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TRADE, SOUTHERN INTEGRATION, AND UNEVEN DEVELOPMENT

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Abstract: The paper demonstrates how trade between developing countries can cause the divergence of long-run growth among these countries. The model describes two symmetric countries trading with each other and the industrial rest of the world. Bilateral trade occurs at any moment if the countries have different numbers of intermediate varieties. The country with a larger number produces more manufactured goods than the other country does. In the bilateral trade the advanced country exports manufactures and imports basic goods and can develop the comparative advantage over the other country. The model demonstrates that Southern integration leads to uneven development paths if there is a high complementarity between intermediate inputs.

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The self-sustained diversity of economic performance has been clearly demonstrated in growth models with increasing returns, threshold externalities and multiple equilibria [e.g. Murphy, Shleifer & Vishny (1989); Azariadis & Drazen (1990), Kelley (1997)]. These models emphasize the role of initial conditions (historical circumstances) in determination of growth paths. The dynamic models of industrialization with multiple equilibrium paths focus on initial beliefs [Krugman (1991), Matsuyama (1991); Fölster & Trofimov (1997)]. Models of this class, however, only show the possibility of failure to coordinate on initial beliefs but do not explain how bad or good equilibria are selected.

The recent paper by Matsuyama (1996) examines the role of international trade in selection among multiple equilibria. A static model of international trade and specialization among symmetric countries demonstrates how production of manufactured goods concentrates into some countries and international division of labor emerges in the trading equilibrium. From the individual country perspective, the poor country fails to achieve a necessary coordination among multiple equilibria to utilize the agglomeration effects and become rich. However, from the global view, some countries stick to the bad equilibrium and remain poor, because in the integrated world economy all nations cannot be rich. Krugman and Venables (1995) demonstrate the similar effect on geographical location and income divergence of the economic integration between initially homogenous countries.

The above quoted papers on trade and uneven growth relate to the North-North or North-South trade. In order to examine the dynamic effects of Southern integration, I suggest a simple dynamic model of bilateral trade that captures the essential features of less developed economies. It is close in spirit to the models by Matsuyama (1996) and legal supports, accounting, advertising, and financial services, and so on» (Ciccone & Matsuyama, 1996, p. 34). Intermediates cannot be imported from abroad and constitute indirect and roundabout ways of production that facilitate domestic manufacturing and increase productivity. By this reason economic development in each country proceeds through new firms entry into the domestic intermediate sector. A new entry requires a fixed amount of the domestic basic resource and of the high-quality import good. Unlike the endogenous growth models with horizontal differentiation of goods (e.g. Grossman & Helpman, 1991), new firms are created without R&D and no labor inputs are required for entry. This is an essential deviation of our model from the standard framework.

Bilateral trade occurs because countries at any moment may have different numbers of intermediate varieties. The country with a larger number produces more manufactured goods than the other country does. The worse performing country imports manufactured goods from and exports basic goods to the advanced country. Trade in the model is interindustry, but unlike the classical trade models the advanced country accumulates a dynamic comparative advantage.

The model demonstrates that in certain cases the advanced country can further develop its comparative advantage, and the South-South trade leads to uneven growth. Development paths of the countries diverge in the case of multiple long-run equilibria that can emerge only under bilateral trade. This property depends on the production technology: the paths diverge if the degree of complementarity between intermediate inputs is quite high. In this case intermediates strongly affect productivity in the manufacturing sector. Accumulation of varieties in both countries moves the price of manufactures down. This increases demands for manufacturing goods in either country, but demand for basic goods and domestic intermediate inputs grows more rapidly in the

$$b_k \geq 0, \tag{3}$$

where δ is the subjective discount rate, d_k is consumption of the final good, c_k is consumption of the high-quality import good, I_k is the sum of wage and dividend stream, b_k is holding of financial asset traded in the international markets and bringing constant riskless return $r = \delta$. Both the high-quality import good and the basic good are traded at the world price normalized to 1. The manufacturing good price p is the same in both countries since bilateral trade is allowed. Constraint (3) forbids borrowing in the international financial markets. Initial asset holdings are assumed zero, $b_k(0) = 0$. Consumption utility in both countries is log-linear,

$$u(d_k, c_k) = \alpha \, ln d_k + (1-\alpha) \, ln c_k, \tag{4}$$

where α is the share of the domestic final good in current consumption. We omit the subscript of the country in describing production activities and autarky equilibrium in this and the next Section, but keep this subscript in the analysis of international trade and development paths in Sections 4-7.

The manufacturing sector

Firms in the manufacturing sector are identical and competitive. The number of manufacturing firms is unity at any moment. Each firm produces homogenous consumption final goods under constant return to scale, and uses intermediate varieties and basic goods as inputs. The firm's production function is

$$y = X^{\beta} Q^{1-\beta}, \tag{5}$$

where

$$X = \left(\int_0^n x_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$$

The intermediate sector

Each variety i is produced by a single specializing firm having a monopoly power over its own market. The number of intermediate firms is large, and they all participate in Dixit-Stiglitz monopolistic competition. An intermediate firm maximizes profit $\pi_i = p_i x_i - w l_i$ where l_i is labor input and w is the price of labor unit. The labor input coefficient is unity for all firms and $\pi_i = (p_i - w) x_i$.

The intermediate firm faces a demand function with the constant price elasticity σ. Because the number of varieties is large, the firm ignores the effect of its own actions on choices of other firms. It sets the monopoly price according to the markup rule

$$p_i = [\sigma/(\sigma-1)]w$$

and obtains operating profit

$$\pi_i = w\, x_i/(\sigma-1). \tag{9}$$

Hence, a higher degree of complementarity between varieties increases monopoly power of producers.

Entry

At each instant new intermediate firms are created and a free entry condition fulfills:

$$v_i = z, \tag{10}$$

where $v_i(t) = \int_t^{\infty} e^{-r(\tau-t)} \pi_i(\tau) d\tau$ is the present value of future profit stream discounted with the interest rate r; z is the fixed cost of a new firm entry into the intermediate sector. Free entry means that the net present value of entry is always zero.

There is no bilateral trade between the countries under autarky. However, each country trades with the rest of the world: basic goods are exchanged for high-quality consumption goods.

Proposition 1. Households do not save if $\dot{w} > 0$ *for all* $t \in [0, T)$, $T \leq \infty$, *and* $\dot{w} = 0$ *for all* $t \in [T, \infty)$.

Proof: in Appendix.

Wage is denominated in units of the high-quality good, and condition of proposition 1 implies that wage is increasing in real terms on a finite or infinite time interval and constant on the remaining period of time. Households anticipate the increase of wage during period [0, T), and would prefer to borrow initially in order to smooth consumption over the life cycle. However, at any moment they face the binding borrowing constraint (3) and consume all current incomes. There is no precautionary or bequest motive for saving in the model, therefore households do not save.[4]

We take for a while for granted that condition of proposition 1 holds. Then the proposition implies that at each instant $b = 0$ and consumers choose the bundle (d, c) providing maximum to the instantaneous utility (4) under the one-shot budget constraint: $pd + c = I$. Current household income is the sum of wage and profit $I = w + R$. The household demand is

$$d = \alpha(w + R)/p, \tag{12}$$

$$c = (1-\alpha)(w + R). \tag{13}$$

Total labor supply is 1 and labor market equilibrium implies that $nx = 1$, or from (11):

$$nrz(\sigma-1)/w = 1.$$

Hence, accounting for (13) $c + Q = (1 - \alpha\beta)(Hn + R)$. Equilibrium equation for the basic good market (16) becomes

$$z'n = \max[\alpha\beta R - (1-\alpha\beta)Hn, 0]. \tag{17}$$

The long-run number of intermediate firms is $n^* = \frac{\alpha\beta\rho}{(1-\alpha\beta)}$, where $\rho = R/H$. The number of intermediates and wage are monotonously increasing for equilibrium trajectories starting from any initial number of varieties below the long-run number n^*. The equilibrium growth rate of these variables is $\rho(1/n - 1/n^*)$. Consequently, the long-run number of varieties n^*, and the speed of convergence to the steady state are higher, the higher are the shares of domestic final goods in consumption α and intermediate inputs in manufacturing β.

4. The trading equilibrium

Suppose that the developing countries trade with each other. The reason for the bilateral trade is that countries at any instant may have different numbers of varieties. The country with a larger number of intermediate firms produces more manufacture goods than the other country does. Therefore the former country exports final goods to and imports basic goods from the latter country. Exports are assumed to meet imports in the bilateral trade.

Consider the trajectories satisfying condition of proposition 1. The household demand in country k is as in the autarky case:

$$d_k = \alpha(w_k + R)/p, \tag{18}$$

$$c_k = (1-\alpha)(w_k + R). \tag{19}$$

Labor market equilibrium in country k is given by equation:

$$R = c_k - pe_k + Q_k + z'\dot{n}_k, \tag{22}$$

$\dot{n}_k \geq 0$, k = 1,2. As in the autarky case, the market is cleared in each country through the adjustment of entry $\dot{n}_k$.

From (7), (11), (21) the basic good input by the manufacturing firm is

$$Q_k = (1-\beta)^{1/\beta} p^{1/\beta} x_k n_k^{\sigma/(\sigma-1)} = (1-\beta)^{1/\beta} p^{1/\beta} n_k^{1/(1-\sigma)} =$$

$$\alpha(1-\beta) n_k^{1/(\sigma-1)} \frac{Hn_1 + Hn_2 + 2R}{n_1^{1/(\sigma-1)} + n_2^{1/(\sigma-1)}}, \tag{23}$$

and from (19), (20)

$$c_k = (1-\alpha)(Hn_k + R). \tag{24}$$

Equations (8), (18) imply the volume of trade in manufactures

$$e_k = (1-\beta)^{(1-\beta)/\beta} p^{(1-\beta)/\beta} x_k n_k^{\sigma/(\sigma-1)} - \alpha(w_k + R)p^{-1} = [(1-\beta)^{(1-\beta)/\beta} p^{1/\beta} n_k^{1/(\sigma-1)} - \alpha(Hn_k + R)]p^{-1}.$$

Hence, from (21) the volume of basic good trade is

$$-pe_k = \alpha(Hn_k + R) - \alpha n_k^{1/(\sigma-1)} \frac{Hn_1 + Hn_2 + 2R}{n_1^{1/(\sigma-1)} + n_2^{1/(\sigma-1)}}. \tag{25}$$

Then, from (21), (23), (24) and (25) equilibrium equations for the basic good market (22) become

$$z'\dot{n}_k = R + \alpha\beta n_k^{1/(\sigma-1)} \frac{Hn_1 + Hn_2 + 2R}{n_1^{1/(\sigma-1)} + n_2^{1/(\sigma-1)}} - (Hn_k + R),$$

for $\dot{n}_k \geq 0$, k = 1,2. This can be rewritten as

$$a\dot{n}_1 = \max\left[\alpha\beta n_1^{1/(\sigma-1)} \frac{n_1 + n_2 + 2\rho}{n_1^{1/(\sigma-1)} + n_2^{1/(\sigma-1)}} - n_1; 0\right], \tag{26}$$

$$a\dot{n}_2 = \max\left[\alpha\beta n_2^{1/(\sigma-1)} \frac{n_1 + n_2 + 2\rho}{n_1^{1/(\sigma-1)} + n_2^{1/(\sigma-1)}} - n_2; 0\right], \tag{27}$$

where $a = z'/H$.

grow unevenly if the degree of complementarity between intermediate firms is high ($\sigma < 2$) and the firms possess quite a high monopoly power.

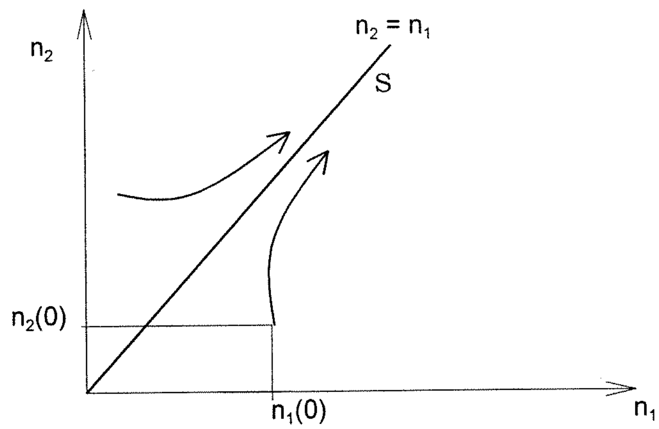

Figure 1a.

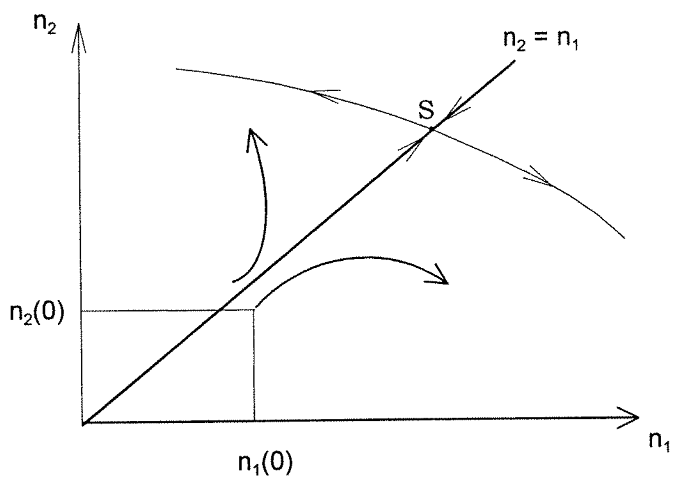

Figure 1b.

origin to the critical point P where $(n_2/n_1)^\theta = (1-\alpha\beta)/(\theta-1)$, as depicted in Figure 2. Another critical point F is such that $(n_2/n_1)^{\theta-1} = \alpha\beta/\theta$.

The zone of positive $\dot{n}_k$, k = 1,2, locates below (O, S, K_1) and to the left from (O, S, K_2). Consider an arbitrary trajectory starting in this domain and satisfying the initial condition $n_1(0) > n_2(0)$. Both state variables are growing along this trajectory, until it intersects curve (O, S, K_2) at point L with $n_2 = n_2'$. Then the non-negativity constraint $\dot{n}_2 \geq 0$ becomes binding on this trajectory, n_2 does not further change, and n_1 continues to grow according to (26). Finally, the trajectory reaches (O, S, K_1) at the non-autarky stationary point $S' = (n_1', n_2')$. Note that $n_1' > n^*$ and $n_2' < n^*$, that is the long run number of varieties is above the autarky level in country 1 and below this level in country 2. Hence, in the long run country 1 gains from trade in terms of relative income, and country 2 loses.

Proposition 1 holds for country 2 where household income does not change on the horizontal tail of the equilibrium trajectory (L, S′). This tail corresponds to the notion of «underdevelopment trap». In the case $n_1(0) > n_2(0)$ country 2 with initial disadvantage falls in such trap. The situation is symmetric if country 2 has initially advantage over country 1. There is a continuum of non-autarky stationary states related to different initial conditions from the zone of positive $\dot{n}_k$. The set of this states is plotted on Figure 2 with bold curves (K_1, A_1) and (K_2, A_2).

If $\theta < 2 - \alpha\beta$, the phase diagram slightly changes, as Figure 3 shows. The locus of $\dot{n}_1 = 0$ is downward sloping at S (notation for the loci, critical points and non-autarky steady states is same as on Figure 2).

varieties in both countries moves the price of the final good down. This increases demand for manufactured goods in both countries, but demand for the basic good grows more rapidly in the country exporting manufactures. As a result, bilateral trade expands and the advanced country enhances import of the basic good.

Thus, the accumulation of varieties generates a negative terms of trade effect on production, same in both countries by the symmetry of the manufacturing good price (21), and a positive quantity effect which is country specific due to the difference in the number of intermediates. The terms of trade effect works through the factor $\frac{n_1 + n_2 + 2\rho}{n_1^{1/(\sigma-1)} + n_2^{1/(\sigma-1)}}$ in the accumulation equations (26)-(27), and the quantity effect works through the factor $n_k^{1/(\sigma-1)}$, k = 1,2. Accumulation of varieties in each country depends on the product of these two factors. If σ is below 2 the quantity effect is relatively weak in the less advanced country which, hence, loses more through the terms of trade deterioration. Due to such comparative disadvantage, bilateral trade benefits manufacturing and induces more intensive entry of intermediate firms in the advanced country. Such a cumulative mechanism leads to a divergence of development and the economies approach to one of the non-autarky steady states.

6. Uneven development and welfare

Suppose that $1 < \sigma < 2$ and the countries develop unevenly if they trade. It is worthwhile to make a welfare comparison for the autarky and non-autarky steady states. This will reveal the long-run effects of bilateral trade on welfare. From (4), (18), (19), (20) the indirect instantaneous utility of consumption by households in country k = 1, 2 is country 2 gains from trade in terms of welfare. If, on contrary, σ is close to 2, the terms of trade effect of the increase in n_1 does not offset the income effect of the decrease in n_2, and welfare of country 2 reduces. This result can be formulated as

Proposition 3. Trade between unevenly developing countries is welfare-improving for the advanced country. Trade is welfare-improving for the underdeveloped country if the elasticity of substitution σ is close to 1, and welfare-deteriorating if σ is close to 2.

Hence, uneven development does not necessarily imply welfare loses by the underdeveloped country. Under a high complementarity between intermediates the terms of trade effect of development is sufficiently strong. In this case both countries gain from trade in welfare terms, although the underdeveloped country suffers from the negative terms of trade effect on production and the reduction of relative income. Welfare improvement in the underdeveloped country occurs due to the dramatic fall of the manufacturing good price that ultimately benefits households in this country.[6]

If the degree of complementarity between intermediates is not very high (but quite significant to cause the divergence of development), the terms of trade effect is not strong enough to offset the reduction of household income in the underdeveloped country. Then both relative income and welfare reduce in this country.

7. Expanding trade with the rest of the world

So far I have assumed that the countries exchange in the world market basic goods for high-quality consumption goods, and are restricted not to sell manufactures to the industrial world. This section attempts to eliminate this restriction. Suppose that where $a' = z'/(H+\delta/\alpha)$, $\rho' = R/(H+\delta/\alpha)$, $\gamma = (H-\delta)/(H+\delta/\alpha)$.

The autarky steady state of the system (36)-(37) is S = (n*, n*), and $n^* = \dfrac{\alpha\beta\rho'}{\gamma - \alpha\beta}$. In order the autarky steady state to exist assume that parameter δ is sufficiently small to ensure that $\alpha\beta < \gamma$ or, equivalently,

$$\delta < \frac{H(1-\alpha\beta)}{1+\beta} \quad . \tag{38}$$

Proposition 4. The autarky steady state S is a unique positive stationary state of the system

$$a'\dot{n}_1 = \alpha\beta \frac{n_1 + n_2 + 2\rho'}{1 + (n_2 / n_1)^{1/(\sigma-1)}} - \gamma n_1 , \tag{39}$$

$$a'\dot{n}_2 = \alpha\beta \frac{n_1 + n_2 + 2\rho'}{1 + (n_1 / n_2)^{1/(\sigma-1)}} - \gamma n_2 . \tag{40}$$

It is a stable node if $\sigma > 2$ and a saddle point if $1 < \sigma < 2$.

Proof: in Appendix.

Consequently, incorporating trade in manufactures with the industrial world into the model does not alter our conclusion about the divergence of development paths. In fact, the model yields exactly the same condition as in Proposition 2 on the elasticity of substitution between intermediates implying uneven development.

8. Concluding remarks

The main conclusion from the model is that trade between developing countries can lead to uneven growth. Development paths of symmetric countries in the model diverge if the elasticity of substitution between intermediate services is quite low (below 2). This is an innovative result contributing to the literature on trade and growth.

Appendix.

Proof of Proposition 1.

The first-order condition for the household problem (1)-(3) is

$$E^{-1} = \eta, \tag{A1}$$

where E = pd + c is consumption expenditures, η is the current value of the costate variable related to (2). Since r = δ, the costate equation is

$$\dot{\eta} = -\lambda \ , \tag{A2}$$

where λ ≥ 0 is the current value of the Lagrangian multiplier corresponding to (3). From (A1) and (A2)

$$\dot{E} = \lambda E^2 . \tag{A3}$$

The solution $E = I$, λ > 0 satisfies (A3) if $\dot{I} > 0$ or, equivalently, $\dot{w} > 0$ for all t in the interval [0, T). Since b(0) = 0, b(t) remains zero for all t ∈ [0, T].

If $\dot{w} = 0$ on the interval [T, ∞), T < ∞, and b(T) = 0, then (2) and the transversality condition: $\lim_{t\to\infty} e^{-\delta t} b(t) = 0$ imply that the intertemporal budget constraint $\int_T^\infty e^{-\delta(t-T)} E dt = \int_T^\infty e^{-\delta(t-T)} I dt$ holds. Hence, $E = I = const$, and λ = 0 on this interval.

Proof of Proposition 2.

Consider the system (28)-(29). In the stationary state

$$n_1 = \frac{2\alpha\beta\rho}{1 + v^{\theta} - \alpha\beta - \alpha\beta v}, \tag{A4}$$

$$n_2 = \frac{2\alpha\beta\rho}{1 + v^{-\theta} - \alpha\beta - \alpha\beta v^{-1}}, \tag{A5}$$

where ν = n_2/n_1, θ = 1/(σ-1). Dividing (A5) by (A4) yields a scalar equation

$$\begin{pmatrix} \frac{\alpha\beta}{2}(1+(1+\rho/n^*)\theta)-1 & \frac{\alpha\beta}{2}(1-(1+\rho/n^*)\theta) \\ \frac{\alpha\beta}{2}(1-(1+\rho/n^*)\theta) & \frac{\alpha\beta}{2}(1+(1+\rho/n^*)\theta)-1 \end{pmatrix}$$

The characteristic roots of this matrix are

$$\mu_1 = \alpha\beta - 1 < 0 \text{ and}$$

$$\mu_2 = \alpha\beta(1+\rho/n^*)\theta - 1.$$

Since $n^* = \frac{\alpha\beta\rho}{1-\alpha\beta}$, $\mu_2 = \alpha\beta(1+(1-\alpha\beta)/\alpha\beta)\theta - 1 = \theta - 1 = 1/(\sigma-1) - 1$. Consequently, $\mu_2 > 0$ and the autarky steady state is a saddle if $\sigma < 2$.

Proof of Proposition 4.

Consider the system (39)-(40). In the stationary state

$$n_1 = \frac{2\alpha\beta\rho'}{\gamma(1+v^{\theta})-\alpha\beta-\alpha\beta v}, \tag{A8}$$

$$n_2 = \frac{2\alpha\beta\rho'}{\gamma(1+v^{-\theta})-\alpha\beta-\alpha\beta v^{-1}}. \tag{A9}$$

Dividing (A9) by (A8) yields:

$$v = \frac{\gamma(1+v^{\theta})-\alpha\beta-\alpha\beta v}{\gamma(1+v^{-\theta})-\alpha\beta-\alpha\beta v^{-1}} \tag{A10}$$

which is equivalent to equation (A7) having only one root: $v = 1$.

Consider local dynamics of (39)-(40) near the autarky steady state. The partial derivatives of the right hand side of (39) are

$$\frac{\partial \dot{n}_1}{\partial n_1} = \alpha\beta\frac{1+(n_2/n_1)^{\theta}+\theta(n_1+n_2+2\rho')(n_2/n_1)^{\theta}n_1^{-1}}{(1+(n_2/n_1)^{\theta})^2} - \gamma,$$

$$\frac{\partial \dot{n}_1}{\partial n_2} = \alpha\beta\frac{1+(n_2/n_1)^{\theta}-\theta(n_1+n_2+2\rho')(n_2/n_1)^{\theta}n_2^{-1}}{(1+(n_2/n_1)^{\theta})^2}.$$

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