $e^j_A$ is share of $j$'s GDP in $A$’s GDP

- Right-hand side of (2) is measure of size dispersion – increases as countries become more similar in size
Empirical evaluation of monopolistic competition story

- (2) is a form of gravity model – but it seems to fit trade in both differentiated and homogeneous goods

- Empirical issue becomes one of determining which theoretical model works best in a given data sample (Evenett and Keller, 2002)

- Gravity equation predicts volume of trade between two countries will be proportional to their GDPs and inversely related to any trade barriers between them – typical specification:

\[
T_{jk} = \beta_0 (Y^j)^{\beta_1} (Y^k)^{\beta_2} (D_{jk})^{\beta_3} (A_{jk})^{\beta_4} u_{jk}
\]
Empirical evaluation of monopolistic competition story

- Evenett and Keller derive theoretical restrictions on country income parameters that form basis of hypothesis testing.

- Use model similar to Helpman and Krugman, allowing for differing degrees of specialization:

- **Case 1**: Perfect specialization $X$ and $Z$ differentiated.

  $s^c$ is country $c = j, k$ share of world spending, $X^c (Z^c)$ is equilibrium quantity of variety $X(Z)$, $Y^c$ is GDP, world GDP is $Y^w = Y^j + Y^k$, and let good $Z$ be *numeraire*, where $p^z = 1$, so that relative price of variety $X$ is $p^x$. 

Empirical evaluation of monopolistic competition story

- Assuming balanced trade, where $s^c = Y^c/Y^w$, both countries demand all varieties according to their share of world GDP, imports being given as:

  \begin{align}
  (4) \quad M^{jk} &= s^j [p_x n^k_x x^k + n^k_z z^k ] \\
  (5) \quad M^{kj} &= s^k [p_x n^j_x x^j + n^j_z z^j ]
  \end{align}

  where terms in brackets are GDP of $k$ and $j$ respectively, therefore:

  \begin{align}
  (6) \quad M^{jk} &= s^j Y^k = \frac{Y^j Y^k}{Y^w} = s^k Y^j = M^{kj}
  \end{align}

  i.e., gravity equation, imports being proportional to GDP
Empirical evaluation of monopolistic competition story

- **Case 2**: Perfect specialization, X and Z homogeneous

Assume X is capital-intensive and Y labor-intensive, j being relatively well-endowed in capital, and k in labor

With perfect specialization, $X^c$ production of X, $Z^c$ of Z, $X^j = X^w$, and $Z^k = Z^w$, and value of production is GDP, $p_x X^j = Y^j$ and $Z^k = Y^k$, therefore:

\[
(7) \quad M^{jk} = s^j Z^k = s^j Y^k = \frac{Y^j Y^k}{Y^w}, \quad M^{kj} = s^k p_x X^j = s^k Y^j = \frac{Y^j Y^k}{Y^w}
\]

Identical to (6), and again imports are proportional to GDP - known as *multi-cone* H-O model

Both equilibria can be described in figure 2
Figure 2: Perfect Specialization

\[ E' = Q \]

\[ E = C \]

\[ n^k_x, C^*_x \]

\[ n^k_z, C^*_z \]

\[ n^j_x, C_x \]

\[ n^j_z, C_z \]
Empirical evaluation of monopolistic competition story

- **Case 3**: Imperfect specialization $X$ differentiated and $Z$ homogeneous

Assume $X$ is capital-intensive and $Y$ labor-intensive, $j$ being relatively well-endowed in capital, and $k$ in labor.

For endowments inside FPE, volume of bilateral trade:

\[
T_{jk} = s^k p_x X^j + s^j p_x X^k + (Z^k - s^k Z^w)
\]

where first term on right-hand side is $j$'s exports, other terms are its imports of other varieties of $X$ and good $Z$, i.e. $M_{jk}$.
Empirical evaluation of monopolistic competition story

Suppose $\gamma^j = Z^j / p_x X^j + Z_j$, share of Z in j's GDP, and also $(1-\gamma^j)$ share of X in j's GDP.

With balanced trade, $M^{kj} = s^k p_x X^j$, then $M^{kj} = s^k (1-\gamma^j) Y^j$

Gravity equation (6) can be rewritten as:

(9) $M^{jk} = (1-\gamma^j) \frac{Y^j Y^k}{Y^w}$

Compared to (6), implies bilateral imports lower than case where both goods are differentiated, and volume of trade higher, the lower is share of Z in GDP.
Empirical evaluation of monopolistic competition story

- **Case 4**: Imperfect specialization, $X$ and $Z$ homogeneous

Volume of bilateral trade:

\[(10) \quad T^{jk} = p_x (X^j - s^j X^w) + (Z^k - s^k Z^w)\]

where first term on right-hand side is $j$'s exports, and second term are its imports, and $M^{jk} = M^{kj}$

Given $X^w = (X^j + X^k)$, $M^{jk}$ can be rewritten as:

\[M^{jk} = (1 - \gamma^j) Y^j - s^j (1 - \gamma^j) Y^j - s^j (1 - \gamma^k) Y^k\]

and with $s^k = (1 - s^j)$, this becomes:

\[M^{jk} = s^k (1 - \gamma^j) Y^j - s^j (1 - \gamma^k) Y^k\]
Empirical evaluation of monopolistic competition story

- The gravity equation becomes:

\[
M^{jk} = (\gamma^k - \gamma^j) \frac{Y^j Y^k}{Y^w}
\]

(11)

As capital-labor ratios of two countries converge, so that \( \gamma^k \rightarrow \gamma^j \), and in the limit, no trade when \( \gamma^k = \gamma^j \)

If \( \gamma^k = 0 \), and \( \gamma^j = 1 \), (7) is special case of (11)

- (9) and (11) are illustrated in figure 3, i.e., either intra-industry trade in \( X \), inter-industry in \( X \) and \( Z \), or inter-industry trade in \( X \) and \( Z \) (uni-cone H-O model)
Figure 3: Imperfect Specialization
Empirical evaluation of monopolistic competition story

- Evenett and Keller tested these 4 versions of gravity model based on classifying 1985 4-digit SITC data for 58 countries into differentiated vs. homogeneous goods

- Perfect specialization:

  \[ M_{jk}^v = \alpha_v \frac{Y_j^v Y_k^w}{Y_w^v} + \mu_{jk}^v, \quad \alpha_v = 1 \]

Sample split into high and low IIT samples:

- high IIT sample, \( \alpha_v = 0.087 \)
- low IIT sample, \( \alpha_v = 0.052 \)

i.e., perfect specialization in either differentiated or homogeneous goods over-predicts bilateral trade
Empirical evaluation of monopolistic competition story

- Imperfect specialization with differentiated and homogeneous goods:

\[
(13) \quad M_{jk}^v = (1 - \psi_v^j) \frac{Y^j_v Y^k_v}{Y^w^v} + \mu_v^{jk}, \quad (1 - \psi_v^j) < 1
\]

Estimated for cases where \( j(k) \) is capital-abundant, median value of \((1 - \psi_v^j) = 0.086\)

- Imperfect specialization with homogeneous goods:

\[
(14) \quad M_{jk}^v = (\psi_v^j - \psi_v^k) \frac{Y^j_v Y^k_v}{Y^w} + \mu_v^{jk}, \quad (\psi_v^j - \psi_v^k) < 1
\]

Estimated for cases where \( j(k) \) is capital-abundant, median value of \((\psi_v^j - \psi_v^k) = 0.04\)
Empirical evaluation of monopolistic competition story

- Evenett and Keller conclude:
  - perfect specialization in increasing returns and multi-cone model over-predicts bilateral trade
  - mixed support for increasing returns model with imperfect specialization
  - uni-cone H-O model works well

- Overall, both factor endowments and scale economies can explain different components of variations in production and trade