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 of monopolistic competition developed 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
Monopolistic competition and trade

- Following Krugman (1980), economy under autarky consists of single industry producing variety of goods

- All varieties enter utility symmetrically, consumers having utility function:

\[
U = \sum c_i^\theta, \quad 0 < \theta < 1, \quad i = 1, \ldots, n
\]

where \( c_i \) is consumption of \( i^{th} \) good, and elasticity of substitution between two goods is a constant \( \sigma = 1/(1-\theta) \)

- If \( w \) is income, consumers maximize utility subject to budget constraint, \( w = \sum p_i x_i : \)

\[
\theta c_i^{\theta-1} = \lambda p_i, \quad i = 1, \ldots, n
\]
Monopolistic competition and trade

- Labor is only factor, all goods being produced with same cost function:

\[(4) \quad l_i = \alpha + \beta x_i, \quad \alpha, \beta > 0, \quad i = 1, ..., n\]

\(l_i\) is labor used in producing \(i^{th}\) good, \(x_i\) is output of \(i^{th}\) good, \(\alpha\) are fixed costs, \(\beta\) are constant marginal costs

- Output of any good equals consumption, so assuming consumers are workers, output of any good is consumption of aggregate labor force:

\[(5) \quad x_i = Lc_i, \quad i = 1, ..., n\]

and assuming full employment, \(L = \sum (\alpha + \beta x_i)\)
Monopolistic competition and trade

- Assuming monopolistic competition, where equilibrium is symmetric with prices and quantities identical across goods, inverse demand for each firm is:

  \[ p = \theta \lambda^{-1} (x / L)^{\theta-1} \]  

- Elasticity of demand defined as, \( \varepsilon = 1/(1-\theta) = \sigma \), where profit maximization implies, \( mc = mr = p(1-1/\varepsilon) \)

- Profit-maximizing price will be:

  \[ p = \theta^{-1} \beta w \]  

- Firm’s profits being:

  \[ \pi = px - (\alpha + \beta x)w \]
Monopolistic competition and trade

- Using (8), (9) can be solved for $x$:

\[(10) \quad x = \frac{\alpha}{(p/w - \beta)} = \frac{\alpha \theta}{\beta(1-\theta)}\]

- Given full employment, and (16), equilibrium number of goods under autarky is:

\[(11) \quad n = \frac{L}{(\alpha + \beta x)} = \frac{L(1-\theta)}{\alpha}\]

i.e., number of goods is a function of size of labor force $L$, level of fixed costs $\alpha$ and value of $\theta$

- Trading with an identical economy, number of goods will be $2n$, as $L$ has doubled

- Each good only produced in one country, sold in both
Monopolistic competition and trade

- Gains from trade are greater diversity as consumers spread incomes over twice as many goods – firms have same level of output in equilibrium as under autarky

- Also in trading equilibrium, prices of any good in either country are the same, and real wages are the same, i.e., factor-price equalization

- Volume of trade is determinate, each country exporting half the output of its goods, but direction of trade indeterminate, i.e., arbitrary which country produces which goods

- 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, $\bar{V}$ 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 $OQO^*Q^*$ as factor-price equalization set (FPE), if endowment is $E$, country $j$ devotes $On^j_x$ resources to $X$ and $OZ$ to $Z$
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)
Figure 1: Trade Equilibrium
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:

\[
GL_{jk} = \alpha + \beta_1 \log \left[ \frac{Y_j}{N_j} \right] - \left[ \frac{Y_k}{N_k} \right] + \beta_2 \min(\log Y_j, \log Y_k) + \beta_3 \max(\log Y_j, \log Y_k) + \mu_{jk}, \quad \beta_1 < 0, \beta_2 > 0, \beta_3 < 0
\]  
(12)

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:

\[
\frac{V_A}{Y_A} = c_A \left[ 1 - \sum_{j \in A} (e_A^j)^2 \right]
\]

where for country group A, \( V_A \) is volume of trade, \( Y_A \) is aggregate GDP, \( e_A \) is share of world GDP, and \( e_A^j \) is share of \( j \)'s GDP in A’s GDP

- Right-hand side of (13) is measure of size dispersion – increases as countries become more similar in size
Empirical evaluation of monopolistic competition story

- (13) 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:

\[
V^{jk} = \beta_0 (Y^j)^{\beta_1} (Y^k)^{\beta_2} (D^{jk})^{\beta_3} (A^{jk})^{\beta_4} u^{jk}
\]
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:

\[
M^{jk} = s^j [p_x n^k_x x^k + n^k_z z^k]
\]

\[
M^{kj} = s^k [p_x n^j_x x^j + n^j_z z^j]
\]

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

\[
M^{jk} = s^j Y^k = \frac{Y^j Y^k}{Y^w} = s^k Y^j = M^{kj}
\]

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:

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

Identical to (17), 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
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:

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

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

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

Gravity equation (17) can be rewritten as:

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

Compared to (17), 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:

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

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:

\[ M^{jk} = (y^k - y^j) \frac{Y^j Y^k}{Y^w} \] (21)

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

If \( y^k = 0 \), and \( y^j = 1 \), (18) is special case of (21)

- (19) and (21) 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:

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

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:

\[
M_{jk}^v = (1 - \psi_j^v) \frac{Y_j^v Y_k^v}{Y_w^v} + \mu_{jk}^v, \quad (1 - \psi_j^v) < 1
\]

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

- Imperfect specialization with homogeneous goods:

\[
M_{jk}^v = (\psi_j^v - \psi_k^v) \frac{Y_j^v Y_k^v}{Y_w^v} + \mu_{jk}^v, \quad (\psi_j^v - \psi_k^v) < 1
\]

Estimated for cases where \( j(k) \) is capital-abundant, median value of \( (\psi_j^v - \psi_k^v) = 0.04 \)
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