Trade liberalization and markup divergence: a general equilibrium approach.

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Motivation

- There is a growing interest in
  - multi-sector monopolistic competition models
  - influence of trade liberalization on markups
  - the interactions between manufacturing and services under trade liberalization
- Trade liberalization in manufacturing should reduce markups for manufacturing goods, while the impact on services is a priori unclear

Contribution

- We develop a fairly natural characterization of Kimball-type preferences (Kimball, 1995; Klenow and Willis, 2006) in terms of the elasticity of substitution
- We propose a two-sector trade model based on monopolistic competition under non-specified Kimball-type preferences
- The model yields clear-cut results; in particular, it captures markup divergence

The model

Model layout

- The economy involves **two countries** (H and F), **two goods** (traded and non-traded), and **one factor** (labor)
- Both traded and non-traded goods are differentiated.

Preferences

We work with preferences which:

- yield well-defined sectoral price indices;
- exibit simple behavior of elasticity of substitution.

We find that both properties hold for a fairly rich subclass of **homothetic** preferences.

Elasticity of substitution

- It is shown in Zhelobodko et al. (2012) that under symmetric additive preferences elasticity of substitution $\bar{\sigma}(x_i, x_j, \mathbf{x})$ depends only on individual consumption level:

$$\bar{\sigma}(x_i, x_j, \mathbf{x})\big|_{x_i = x_j} = \sigma(x_i).$$

- However, non-CES additive preferences do not induce a well-defined price index.
- We focus on preferences such that

$$\bar{\sigma}(x_i, x_j, \mathbf{x})\big|_{x_i = x_j} = \sigma\left(\frac{x_i}{u(\mathbf{x})}\right).$$

- Here $u(\mathbf{x})$ is the utility level.

Implicitly additive preferences

Proposition 1. *A preference relationship satisfies*

$$\bar{\sigma}(x_i, x_j, \mathbf{x})|_{x_i = x_j} = \sigma\left(\frac{x_i}{u(\mathbf{x})}\right)$$

if and only if it is given by a Kimball-type utility function $u(\mathbf{x})$, i.e. the one implicitly defined by

$$\int_0^N \theta\left(\frac{x_i}{u}\right) \mathrm{d}i = 1,$$

where $\theta(\cdot)$ is increasing and concave.

In particular, $u(\cdot)$ is *symmetric and homothetic.*

Elasticity of substitution

- The relationship between θ and σ is as follows:

$$\frac{1}{\sigma(z_i)} = r_\theta(z_i) \equiv -\frac{z_i\theta''(z_i)}{\theta'(z_i)}, \qquad z_i \equiv \frac{x_i}{u(\mathbf{x})}.$$

- Kimball (1995) uses this class of functions for a production function representation (under $N = 1$).

- Under CES, $r_\theta(z_i) = 1 - \rho$ is a constant.

Consumers

- Each country is endowed with a mass L of consumers, who share identical homothetic preferences given by

$$\mathscr{U}^k = U\left[u(\mathbf{x}^{kk}, \mathbf{x}^{lk}), v(\mathbf{y}^k)\right], \quad k, l \in \{H, F\},\ k \neq l,$$

- here U is the upper-tier utility, u and v are lower-tier utilities of consuming, respectively, traded and non-traded good.

- We assume that U, u and v are strictly increasing, strictly quasi-concave and positive homogeneous of degree 1.

Demand

- We also assume that lower-tier utilities are *implicitly additive*:

$$\int_0^{N^k} \theta\left(\frac{x_i^{kk}}{u}\right) \mathrm{d}i + \int_0^{N^l} \theta\left(\frac{x_j^{lk}}{u}\right) \mathrm{d}j = 1, \quad \int_0^{M^k} \psi\left(\frac{y_i^k}{v}\right) \mathrm{d}i = 1, \quad k, l \in \{H, F\}.$$

- The inverse demands are given by

$$\frac{\theta'\left(x_i^{kk}/u\right)}{\mu^k} = p_i^{kk}, \quad \frac{\theta'\left(x_i^{kl}/u\right)}{\mu^l} = p_j^{kl}, \quad \frac{\psi'\left(y_i^k/v\right)}{\lambda^k} = q_i^k.$$

- Here μ^k and λ^k are sectoral market aggregates.

Firms

- Each firm in each sector has a fixed labor requirement F and a marginal labor requirement c.
- Trade costs for manufacturing goods have a standard iceberg form while *services are non-traded*.
- Each firm produces a single variety and each variety is produced by a single firm.
- No firm can strategically manipulate μ^k and λ^k.

Profit maximization

Profit-maximizing prices of firms in country $k \in \{H, F\}$ are given by

$$p_i^{kk} = \frac{c}{1 - r_\theta\left(x_i^{kk}/u\right)}, \quad p_i^{kl} = \frac{c\tau}{1 - r_\theta\left(x_i^{kl}/u\right)}, \quad q_j^k = \frac{c}{1 - r_\psi\left(y_j^k/v\right)},$$

where $l \in \{H, F\}$ and $l \neq k$.

Symmetric outcome

We assume countries to be symmetric. We focus on a symmetric outcome:

$$x^H \equiv x^{HH} = x^{FF}, \quad x^F \equiv x^{FH} = x^{HF}, \quad y \equiv y^H = y^F,$$

$$p^H \equiv p^{HH} = p^{FF}, \quad p^F \equiv p^{FH} = p^{HF}, \quad q \equiv q^H = q^F,$$

$$N \equiv N^H = N^F, \quad M \equiv M^H = M^F.$$

Competition in non-traded sector

- The price index Q for the non-traded good is pinned down by the number of firms in this sector:

$$Q = \frac{cM\psi^{-1}(1/M)}{1 - r_{\psi}[\psi^{-1}(1/M)]}.$$

- Total expenditure for non-tradables is given by

$$E(M,Q) \equiv L\left[1 - \alpha\left(\frac{P}{Q}\right)\right]$$

- Here P is the price index for traded goods, while $\alpha(P/Q)$ is the share of consumers' expenditure on traded goods.

Non-traded sector: free-entry equilibrium

- If we assume that $\alpha(P/Q)$ decreases “relatively slowly”, then
  - a unique symmetric free-entry equilibrium exists;
  - the number of firms producing non-traded varieties decreases in response to a decrease in P.
- Otherwise, multiple equilibria may arise
- However, if we focus on stable equilibria (where $\partial\pi/\partial M < 0$), then the number of firms still decreases in response to a decrease in P.

Why to assume α "almost horizontal"?

- If the upper-tier utility is CES, then

$$\alpha\left(\frac{P}{Q}\right) = \frac{(P/Q)^{1-\sigma}}{(1-\beta)/\beta + (P/Q)^{1-\sigma}}.$$

- When σ gets closer to 1, $\alpha(P/Q)$ becomes more horizontal.
- Since "services" are *poor* substitutes to "manufacturing goods", assuming σ close to 1 makes sense.

The impact of trade liberalization on prices

- When $r_\psi(\cdot)$ is either increasing or "slightly decreasing", we show that the relationship $Q^* = Q(P)$ between Q and P is downward-sloping.
  - Furthermore, this relationship does not directly involve τ.
- Hence, the impact of trade liberalization on the non-traded sector is *fully captured by changes in P.*

How P affects expenditure shares

- Define $a(P) \equiv \alpha(P/Q^*(P))$ as the equilibrium expenditure share for traded goods as a function of the trade goods price index P only.
- Clearly, $a(P)$ is a decreasing function of P.

Traded sector: equilibrium conditions for a given N

- Implicitly additive utility:

$$N\left(\theta\left(\frac{x^H}{u}\right)+\theta\left(\frac{x^F}{u}\right)\right)=1$$

- Inverse demands + profit maximization:

$$\frac{\theta'\left(\frac{x^H}{u}\right)\left(1-r_\theta\left(\frac{x^H}{u}\right)\right)}{\theta'\left(\frac{x^F}{u}\right)\left(1-r_\theta\left(\frac{x^F}{u}\right)\right)}=\frac{1}{\tau}$$

- Budget constraint:

$$Pu=N\cdot\left(\frac{cx^H}{1-r_\theta\left(\frac{x^H}{u}\right)}+\frac{c\tau x^F}{1-r_\theta\left(\frac{x^F}{u}\right)}\right)=a(P)$$

Traded sector: the impact of entry and trade cost on markups

Proposition 2. *Assume that $r'_\theta(z) > 0$. Then:*

- *there exists a unique symmetric equilibrium for any given N;*
- *the equilibrium markups $m^H(N,\tau)$ and $m^F(N,\tau)$ both decrease with N;*
- *$m^H(N,\tau)$ decreases in response to a decrease in τ, while $m^F(N,\tau)$ does the opposite.*

When $r'_\theta(z) < 0$, Proposition 3 is reversed.

Traded sector: free entry equilibrium

- We focus on **stable** free entry equilibria, i.e. those where $\partial\pi^*/\partial N < 0$.
- Here $\pi^*(N,\tau)$ is the **equilibrium operating profit** of each firm.

Proposition 3. *A sufficient condition for* $\mathrm{d}P^*/\mathrm{d}\tau > 0$ *is that (i)* $\partial\overline{P}/\partial N < 0$*, and (ii)* $\mathrm{d}N^*/\mathrm{d}\tau < 0$*.*

- Both (i) and (ii) hold for the CES, but it fails to capture markup divergence.
- We establish desirable results when preferences are "close" to the CES, but not exactly CES

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Defining ε-CES preferences

- We focus on "**perturbations**" of the CES, which we call ε-CES.
- We consider implicitly additive preferences with θ of the following form:

$$\theta(z) = z^{\rho} \exp\left[\varphi(z)\right],$$

- Here $\rho \in (0,1)$, and φ is a twice continuously differentiable function.
- We assume that $\varphi \in C^2(\mathbb{R}_+)$ and $||\varphi||_{C^2} < \varepsilon$, where $||\cdot||_{C^2}$ is the norm in C^2 space.

ε-CES equilibrium: existence and continuity

Proposition 4. *For ε-CES preferences, with ε 'sufficiently small', an equilibrium in the traded sector exists and is a small perturbation of the CES equilibrium.*

The impact of trade liberalization

Proposition 5. *Assume that $r'_\theta > 0$ and $r'_\psi > 0$. Consider ε-CES preferences generated by θ. Then there exists $\overline{\varepsilon} > 0$ such that for every $\varepsilon < \overline{\varepsilon}$, trade liberalization leads to*

(i) decreasing markups for traded good in the domestic markets;

(ii) increasing markups for traded good in the foreign markets;

(iii) more firms in the traded sector;

(iv) increasing markups for non-traded good;

(v) less firms in the non-traded sector.

Thank you for your attention!