

WORKING PAPERS IN ECONOMICS

**A Theory of Intermediate Services
and the Inequality of Nations**

by

Jeffrey Sheen

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ABSTRACT

An iceberg theory of intermediate services that bridge the transaction cost gap between producers and consumers is immersed in a symmetric two country-two sector model with a monopolistically competitive manufacturing sector producing an endogenous number of varieties. With a proportion of the expenditure of produced goods effectively 'melting' on their way to the consumer, firms can choose to invest scarce resources and create intermediate market services that inhibit the loss, thereby improving demand for their product. Their ability to do so depends on the exogenous productivity of labour in creating these market services, with the inequality across nations distinguished by this parameter. The general equilibrium effects of improvements in this productivity are analysed. For poor countries, two equilibria emerge with one involving much higher welfare. As productivity improves, the poor do catch up with the rich on their single equilibrium path, but may suffer in transition.

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A Theory of Intermediate Services and the Inequality of Nations

A significant proportion of any country's GDP involves the production of services which do not provide final consumer benefits. Instead, they serve to assist consumers in obtaining as much as possible from produced final goods and services that deliver direct utility. For example transport, marketing, communications, retail, information, financial, insurance, legal, perhaps even medical and social services may be seen as intermediate services that enhance the utility obtained from final goods and services. For many individual products, there is a very large difference between the pure producer price and the final consumer price that cannot simply be explained by price-cost margins. These price gaps may be better understood by considering the role of intermediate services. In particular, this paper will focus on the expenditures on those services which can be thought of as transaction costs¹ incurred by firms in the process of exchange, rather than in production - in their absence the volume of exchange would be significantly reduced.

One way of characterising this perspective is to extend the 'iceberg' approach² as applied to transport costs to a more general setting. A natural proportion of the expenditure on a product evaporates or melts in getting it from the supplier to the demander. This means that the implied consumer price of a unit exceeds the producer price by a certain proportion. A firm can invest scarce resources to ameliorate this natural melting suffered effectively by its consumers, thereby shifting the demand for its product. We shall say that this expenditure generates intermediate market services³ that reduce the transaction cost wedge between producer and consumer.

In his illuminating theory of economic history, Hicks (1969) provided a rich economic analysis of institutional and market developments that allowed many of the world's economies to evolve and deliver the progress that many can enjoy in the present day. He focussed on developments that had little to do with technology and production. Similarly, North (1990) emphasised the importance of institutional developments and showed that there were significant institutional differences across countries. These differences will influence the effectiveness of transaction costs incurred for enhancing market exchange. Thus we are led to the old question why some countries have evolved faster than others. There may be many economic, social and cultural explanations, but it is interesting to consider how economic forces in the present context of transaction costs and intermediate services may have led to the inequality of nations. This paper provides a particular model that examines some aspects of this fundamental question.

In a fascinating paper, Krugman & Venables (1995) showed how transport costs (in the ‘iceberg’ form) may help to explain the differential performance of countries. Using a two country-two good model with a monopolistically competitive manufacturing sector producing varieties of final and intermediate goods, they show that trade patterns and real income inequality change dramatically with exogenous transport costs. When these costs are very high, the equilibrium is symmetric. For an intermediate range, one country will move dramatically ahead of the other by exploiting the economies of scale that geography through transport costs makes possible, and it will experience specialisation in manufacturing and increasing real wages. As transport costs fall eventually into a low range, the poorer country’s lower real wages become a competitive factor leading to relocation of manufacturing there and a process of catch-up with the rich country.

This paper builds on the Krugman & Venables real trade⁴ model by generalising the exogenous iceberg transport cost into an endogenous ‘melting’ process in every trade between manufacturing producers and consumers. Furthermore, firms are allowed to optimally allocate scarce resources to control the ‘melting’ with market services. The exogeneity aspect is reduced to the technology parameters involved in creating these services. By considering an exogenous improvement in the labour productivity of market services, we shall address some characteristics of the process driving the inequality across nations.

With the focus on service productivity improvements, countries will be seen to face a trade-off between reducing transaction costs through the service sector and increasing the varieties of consumed goods⁵. Richer countries do better with the former, poorer countries with the latter. Two major results are obtained in this paper: the model offers a supply-side explanation for the pattern of growth of the service sector relative to the goods sector as an economy develops; and, the pattern may differ for rich and poor countries.

The main questions addressed in this paper are: in Section 1 - restricting attention to a symmetric world, what is the nature of the equilibrium?, as countries raise their productivity in generating market services, how does that equilibrium change? ; in Section 2 - what are the implications of changing key parameters in the model such as the elasticity of substitution between goods, or transport costs between countries?; in Section 3 - what roles do manufactured intermediate goods play? At the end some conclusions are offered.

Section 1 The Model

Consider a two country world where each country (home and foreign) produces agricultural and manufactured goods. There is free entry and exit in each sector in each country. In this paper perfect country symmetry is assumed so that the properties of the general model can be studied without the added complications of asymmetries. With both countries being structurally similar, definitions for only the home country (generally in upper case) are detailed in what follows.

Agricultural produce (A_g) is traded in a perfectly competitive market and is a homogeneous consumer good produced using only labour (L_A) under constant returns so that:

$$(1) \quad A_g = L_A$$

The world-wide price of the agricultural good is taken as the numeraire and set to 1. Assume that neither country specialises its production and that full employment prevails. Therefore the nominal wage rate, W , must be one. For simplicity, assume no distinction between the consumer and producer price of the agricultural good.

We choose to model a monopolistically competitive manufacturing sector because this industrial structure is the simplest form of imperfect competition - the role of intermediate services can be examined relatively easily. Manufactured goods varieties are produced by a finite endogenous number of firms in each country (N and n) under decreasing costs using labour (and intermediate manufactured goods in Section 3). Each variety is used for final consumption (and as an intermediate input). They are sold in competitive markets, with their demands depending on producer prices, melting costs and endogenous intermediate market services. The market services are country-dependent and provide benefits to all consumers but costs to producers. For manufactured goods, this means that there is an endogenous wedge between their producer and consumer price.

Home Consumption Choices

The representative home country household’s utility is a Cobb-Douglas function of agricultural goods consumption (A_g^d) and a manufactured goods consumption index (M_C), which is maximised subject to its budget constraint. Its only income is wage income, WL , (profits being zero because of free firm entry and exit). The relative price index of the manufactured aggregate is given by Q_M . Indirect utility, V , the consumption demand for manufactures and agricultural goods are:

$$(2) \quad V = Q_M^{-\gamma} WL \quad ; \quad M_C = \gamma Q_M^{-1} WL \quad ; \quad A_g^d = (1-\gamma)WL$$

where γ is the manufactured goods’ elasticity of utility.

Individual manufactured varieties are valued and aggregated into the M_C index by a CES function:

$$(3) \quad M_c = \left(\sum_{i=1}^N M_{c_i} \frac{\sigma-1}{\sigma} + \sum_{i=1}^n m_{c_i} \frac{\sigma-1}{\sigma} \right)^{\frac{\sigma}{\sigma-1}}$$

where M_{c_i} (m_{c_i}) is the domestic consumption of domestic (foreign) manufactures. As usual, we need a finite $\sigma > 1$ which means that these varieties are sufficiently substitutable to be grouped; as $\sigma \rightarrow \infty$, all manufactures become perfect substitutes and varieties become irrelevant. With N and n being endogenous, many of the welfare effects obtained in this paper will come from the variety channel.

When transacting particular manufactured goods, consumers and producers have to participate in their markets and this participation adds cost over and above the production price of the goods. Consumers face considerable information requirements, physical demands, insecurities and financial constraints. Some part of their income has to be spent in meeting these participation imposts. These costs are accumulated together in a simple 'iceberg' form such that some fraction of expenditure on a good effectively melts⁶ away in the process of getting the manufactured good from the producer to the consumer. In this connection, extra customer service expenditures by firms may be desirable on advertising, insurance against the riskiness of contracts, legal support, quality verification, transport costs, financial intermediation, security against theft et al. With expenditures on these intermediate market services, firms have the power to alleviate the melting costs of consumers. Here we shall distinguish only between home market services, using an index K , and foreign market services, k .⁷

Thus each home-produced manufactured good will effectively cost the home consumer $P_i S[K_i]$, where P_i is the price paid to the i 'th home manufacturer, and $l/S[K_i]$ measures the remaining iceberg proportion which is improved by the provision of home market services. It is assumed that $S[\cdot]$ is decreasing and convex, and as an example to be used in the paper, with the following simple form:

$$(4) \quad S[K_i] = 1 + \frac{\bar{S}}{(1+K_i)} \geq 1$$

where $\bar{S} (> 0)$ can be thought of as a melting parameter. This function⁸ has the following appealing properties: if a firm chooses not to contribute to market services costs, then $K_i = 0$, and consumers suffer the maximum meltdown; however as $K_i \rightarrow \infty$, the meltdown is avoided altogether. In Figure 1, an example of the melting proportion $(1-l/S)$ as a function of $1+K_i$ is shown.

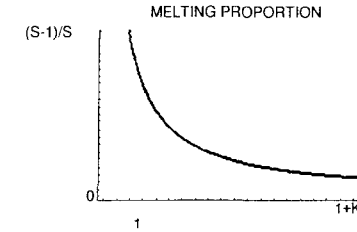


Figure 1

Home consumers suffer from a foreign melting function when they purchase foreign goods. In addition they incur proportional geographical melting, defined as $t (\geq 1)$, from which foreign consumers of foreign goods are absolved⁹. Thus the implied value of home consumption of all manufactures becomes:

$$(5) \quad Q_M M_c = \sum_{i=1}^N P_i S[K_i] M_{c_i} + \sum_{i=1}^n p_i s[k_i] t m_{c_i}$$

Minimising (5) subject to (3) (after dropping producer subscripts on prices and market services because all N home and n foreign firms are identical) we get:

$$(6) \quad M_{c_i} = \left(\frac{P S[K]}{Q_M} \right)^{-\sigma} M_c \quad ; \quad m_{c_i} = \left(\frac{p s[k] t}{Q_M} \right)^{-\sigma} M_c$$

and:

$$(7) \quad Q_M = \left(N (P S[K])^{1-\sigma} + n (p s[k] t)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

An increase in either market services index, given the number of firms and prices, will raise manufactured consumption, lower the aggregate manufacturing price index (ie $Q_{M,K} < 0$, $Q_{M,k} < 0$), and thereby increase real wages and utility. With goods being normal, market services spending can be seen as an instrument of demand-shifting between (and potentially within) the two countries. The demand for a home firm's product (at a given producer price) as a function of $1+K_i$ is shown in Figure 2.

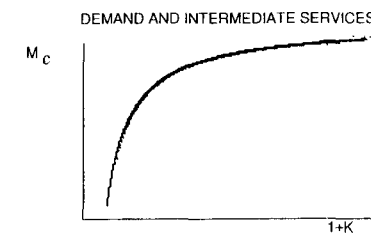


Figure 2

Home Manufacturing Sales, Production and Market Services Expenditure

In this section, all of the output (M) of a home manufacturing firm is sold to home and foreign consumers. In Section 3, manufactured goods are also used as intermediate goods in their production. Let exports and domestic sales be defined as X and Y . Using (2) - (7), and the foreign economy equivalents, the total demand for an individual home firm's product can be written as (dropping subscripts):

$$(8) \quad M = X + Y = \left(P \left(1 + \frac{\bar{S}}{1+K} \right) \right)^{-\sigma} \left(\frac{\gamma W L}{Q_M^{1-\sigma}} + \frac{t^{-\sigma} \gamma w l}{q_m^{1-\sigma}} \right)$$

The two terms on the right of (8) arise from domestic and foreign consumption demand. Though an increase in Q_M (or q_m) lowers the individual firm's relative price and improves its sales, if the number of firms and therefore varieties is large enough, the effect of a price change of any one will be negligible on the others. Therefore each firm will be assumed to take the price indices (and hence the number of firms) as given when making all its decisions.

Each firm uses a constant returns to scale technology with labour and an index of all intermediate manufactured goods to produce its output:

$$(9) \quad M = A L_M^{1-\alpha} M_I^\alpha$$

with the aggregate M_I index of manufactured intermediates determined in the same way¹⁰ as the consumption aggregate in (3). However for the remainder of this section, we shall assume α is zero (see Section 3 for the more general case) so that:

$$(9a) \quad M = A L_M$$

In addition to its wage expenditure and a fixed cost, F , each firm can choose to incur intermediate market services costs¹¹ for the sake of enhancing or protecting its sales. The demand for a firm's product depends on K and these services are produced using labour, L_K , again under constant returns:

$$(10) \quad K = B L_K$$

As the productivity parameter B improves over time, both K and L_K will vary but not necessarily with a consistent correlation. The effects of changes in this parameter are the primary focus of this paper.

Profits are:

$$(11) \quad \pi = P M - W(L_M + L_K) - F$$

Maximising (11) with respect to M and K using (8) - (10), and recognising that free entry and exit imply zero profits, we obtain the following partial equilibrium conditions:

$$(12) \quad P = \frac{\sigma W}{(\sigma - 1)A}$$

$$(13) \quad \frac{P M \bar{S}}{(1+K)(1+K+\bar{S})} = \frac{W}{B}$$

$$(14) \quad \pi = \left(P - \frac{W}{A} \right) M - \frac{W K}{B} - F = 0$$

The first is the standard condition that marginal revenue equals marginal cost of output, implying the equality of the price elasticity of demand and the elasticity of substitution. The second sets equal the marginal benefit and cost of additional market services¹², while the third is the zero profit condition.

Substituting (12) into (13) (and recognising that W is 1 in the symmetric model) we get a relationship between M and $1+K$ which is depicted in Figure 3 as the MBC curve ie

$$(15) \quad M = \frac{A(\sigma - 1)}{\sigma B \bar{S}} (1+K)(1+K+\bar{S})$$

The steepening slope reflects the ever decreasing marginal benefits from more market services. Any point above the MBC curve implies an excess of marginal benefit over cost of K .

(12) and (14) give a zero profit locus at the optimal price, which is linear in M and $1+K$, and shown in Figure 3 as the $\pi=0$ line ie

$$(16) \quad M = A(\sigma - 1) \left(\frac{K}{B} + F \right) = \frac{A(\sigma - 1)}{B} ((1+K) + (FB - 1))$$

Any point above the $\pi=0$ line implies positive profit.

Equilibrium values, \hat{M} and \hat{K} are obtained at the intersection of the MBC and $\pi=0$ curves. An equilibrium cannot exist for $1+K < 1$. The equilibrium firm size is determined solely by the zero profit condition and the first order conditions for each firm. The equilibrium number of firms does not enter into these calculations, a feature that is due to the iceberg formulation in (4), the assumption that each firm makes its decisions taking the behaviour of other firms as given, and the absence, for the time

being, of intermediate goods in production. In Figure 3, as drawn, there are two equilibria, a high activity one and a low activity one. As B declines to a minimum value, \underline{B} , we shall see below that these two converge to one. When B is very large there will be only one equilibrium (in the high activity region).

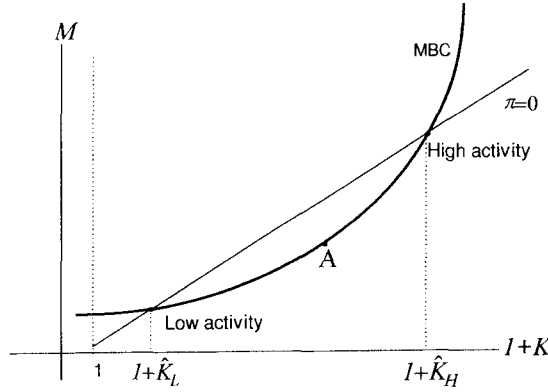


Figure 3

The possibility of two feasible equilibria for particular values of B arises because of the convexity of the MBC curve. Consider point A in Figure 3 where the marginal benefit of K equals its marginal cost, but profits are negative. To eliminate this loss, the firm could expand output, M , up to the $\pi=0$ line, thus creating an excess marginal benefit of K . Raising K sufficient to return to the MBC line recreates the loss, but at a smaller value than at A. Continuing in this way to the point labelled 'High activity', an equilibrium is established. Alternatively, the loss at point A could be eliminated by a fall in K spending to the $\pi=0$ line, then a fall in M to return to the MBC line, recreating a loss which is smaller than at A. The equilibrium point labelled 'Low activity' will eventually be reached.

Existence of Equilibria

Proposition 1: If $\sigma > 1 + \frac{2}{\bar{S}}$, a unique feasible equilibrium for \hat{M} and \hat{K} exists when $\infty > B > \bar{B}$ for a finite positive \bar{B} ; there will be two feasible equilibria for B in a finite interval with a positive lower bound, $\underline{B} < B \leq \bar{B}$, whose size depends only on \bar{S} , σ and F ; and a single equilibrium for $B = \underline{B}$.

Proof: (12), (13) and (14) together give a quadratic in $I+K$ whose solution is:

$$(17) \quad 1 + \hat{K} = (\sigma - 1)\bar{S} / 2 \pm \sqrt{(\sigma - 1)^2 \bar{S}^2 + 4\sigma\bar{S}(FB - 1)} / 2$$

Given the other parameters, this quadratic has a real solution for a minimum value of $B = \underline{B}$; below that an equilibrium on the real line does not exist. At this point, the $\pi=0$ line will be tangential to the MBC line in Figure 3. From the quadratic, such a unique solution is obtained when

$$\underline{B} = \frac{(1 - (\sigma - 1)^2 \bar{S} / 4\sigma)}{F} \quad \text{where} \quad I + \hat{K} = \frac{(\sigma - 1)\bar{S}}{2}.$$

A non-negative \underline{B} and a positive \hat{K} here requires

$$(18) \quad 1 + \frac{2}{\bar{S}} < \sigma \leq 1 + \frac{2}{\bar{S}} + \sqrt{\left(1 + \frac{2}{\bar{S}}\right)^2 - 1}.$$

To prove that the low activity equilibrium is feasible, we use the fact that when $B = \underline{B}$, a positive and unique \hat{K} may exist at this point if the above condition is met¹³. Thus a small increase in B can generate two feasible equilibria - one for which \hat{K} must fall (the low activity solution), and the other, where \hat{K} rises (the high solution). The gap between the two will widen until $B = \bar{B}$ when \hat{K} reaches zero for the low activity equilibrium. Thus in the range $\underline{B} < B \leq \bar{B}$, firms may select the low or high manufacturing activity equilibrium. This possibility is actually shown in Figure 3.

At the critical value (provided $\sigma > 1 + 2/\bar{S}$)

$$(19) \quad \bar{B} = \frac{(1 + \bar{S})}{\sigma\bar{S}F}, \quad \hat{K} = 0 \quad \text{or} \quad \hat{K} = (\sigma - 1)\bar{S} - 2$$

at which point either $\hat{M} = (\sigma - 1)AF$ or $\hat{M} = (\sigma - 1)^2 AF\sigma\bar{S} / (1 + \bar{S})$, the latter exceeding the former low activity solution under the provision.

For $\infty > B > \bar{B}$, the low activity solution is ruled out as \hat{K} would become inadmissibly negative, while the second, if it exists, would increase. In Figure 3, the $\pi=0$ line would intersect the MBC line feasibly only once, high up. As $B \rightarrow \infty$, $\hat{K} \rightarrow \infty$ though $\hat{K}/B \rightarrow 0$ and $\hat{M} \rightarrow A(\sigma - 1)F$; with no labour being utilised in market services production and melting costs eliminated, we are effectively back to the Dixit & Stiglitz (1977) model, which is at the base of the present one.

The range of B which allows a double equilibrium will have the size:

$$(20) \quad \bar{B} - \underline{B} = \frac{1}{\sigma\bar{S}F} \left(\frac{(\sigma - 1)\bar{S}}{2} - 1 \right)^2$$

This range is positive under the condition and will enlarge with \bar{S} and σ (as long as $\underline{B} > 0$), and contract with F .

Which of the two equilibria a country may find itself in is determined by historical dynamics. For the time-being, we shall ignore the stability properties of the equilibria. Naturally, these properties will have an important bearing on the relevance of these points. It will be shown below that only the 'high equilibrium' is stable in the model presently outlined, but that the low activity one can be sustained if we introduce perhaps more realistic dynamic adjustment assumptions, or if government subsidies or regulation prevent optimal industrial concentration. Before establishing the dynamic properties of the model above, we need to determine the equilibrium number of firms by introducing labour and goods market clearing, and to establish the welfare characteristics of the equilibria.

Market Equilibrium

There are three markets in equilibrium in each country - labour, agriculture and manufacturing - and the balance of trade between them must always be zero. The exogenous labour supply is assumed to be fully employed in agricultural, manufacturing and service production. Total demand for manufactures (agriculture) from home and abroad must be equated to output net of any real fixed costs. The value of net exports of agricultural goods have to equal net imports of all manufactured goods. In solving, one market in each country can be dropped; thus, ignoring manufacturing equilibrium, from (9a), (10) and (16) we have:

$$L = L_A + N(L_M + L_K) = L_A + N\left(\frac{\hat{M}}{A} + \frac{\hat{K}}{B}\right) = L_A + N\left(\sigma \frac{\hat{K}}{B} + (\sigma - 1)F\right)$$

or:

$$(21) \quad N = \frac{1}{\frac{\sigma \hat{K}}{B} + (\sigma - 1)F} (L - L_A)$$

The denominator in (21) varies with \hat{K} as determined in (17). The trade-off between N and L_A reflects the fact that if more labour is absorbed in agriculture, less is available for manufacturing, and so given the equilibrium usage by each firm, the number of firms must fall.

From (1) and (2) home agricultural demand is given by $(1-\gamma)L$ while home supply equals L_A . To complete this solution, we invoke our benchmark assumption that the countries are symmetrical. In this event, home agricultural demand will equal supply and the only international exchanges between the countries will be in reciprocal trades in their manufacturing varieties. Thus with the symmetry assumption, (21) becomes

$$(22) \quad \hat{N} = \frac{\gamma L}{\frac{\sigma \hat{K}}{B} + (\sigma - 1)F}$$

which is depicted as the NN line in Figure 4. Note that the equilibrium number of firms in a low activity equilibrium is greater than in a high activity one.

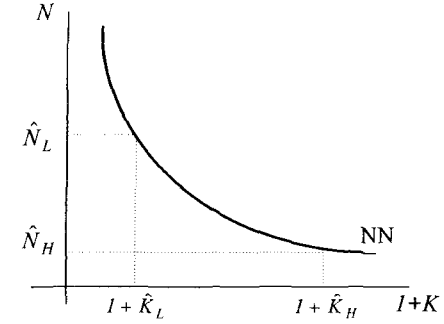


Figure 4

In the range $\infty > B > \bar{B}$, when only one equilibrium exists, \hat{K}/B declines to zero with B and so \hat{N} converges to $\gamma L / ((\sigma - 1)F)$. The slope of NN flattens with B . Moving down into the range $\underline{B} < B \leq \bar{B}$, when the two solutions emerge with \hat{K} less in the low activity equilibrium, the number of firms will be higher. As B approaches the minimum value \underline{B} , the NN curve becomes its flattest and the low and high points converge.

Proposition 2 An increase in B will reduce \hat{K} and \hat{M} but raise \hat{N} in the low activity equilibrium (for $\underline{B} < B \leq \bar{B}$). In the high activity one, \hat{K} rises while \hat{M} initially rises and then falls, but \hat{N} initially falls, then rises though slower than in the low activity one.

Proof: Differentiating (13) and (14) with respect to B , and solving we get:

$$(23) \quad \frac{d\hat{K}}{dB} = \frac{\sigma F \bar{S} / 2}{I + \hat{K} - \bar{S}(\sigma - 1) / 2}$$

It was shown above that at the minimum value \underline{B} , $I + \hat{K} = (\sigma - 1)\bar{S} / 2$ and so the derivative is infinite at that point. Where a low activity equilibrium exists for $\underline{B} < B \leq \bar{B}$, $I + \hat{K}$ will be less than that value (see Proposition 1) and so the denominator in (23) will be negative. For a high activity equilibrium it will be positive. With \hat{K} and B going in opposite directions in the low activity equilibrium, the NN curve flattens and the \hat{K}_L value shifts left in Figure 4, causing a large firm entry. By contrast in the high activity one, they move in the same direction, and so their ratio increases more slowly and eventually reverses itself. Hence exit occurs initially followed by slow entry. For the same reason,

output initially increases and then decreases in the high activity equilibrium. These results can be seen in Figure 7 which produces numerical solutions¹⁴ of the model for different values of the exogenous parameter B . In each of the diagrams, the thicker curve represents high activity equilibrium solutions, and the thinner one gives low activity ones. Between \underline{B} and \bar{B} , the existence of the two equilibria is evident.

Finally it is important to consider what happens to welfare for different values of B .

Proposition 3: \hat{V} always increases with B , but for $\underline{B} < B \leq \bar{B}$, it is generally higher in the low activity equilibrium.

Proof: As $B \rightarrow \infty$, the melting effects are eliminated at no cost to the firm. Therefore indirect utility \hat{V} must approach a maximum value. (Equivalently, \hat{Q}_m must decline to a minimum value.) At $B = \underline{B}$, the low and high activity equilibria are identical. In general, from (2), (4), and (7), the welfare ratio for the low activity and high' symmetric equilibria

$$(24) \quad \left(\frac{\hat{V}_L}{\hat{V}_H} \right)^{\sigma-1} = \frac{\hat{N}_L}{\hat{N}_H} \left(\frac{1 + \frac{\bar{S}}{1 + \hat{K}_H}}{1 + \frac{\bar{S}}{1 + \hat{K}_L}} \right)^{\sigma-1}$$

can be shown to be greater than 1 in the dual equilibria range. From Proposition 1, it was shown that, with an increase in B in the range $\underline{B} < B \leq \bar{B}$, \hat{K} falls continuously towards zero in the low activity equilibrium reducing welfare via the intermediate services effect. By contrast in the high activity equilibrium \hat{K} increases. On the other hand, in Proposition 2, it was shown that \hat{N} increases more rapidly in the low activity than the high activity equilibrium. Thus on the right of the above equation, the first term is greater than one, while the second is less than 1.

Substituting (19) and (22) into (24) yields a highly non-linear condition (of σ and \bar{S} alone) for comparing low and high activity welfare at the point of their greatest differential, \bar{B} . An analytical solution could not be found, but from contour maps of the condition and of the feasible double equilibrium range (see (18)), it is apparent in Figure 5 that $\hat{V}_L / \hat{V}_H > 1$ for almost all sensible values of the two key parameters. The unit contour coincides with the lower feasibility condition except in a tiny zone when \bar{S} is particularly small and σ big.

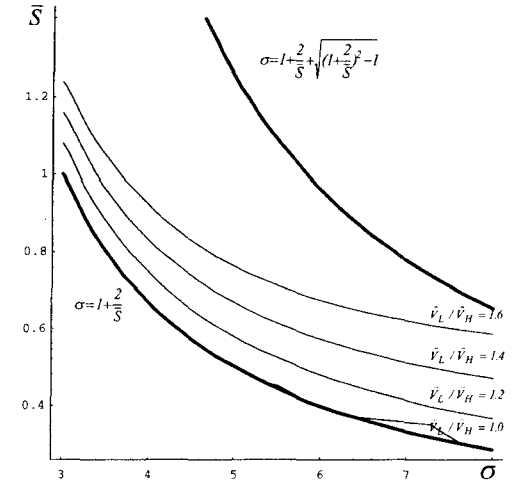


Figure 5

Thus in this model, the variety effect is generally more powerful in improving the low activity's relative welfare than the relative worsening caused by the intermediate services effect. This conclusion can also be seen in the simulation results shown in Figure 7. The low activity one is seen to have a higher equilibrium welfare. This occurs because of its dramatic increase in the number of firms despite the fall in \hat{K} . The increase in \hat{K} in the high activity equilibrium does improve welfare but in no way compares to the effect of greater product variety that emerges in the low activity one.

Thus it is an interesting feature that the low activity equilibrium has a higher welfare than the alternative high one for a range of B . Indeed there is a finite range above \bar{B} in which the unique (high activity) equilibrium value of welfare is less than the maximum achieved by the low one at \bar{B} . Now that we have compared the equilibria, we turn to an analysis of their stability properties.

Stability of Equilibria

Proposition 4: A unique equilibrium is stable. When there are two equilibria, only the high activity one is stable

Proof: The underlying assumption of this standard monopolistic competition model is that free entry and exit occur over time when profits are positive or negative. Whenever firms find themselves at a point below the $\pi=0$ line in Figure 3, their profits will be negative, and exit will take place. Similarly, find below the MBC line, the marginal benefit of an additional dollar of market services will be less than the cost, and K will decline. This adjustment of K is permitted (for now) to be instantaneous. Consider the effects of an increase in

B starting from a low activity equilibrium point as in Figure 6. This causes the MBC curve to tilt rightwards with a lower intercept. The $\pi=0$ line does not shift but flattens. Thus at an initial low activity equilibrium, profits become positive, and the marginal benefit of K exceeds cost. K expands to point A immediately to restore the first order condition, which must turn profits negative because of the convexity of the marginal benefit function; thus instead exit will take place concentrating the industry with bigger firms. As product variety declines, the marginal utility of income will fall (with Q_m rising), raising the demand for manufactures and output (see (8)), thus improving the negative profits until a high activity equilibrium is attained at point H_1 .

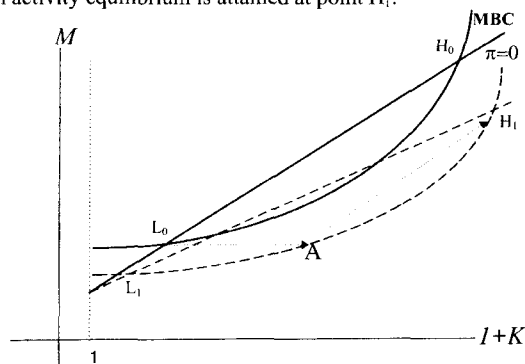


Figure 6

Therefore with the low activity equilibrium unstable, our interest in it would dissolve. However if we can find conditions under which the low activity equilibrium is sustainable in the face of minor perturbations, its existence would become relevant. After all, when it exists, we have shown above that it has superior welfare properties.

Alternative Stability Assumptions

To stabilise a low activity equilibrium, two alternatives are offered: firstly, a re-ordering of the adjustment speeds between N and K ; and, secondly, the imposition of government regulations and subsidies to prevent industrial concentration or the collapse of individual firms. In the first case, the assumption implies that in poorer countries (with services productivity in the low range between \underline{B} and \bar{B}), significantly less time is needed to begin manufacturing with a small firm than to create a different level of beneficial intermediate services¹⁵.

In a low activity equilibrium, if, instead, entry is allowed to occur rapidly in response to the initial profit improvement, while K can adjust only very sluggishly, then given unchanged demand, K and M would begin to fall. This would have to mean a temporary suspension of the effect of the initial positive net marginal benefit of K

after a B increase. The expansion of firms would create an excess demand in the labour market, and manufacturing employment would have to contract. Therefore K (and M) would have to be lower. With B rising, \hat{K} can continue to fall until eventually it reaches 0 when firms achieve their minimum size for equilibrium. Beyond this point, ie \bar{B} , a higher B will tilt down the $\pi=0$ line and shift and tilt down the MBC line in Figure 3. Thus profits remain at zero initially, while excess marginal benefits of K will appear unsatisfied. Eventually these will become over-powering and K will begin to rise, creating negative profits and a catastrophic collapse in firm numbers and welfare as the economy finds its way slowly to the unique equilibrium (on the high activity path) with much larger and fewer firms. Welfare in the high activity equilibrium will ultimately exceed the peak of the low one as B continues to increase. In summary, when a country begins at the lowest level of market services productivity, and development proceeds in this context, the spending on market services by each firm declines as does size, but a substantial number of new firms enter thus greatly raising welfare through the product variety route. This process continues towards a negligible commitment to market services spending, after which entry ceases and the pressure for increased market services becomes effective. Profits then become negative, and dramatic exit occurs as welfare falls to a lower path; ultimately slow entry and increased market services spending will take place along this path leading in the long run to much higher welfare.

The second possibility is if the standard dynamic assumptions are retained, but governments support an unstable low activity equilibrium by using regulation and subsidies to prevent the natural collapse or concentration of firms onto the high activity equilibrium path. These governments in countries that are poor in market services productivity will feel they have every reason to impose these policies. After all, welfare is much higher in the unstable low activity equilibrium than in the stable high one. Many developing countries are advised by multilateral agencies to remove their government subsidies and regulations. The reasons are usually that these policies introduce welfare-reducing distortions. However our model suggests that the instability of the low activity equilibrium which has higher welfare is the key distortion. The potential of higher welfare in the future after dramatic productivity improvements on the stable equilibrium path may not be relevant to a government of a poor country in the present.

Section 2 Comparative Statics

We shall now discuss briefly the effects on the equilibria of changes in the other exogenous variables - $\bar{S}, \sigma, F, A, \gamma, L, t$. The implications of these changes are shown in Figure 8 - Figure 16. The outcomes are shown as the dashed lines, and are compared to the base case shown in Figure 6 and reproduced as the solid lines in Figures 7-16. In the base case, calibration of the model led to the following parameter values: $\bar{S}=1$; $\sigma=5$; $F=0.6$; $A=2.5$; $\gamma=0.7$; $L=1000$; $\alpha=0$; $t=1$.

A lower melting parameter, \bar{S} , reduces the range of B (see (20)) for the double equilibrium. In Figure 3, the zero profit line is unaffected by this change, but the MBC line shifts up and steepens, while in Figure 4, the NN curve remains unchanged - therefore the new equilibrium requires smaller (bigger) and more (fewer) firms in the high (low) activity equilibrium, and involves higher welfare generally. Thus if the natural market gap between consumers and producers diminishes, the issues raised by this paper will become less relevant.

A lower elasticity of substitution, σ , between manufactured varieties has similar effects as lower \bar{S} , though the changes are more intense because the zero profit line in Figure 3 also shifts and tilts (down), and the NN curve shifts up and flattens. As the goods become less substitutable, the benefits from variety are enhanced. If consumers in poorer countries had less interest in variety, and more interest in total income, the importance of the low activity versus high activity equilibrium problem would be less.

With a lower fixed cost, F , the only change in Figure 3 is a shift down of the zero profit line, while in Figure 4, the NN curve shifts up. This once again has similar effects on output, market services spending and concentration. The welfare effects differ in the low activity equilibrium. Lower fixed costs reduce low activity equilibrium welfare because the shrinking variety effect plays such an important role. The double equilibrium range shifts to the right and expands. With a smaller barrier to entry of this form, the double equilibria outcome becomes more likely.

With an improvement in goods productivity, A , the slopes and intercepts of both curves in Figure 3 increase such that K (and hence N) is unchanged but each firm produces more output and welfare is obviously higher. Changes in the A parameter may be brought about as a result of R & D expenditures¹⁶.

A higher share of manufactured goods in consumption, γ , has no effect on Figure 3, but shifts up and flattens the NN curve in Figure 4 - thus this change simply expands the number of firms, and thereby raises welfare through the increase in variety.

An expansion in country size, measured through the labour force, L , increases the number of firms and raises welfare, again because of the variety effect.

Raising t makes it more costly for consumers to do international rather than national trade, and the only effects are the fall of welfare brought about by a lower real wage.

Section 3 Introducing Intermediate Goods and Intra-Industry Trade

Up to now, manufactured goods have been used for consumption purposes only. In our symmetrical world, this has meant that trade was trivial, with each country's consumers consuming equal proportions of every good available throughout the world. It is well-known that a significant amount of trade is intra-industry trade, and so now we amend the model to account for the use of manufactures as intermediate goods in production. We now let α vary from 0 in (9).

The demand for a firm's product given in (8) expands to:

$$(8a) \quad M = \left(P \left(1 + \frac{\bar{S}}{1+K} \right) \right)^\sigma \left(\frac{\gamma W L}{Q_M^{1-\sigma}} + \frac{\gamma w l t^{-\sigma}}{q_m^{1-\sigma}} + \frac{1}{A} \left(\frac{\alpha}{1-\alpha} \right)^{(1-\alpha)} Q_M^{\sigma+\alpha-1} N M + \frac{1}{a} \left(\frac{\alpha}{1-\alpha} \right)^{(1-\alpha)} t^{-\sigma} q_M^{\sigma+\alpha-1} n m \right)$$

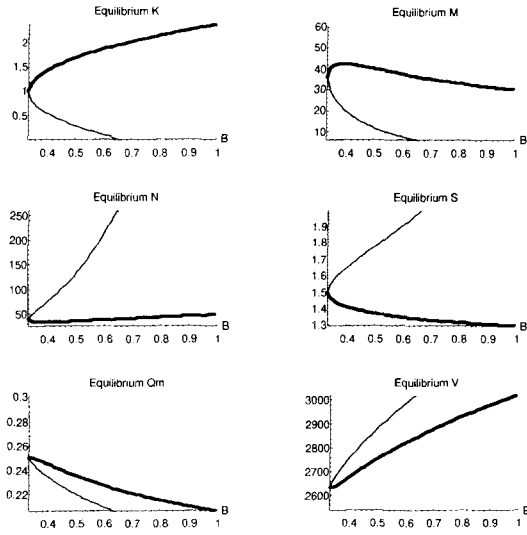
with the last two terms on the right arising from the intermediate demands of every home and every foreign firm for this manufactured good. Both first order conditions and the zero profit condition ((12)- (14)) are affected - the price-cost margin now depends on Q_M and thus N , and therefore so does the marginal benefit of K and total revenue. However the fundamental quadratic and its solutions in (17) are unchanged. Therefore the low and high activity equilibrium issue remains intact.

The implications of an increase of the share of intermediates in production from 0 to 0.2 and to 0.5 can be seen in Figure 15 and Figure 16. Comparing to the base case, we see that the number of firms is generally greater, but that firms are smaller when α is 0.2 and little changed when 0.5. Welfare is improved for a small increase in intermediates, but actually reduced by the time the share reaches 0.5. The intuition for this is that as the production share of intermediates increases, the number of intra-producer transactions expands significantly each of which suffers from the 'melting' parameter. However as the productivity parameter, B , approaches infinity, welfare increases much more with the bigger share of intermediates - 'melting' becomes increasingly irrelevant as B improves, and the variety effect from intermediate goods expansion feeds into consumption and thus utility. Therefore there is an important welfare link between the effects of B and α . By adding manufactured intermediates in production, there will be an increasing welfare gap to bridge between the low and high activity equilibria which occurs because that issue arises on account of the melting inefficiencies coming through manufactured goods.

Figure 7

BASE CASE

$\bar{S} = 1; \sigma = 5; F = 0.6; A = 2.5; \gamma = 0.7; L = 1000; \alpha = 0; t = 1$
 Thicker (thinner) line traces 'High' ('Low') equilibrium



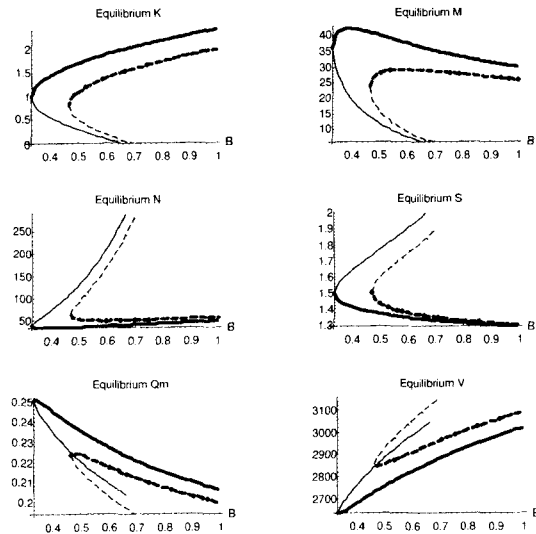
As $B \rightarrow \infty$: $K \rightarrow \infty; M \rightarrow 6; N \rightarrow 291; S \rightarrow 1; Q_m \rightarrow 0.10; V \rightarrow 4952$
 Two countries are symmetrical

Figure 8

LOWER MELTING

$d \ln \bar{S} = -0.1$

Dashed lines represent new equilibria



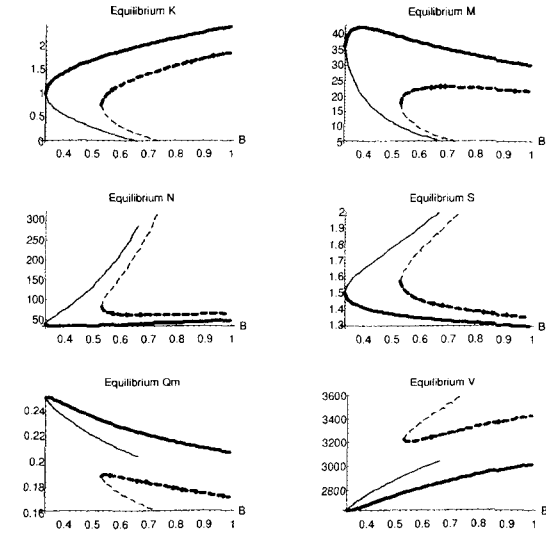
As $B \rightarrow \infty$: $d \ln K \rightarrow 0; d \ln M \rightarrow 0; d \ln N \rightarrow 0; d \ln S \rightarrow 0; d \ln Q_m \rightarrow 0; d \ln V \rightarrow 0$

Figure 9

LOWER ELASTICITY OF SUBSTITUTION

$d \ln \sigma = -1$

Dashed lines represent new equilibria



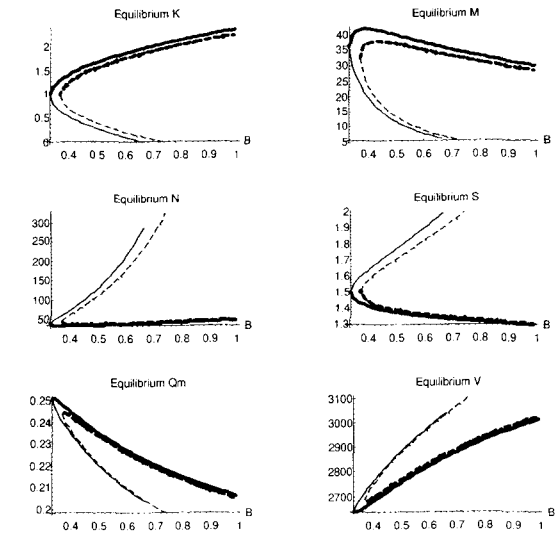
As $B \rightarrow \infty$: $d \ln K \rightarrow -0.05; d \ln M \rightarrow -0.13; d \ln N \rightarrow 0.13; d \ln S \rightarrow 0; d \ln Q_m \rightarrow -0.24; d \ln V \rightarrow 0.16$

Figure 10

LOWER FIXED COST

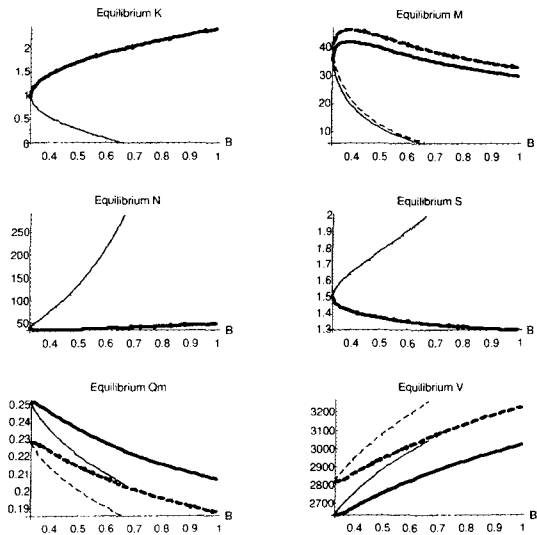
$d \ln F = -0.1$

Dashed lines represent new equilibria



As $B \rightarrow \infty$: $d \ln K \rightarrow 0; d \ln M \rightarrow -0.10; d \ln N \rightarrow 0.10; d \ln S \rightarrow 0; d \ln Q_m \rightarrow -0.02; d \ln V \rightarrow 0.02$

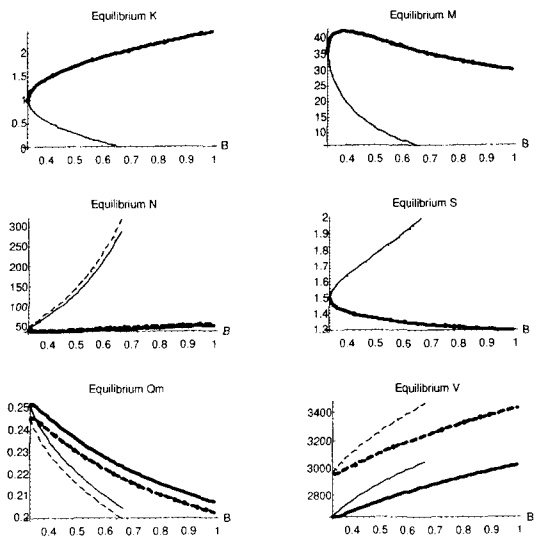
Figure 11
RAISING MANUFACTURING PRODUCTIVITY
 $dlnA=0.1$
Dashed lines represent new equilibria



As $B \rightarrow \infty$: $dlnK \rightarrow 0$; $dlnM \rightarrow 0.09$; $dlnN \rightarrow 0$; $dlnS \rightarrow 0$; $dlnQ_m \rightarrow -0.09$; $dlnV \rightarrow 0.07$

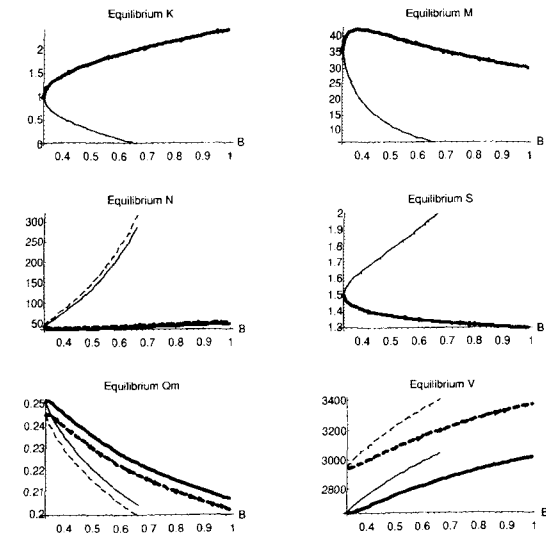
Figure 12

HIGHER SHARE OF MANUFACTURES IN CONSUMPTION
 $dln\gamma=0.1$
Dashed lines represent new equilibria



As $B \rightarrow \infty$: $dlnK \rightarrow 0$; $dlnM \rightarrow 0.09$; $dlnN \rightarrow 0.1$; $dlnS \rightarrow 0$; $dlnQ_m \rightarrow -0.02$; $dlnV \rightarrow 0.17$

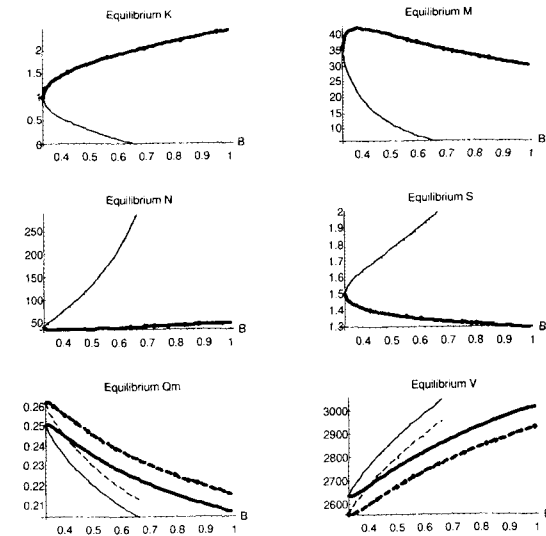
Figure 13
LARGER ECONOMY
 $dlnL=1$
Dashed lines represent new equilibria



As $B \rightarrow \infty$: $dlnK \rightarrow 0$; $dlnM \rightarrow 0$; $dlnN \rightarrow 0.1$; $dlnS \rightarrow 0$; $dlnQ_m \rightarrow -0.02$; $dlnV \rightarrow 0.11$

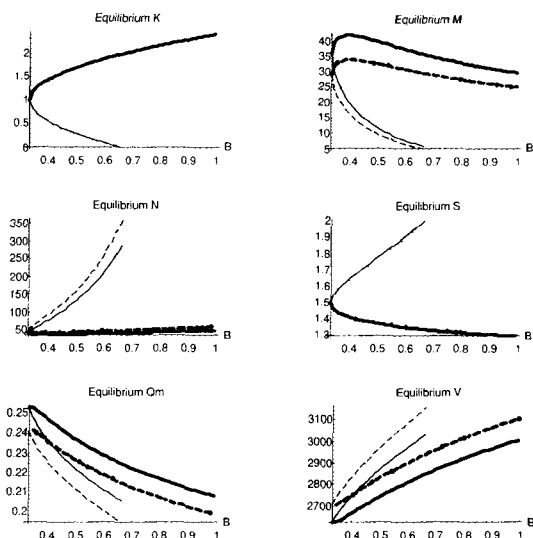
Figure 14

INTRODUCING TRANSPORT COSTS FOR INTERNATIONAL TRADE
 $dln\tau=0.1$
Dashed lines represent new equilibria



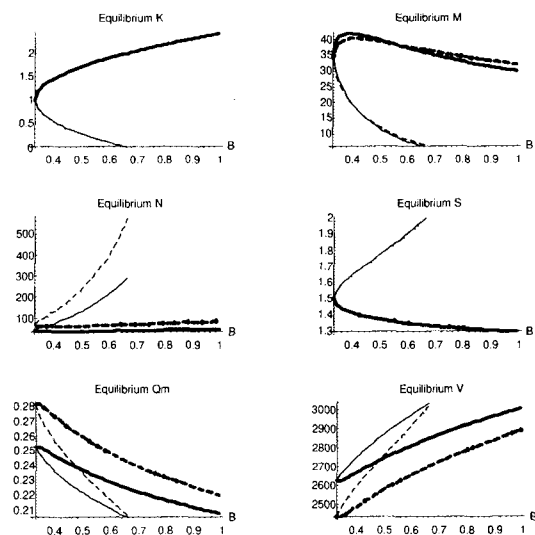
As $B \rightarrow \infty$: $dlnK \rightarrow 0$; $dlnM \rightarrow 0$; $dlnN \rightarrow 0.22$; $dlnS \rightarrow 0$; $dlnQ_m \rightarrow -0.012$; $dlnV \rightarrow 0.01$

Figure 15
USING MANUFACTURED GOODS AS INTERMEDIATES
 $d\alpha = 0.2$
Dashed lines represent new equilibria



As $B \rightarrow \infty$: $d\ln K \rightarrow 0$; $d\ln M \rightarrow 0$; $d\ln N \rightarrow 0.22$; $d\ln S \rightarrow 0$; $d\ln Q_m \rightarrow -0.06$; $d\ln V \rightarrow 0.04$

Figure 16
USING MANUFACTURED GOODS AS INTERMEDIATES
 $d\alpha = 0.5$
Dashed lines represent new equilibria



As $B \rightarrow \infty$: $d\ln K \rightarrow 0$; $d\ln M \rightarrow -0.005$; $d\ln N \rightarrow 0.69$; $d\ln S \rightarrow 0$; $d\ln Q_m \rightarrow -0.16$; $d\ln V \rightarrow 0.12$

Conclusions

An interesting property of this model is that it predicts the 'stylised fact' that as rich countries get richer, the output of the service industry will expand relative to manufacturing output. In the model this arises from the general equilibrium effects of the increasing productivity of factor inputs that create these services. An alternative but less satisfying explanation for this 'fact' is that services are luxuries in consumption.

The results in this paper bear some comparison to those of Krugman and Venables (1995). They analysed exogenous transport costs that created an 'iceberg' wedge between consumers in one country and producers in another. This paper allows a separate 'iceberg' wedge between consumers and producers in both countries. In addition, here it is assumed that resources are committed optimally by firms to mitigate the melting effects. While Krugman and Venables focussed on an exogenous decline in transport costs (or melting), this paper considered what will happen as firms' costs and/or productivity vary exogenously. In their model, which country finds itself relatively poor is indeterminate, and the inequality is supported by the high transport costs. As these costs fall, the poorer country will eventually be able to catch up because it can attract manufacturing from the other country on account of its lower wages. In my model, a country is poor if its market services productivity is very low. As 'catch-up' occurs, the process may follow a surprisingly rocky path.

This paper demonstrates that with regard to market services productivity, a poor country may find itself unnecessarily poor in a so-called high activity equilibrium, with too few big firms. So long as the two equilibria exist (for a range of low productivity levels), there is an incentive to be on the low activity path, where firms are more plentiful and smaller, and welfare is higher. The gap between rich and poor countries will be smaller. The stability of this equilibrium path can be supported either by a much slower adjustment of market services (relative to firm entry) or else by government subsidy and regulation. Multilateral agencies may advise against these government supports, and indeed they usually do. A basis for their position could be that as the market services productivity improves with time, the poor country will eventually lose that better equilibrium path, and will experience a major painful decline in welfare as it adjusts to the path that the rich countries are on. Though they will catch up eventually, the decision has to be based on an intertemporal comparison of welfare paths, something the model in this paper is not set up to handle.

The results in this paper have been obtained when restricting the model to a symmetric world equilibrium. An asymmetric model would allow the relative growth of poor and rich nations to be influenced by trade - in the present model, growth encourages trade, but trade has no implications for growth. Furthermore all intermediate market services have been assumed to have no public good characteristics and to be produced under constant returns. The more realistic situation is where poor countries co-exist and trade with rich countries, and where some services should be (and are) publically provided using more general technologies. Finally geography played a trivial role in this paper, yet the need for intermediate services (such as retail outlets) is crucially dependent on spatial constraints. A richer set of conclusions should emerge from a less restricted model.

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ENDNOTES

- ¹ The importance of transaction cost economics is discussed in depth by Dietrich (1994).
- ² The iceberg model where transport costs involve shrinkage in transit was introduced by Samuelson (1954) and used by Dornbusch, Fischer & Samuelson (1977), Krugman (1980), and Krugman & Venables (1995) amongst others.
- ³ To keep complexity to a minimum in this paper, we shall ignore the distinction between public and private services, assuming the latter applies. While much market services provision has 'public good' features and is provided by governments, ultimately it has to be paid for by taxes. Thus this can also be incorporated into an iceberg model with the costs of preventing melting using public services being borne ultimately by the private sector.
- ⁴ By working with a real trade model, the crucial role of money and the financial system in facilitating transactions is not analysed explicitly. Nevertheless the general iceberg model is consistent with various monetary theories such as real balances in utility functions or in transaction cost functions in budget constraints. The supply of intermediate services by firms in this context might for example be the provision of facilities for electronic funds transfer at the point of sale (EFTPOS).
- ⁵ One aspect of our general model - advertising - has received much attention in the industrial organisation literature. Sutton (1991) examined the implications of the technology of advertising in determining market structure. He argued that strategic behaviour in the presence of endogenous sunk costs can influence industry concentration. He brought an empirical perspective to bear on this issue and undertook cross-country comparisons which suggested a hump-shaped relationship between industry concentration and the ratio of advertising/sales. However there is other evidence that has detected a positive correlation with selling expenditures other than advertising (eg see Weiss et al (1983)). By generalising the sunk costs in a general equilibrium iceberg model with differentiated products, we will not be able to support the hump-shaped hypothesis, but can predict the positive correlation in one equilibrium type (the so-called high activity one).
- ⁶ Previous iceberg models (cited in footnote 2) have assumed physical melting of goods in transit. This makes less sense in the present context because general transaction costs need not tax a particular good directly. The physical melting assumption would mean that the melting function in (4) below would affect utility directly. Thus an alternative would be to include the 'melting function, S_f ' inside (3). The general conclusions of this paper would not be affected.
- ⁷ In a more detailed analysis, the market services indices, K and k may be thought of as vectors with each element impacting in different ways on consumers and producers.
- ⁸ The term in the denominator of S_f has a unit exponent. The number of equilibrium outcomes (to be determined below) will expand accordingly with a larger integer exponent.
- ⁹ If $S_f = s_f$ always, the present model would be the same as that in Krugman and Venables (1995).
- ¹⁰ No results are affected significantly by assuming the same elasticity of substitution in consumption and production. With only one price index for intermediates needed, the analysis simplifies.
- ¹¹ In what follows, these costs may appear to be generated internally by the firm. They need not be. They may involve the purchase of services sold externally.
- ¹² This relationship is analogous to the Dorfman & Steiner (1954) condition that the optimal advertising to revenue ratio equals the ratio of the advertising elasticity to price elasticity of demand. For a given advertising elasticity, an increase in the price elasticity (which is σ in this paper) lowers the price-cost margin and reduces the gains from advertising. For a given price elasticity, an increase in the advertising elasticity (which would be $\sigma K \bar{S} / ((1 + K)(1 + K + \bar{S}))$) in this model will encourage advertising. The only difference here is that the marginal cost of producing K is allowed to change exogenously and that K is interpreted more generally.
- ¹³ If the right hand side of the above condition is not met, then $\underline{B} < 0$, and the two equilibria will coexist in the range $0 < B \leq \bar{B}$. The feasibility range of B for the dual equilibria implies a lower and an upper bound for σ . If σ is too low, the value of variety becomes so great that there would have to be great deal of atomistic firms, which is impossible given the fixed cost F . If σ is too high, variety would become so unimportant that the low scenario with lots of firms would not be an equilibrium.
- ¹⁴ All numerical solutions in this paper have been obtained using *Mathematica* (Wolfram Research).
- ¹⁵ Adjustment costs could be introduced explicitly. The role of time in making adjustments may arise from capital stock inputs in the intermediate service production functions- rich countries have a large capital stock base to build on, and can adjust service output quite rapidly. Institutional differences

between rich and poor countries might also explain why these costs are greater for service than for manufacturing production in poorer countries - when a country becomes sufficiently rich, the order may reverse itself.

¹⁶ A minor reformulation of the present model would involve interpreting K as the yield on R & D with the S/J function impacting directly through A rather than on consumer expenditures. An increase in K would reduce S/J and raise A . Using (12), the price level would fall generating the same sort of welfare effects as in the current model.

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