Abstract

We analyse a monopolistically competitive model of international trade where goods must be consumed in indivisible amounts. The number of varieties that enter a consumer's optimal consumption bundle is increasing in the consumer's per capita income. We first show that, for a given level of GDP, less populous and richer economies have a larger equilibrium number of product varieties. We then show that in an integrated world, even when total GDP is kept constant in all markets, as the levels of and the similarity in the trading partners' per capita incomes increase, so do the number of varieties exchanged and the volume of bilateral trade flows, as conjectured in the Linder hypothesis. Implications for the distribution of gains from trade between and within countries are also discussed.

This paper was produced as part of the Centre's
Globalisation Programme

Per Capita Income, Demand for Variety, and International Trade: Linder Reconsidered

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June 2000

Series Editor: Graham Ingham

Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

ISBN 0 7530 1386 X

Individual copy price: £5

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The Centre for Economic Performance is financed by the Economic and Social Research Council.

Acknowledgements

This paper is part of my PhD thesis to be submitted at the London School of Economics. I thank Nobu Kiyotaki, Giovanni Maggi, Niko Matouschek, Peter Neary, Christopher Pissarides, Stephen Redding, Daniel Sturm, my thesis advisor Tony Venables, and Alan Winters for helpful comments. This research is supported by a TMR grant of the European Commission (ERBFMBICT983178), which is also gratefully acknowledged.

Paolo Ramezzana is a member of the Centre for Economic Performance, London School of Economics.

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1 Introduction

Contrary to the predictions of the standard Heckscher-Ohlin theory of international trade, over the last decades a large share of world trade has taken place between countries at similar stages of economic development and with rather similar factor endowments. The volume of trade among developed countries largely outweighs the volume of trade between the former group and developing countries and the volume of trade taking place among developing countries themselves. While the relatively low volume of North-South and South-South trade could be partly explained by many years of protectionist trade regimes in developing countries and by the small economic size of the developing world,[1] it may also be the consequence of more fundamental economic mechanisms. Theoretical results that are consistent with these facts can indeed be obtained if one departs from two basic assumptions of the neoclassical model, namely that technology displays constant returns to scale and that the composition of demand is invariant with respect to the level of consumers' personal income.[2] Whereas the implications of increasing returns technologies for the volume of trade have been widely studied, demand structures arising from more realistic consumers' behavior have received much less consideration. However, the level and the distribution of per capita

[1] James Markusen and Randall Wigle (1990) use a constant returns to scale, perfectly competitive, computable general equilibrium model of world trade to show that a liberalisation of world trade and an increase in the economic size of the developing world would considerably increase the volume of North-South and South-South relative to North-North trade.

[2] However, Donald Davis (1997) shows that large gross volumes of North-North trade and small gross volumes of North-South and South-South trade can also be obtained in a neoclassical Heckscher-Ohlin-Vanek model with homothetic preferences if one imposes particular restrictions on the technological differences both between and within appropriately defined groups of industries.

income seem to have important implications for the structure of aggregate demand and thus for the pattern of industrialisation and international trade. At a micro level, Laurence Jackson (1984) finds empirical evidence that the variety of goods consumed increases with income. At a macro level, Davis and David Weinstein (1998) show that correctly accounting for demand substantially improves the predictions of the Heckscher-Ohlin-Vanek model about the volume of the factor content of international trade.

One of the first attempts to explain the implications of per capita income for the composition of demand and for the volume of trade between countries at different stages of economic development was made by Staffan Linder (1961). His verbal theory, which already contained in a nutshell some of the insights of monopolistically competitive models of international trade, combined aspects of the composition of demand and scale economies in production to explain patterns of international specialisation. Linder argued that individuals with different income levels tend to consume different bundles of goods, with richer consumers expressing a latent demand for some new goods. Since under increasing returns to scale efficiency requires that production be concentrated in one location and since there is always a cost of producing far from demand, these new goods are introduced in the countries where there is a sufficiently large representative demand for them, namely in the developed regions of the world. Once a new variety of a good has been introduced in a given market, domestic producers may find it convenient to export it to other countries. However, for most goods the only potential trading partners are other developed economies, where consumers are rich enough to be able to afford new product varieties. Poor countries can import only a limited number of product varieties from developed economies. This line of reasoning leads to the well known Linder hypothesis: all else, including total GDP, equal, one would expect the volume of trade to be larger between rich and similar economies than between poor and dissimilar ones.[3]

In this paper we set out a simple general equilibrium model of international trade that combines the three fundamental elements in Linder's reasoning - the effects of per capita income on the composition of demand, scale economies in

[3]The importance of the level and of the distribution of per capita income in determining sufficient demand for the emergence of industries characterised by increasing returns to scale has received much attention also in the economic history and economic development literature. See, e.g., David Landes (1969) for an account of the early stages of the British industrial revolution and Kevin Murphy, Andrei Shleifer, and Robert Vishny (1989) for a formal treatment of these ideas.

production, and the advantage of producing near demand - to provide purely demand-based predicitions about the implications of the level and of the world distribution of per capita income for the volume of trade. We consider economies with labor as the only primary factor, that is used to produce competitively a divisible good under constant returns to scale and possibly many varieties of a manufactured good under increasing returns and monopolistic competition. We assume that each variety of the manufactured good can be consumed only in indivisible amounts, which makes the level and the distribution of per capita income crucial for aggregate demand and is what drives our results. We first show that, given two closed economies with the same GDP, the economy with higher per capita income experiences the introduction of a larger number of product varieties. We then consider an integrated world divided into two countries with identical GDP and technologies, but with different population size and thus different per capita income levels. We show that, for a given world average level of per capita income and keeping all else equal, as the difference in the two countries' per capita incomes increases, the number of products that are actually traded in equilibrium decreases and so does the bilateral volume of trade. This means that we should indeed expect the volume of North-South trade to be smaller than that of North-North trade. We then show that, for a given degree of inequality between the two countries, as the average level of per capita income in the world, and thus in each country, increases, so does the volume of bilateral trade. This means that we should indeed expect the volume of North-North trade to be larger than that of South-South trade.

The remainder of the paper is in six sections. Section 2 discusses where the existing literature stands as regards the implications of per capita income and demand for the volume of international trade. Section 3 sets out and analyses our basic model of a closed economy. Section 4 uses this basic model to study international trade between two countries with different per capita income levels and derives results that constitute a formal version of Linder's insights. Section 5 discusses the implications of our approach for the distribution of gains from trade between and within countries. Section 6 concludes.

2 Per Capita Income and Trade Theory

When looking for theoretical explanations for the empirical relevance of North-North trade, economists usually turn to monopolistically competitive models of international trade,[4] as introduced in Paul Krugman (1979, 1980) and Elhanan Helpman (1981) and consolidated in Helpman and Krugman (1985). These models have developed a consistent general equilibrium framework to analyse how product differentiation and increasing returns to scale in production can give rise to trade even in the absence of comparative advantage. In particular, these models predict that the volume of trade should be large between countries with large and similar market size, as measured by GDP. However, once one controls for the effects of aggregate GDP, these models do not have much to say about the implications of *per capita* income for the volume of trade. The particular type of consumers' preferences that they use imply that there is no difference between the demand structure of a small and rich country on the one hand and of a very populous and poor country on the other, provided that they have similar GDP. In these models per capita income can have effects on the volume and composition of trade only if it is related in some way to factor endowments and therefore to the supply side of the economy. Helpman and Krugman (1985, Chapter 8) analyse this possibility, by assuming that higher levels of per capita income correspond to greater capital abundance. They find that we should expect the *share* of intra-industry trade in total trade to be higher in trade flows between countries with similar per capita income levels. However, in their framework, once the level of GDP has been controlled for, the *total volume* of bilateral trade is still maximised between countries with different relative capital abundance, and thus with different levels of per capita income.

To see this, consider the integrated world equilibrium box in Figure 1. Note that all factor endowment points along the $B\bar{B}'$ line imply a constant GDP in both countries. Along this line, the *share* of intra-industry trade is maximised at C, where countries have identical capital-labor ratios and thus identical per capita incomes. However, the *total volume* of trade is maximised at E or E', which imply rather different capital-labor ratios, and thus different per capita income levels, between the two countries.[5] This prediction is at odds with the

[4] However, see the discussion of Davis (1997) in footnote 2.

[5] In monopolistically competitive models with only one factor, as in Krugman (1979, 1980), the volume of trade is constant with respect to per capita income once total GDP has been

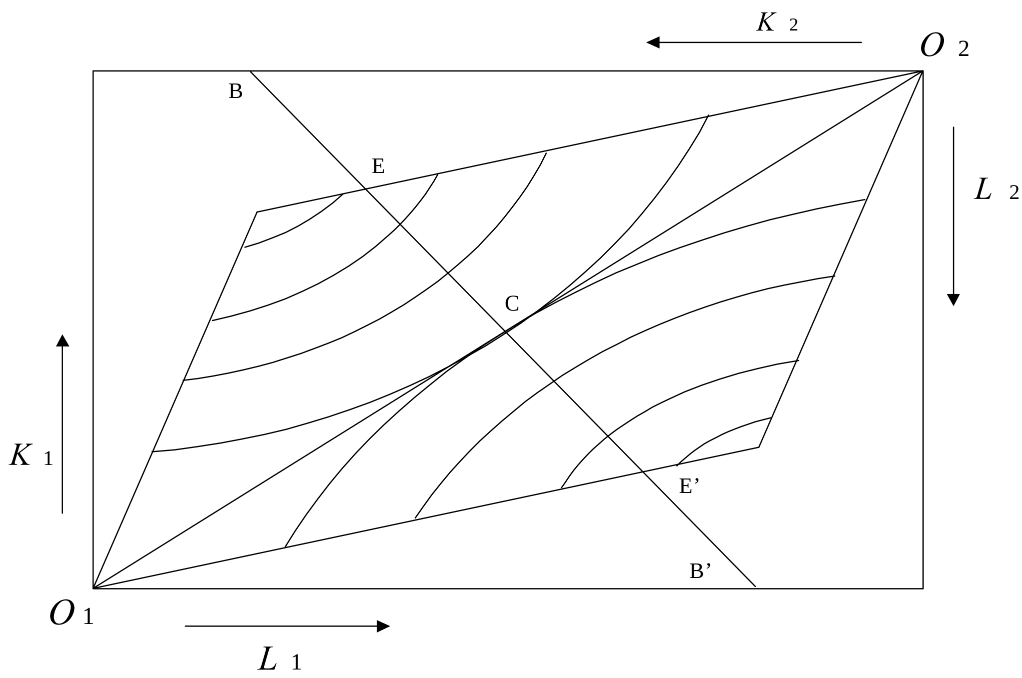

Figure 1: The integrated world equilibrium.

Linder hypothesis and, more importantly, with available evidence. As argued by Helpman (1981), even though it has the "flavor of the Linder hypothesis", this approach cannot actually generate the same mechanisms and results, because it is not "based on the assumption that relative demands change with per capita income".

The implications of per capita income for the composition of demand and thus for the volume of trade have been more carefully considered from a theoretical point of view by Markusen (1986) and shown to be empirically relevant in Linda Hunter and Markusen (1988) and Hunter (1991).[6] Markusen considers a two-sector, two-factor, three-region world, with two identical regions located in the capital abundant and rich North and the other region in the labor abundant and

controlled for.

[6] Hunter and Markusen (1988) estimate a linear expenditure system for 34 countries and 11 commodity groups and reject the hypothesis of homothetic preferences at very high levels of statistical significance. Hunter (1991), using the same methodology and data as in the previous paper, compares actual trade flows to those that would obtain in a counterfactual world with homothetic preferences, and shows that the volume of trade would increase by 29 percent if preferences were indeed homothetic.

poor South. By assuming non-homothetic preferences that exhibit a greater-than-unit income elasticity of expenditure on the capital intensive good, he shows that as the relative factor endowments, and thus relative per capita incomes, of the North and the South become more dissimilar, the volume of North-North trade increases relative to the volume of North-South trade. Intuitively, this happens because every region tends to consume relatively more of the good in which it is becoming progressively more specialised. However, the assumption that the production of the high income elasticity good is relatively intensive in the factor that is in relatively abundant supply in the rich country is crucial: if it were reversed, so would be the results. Although Markusen's framework neatly captures some of the aspects of Linder's reasoning, the two differ markedly in one respect: whereas demand is crucial in determining which country develops new products in the Linder hypothesis, it has no implication for specialisation in Markusen's model. In the latter it is relative factor endowments that determine *independently* both interindustry specialisation, through technology, and the composition of demand, through per capita income: only if the two effects happen to operate in the same direction Linder's conclusion regarding the volume of trade obtains. One of the main contributions of our model is to generate Linder-type results without having to rely on any assumption on factor intensities, because, much in the spirit of Linder, it is the combination of demand characteristics and trade costs that determines who produces what.

3 The Closed Economy Model

Our stylised economy is inhabited by N individuals. Individual k is endowed with h^k effective units of the only factor of production, labor, so that the total labor supply is $L = \sum_{k=1}^{N} h^k$ effective units. Higher individual endowments of effective units of labor can be interpreted as higher individual productivity levels, which we take as exogenously given. This set up will be used in the rest of the paper to compare economies with equal levels of L, and thus with equal levels of GDP, but with different population sizes and different levels of per capita income. This economy produces a good x_0 (e.g., an aggregate good that includes food and basic clothing) under perfect competition and using a constant returns to scale technology that requires one effective unit of labor per unit produced. The constant returns to scale good is used as numéraire and its price normalised to one; this implies that the wage rate per effective unit of labor is also unity, since, as we will show, some positive amount of x_0 will always be produced in equilibrium. Individual k's income is therefore equal to her endowment of effective units of labor h^k. Besides this constant returns to scale good, our economy also knows how to produce a large number of varieties of a manufactured good, which we denote by $i = 1, 2, \cdots, \infty$. Each variety is produced under increasing returns with a fixed amount of F units of labor and unit marginal labor requirement. We assume that the manufacturing sector is characterised by free entry and exit of firms, and accordingly we model it as being monopolistically competitive. We also make the crucial assumption that, while x_0 can be bought in any divisible amount, available manufactured varieties are indivisible and consumers cannot buy more than one unit of each of them.[7] Apart from this assumption, our treatment of the demand side of the economy is very general. Namely, we assume that all consumers have identical preferences and choose $x_0 \in [0, \infty)$ and $x_i \in \{0, 1\}$, for all i, to maximize the following additively separable and symmetric utility function

$$U = \sum_{i=0}^{n} u(x_i), \tag{1}$$

subject to the individual resource constraint

$$x_0 + \sum_{i=1}^{n} p_i x_i = h^k. \tag{2}$$

The subutility function $u(\cdot)$ satisifies the usual properties $u'(\cdot) > 0$ and $u''(\cdot) < 0$. For conveniency we also normalise $u(0) = 0$.

In what follows we focus on the equilibrium of a closed economy where all consumers have the same income, i.e. where $h^k = h$ for all k. Since we restrict the quantity purchased of each manufactured good to be discrete, we cannot rely

[7] Ruling out the possibility of multiple purchases of the same variety seems much more restrictive than it actually is in this context. For one thing, by imposing a mild restriction on the utility function, that requires the elasticity of substitution to be sufficiently low with respect to the degree of increasing returns embedded in technology, one obtains that in equilibrium only one unit of each good is actually bought, even when multiple purchases are ex-ante allowed. However, even without imposing any restriction on utility and thus allowing multiple purchases of the same good to occur in equilibrium, we would still have the fundamental result that sizeable changes in per capita income cause changes in the number of varieties consumed. Since ruling out multiple purchases greatly simplifies the technicalities of our analysis, we preserve this assumption throughout the paper.

on standard differentiation techniques in order to solve for the consumer's utility maximisation and for the firm's profit maximisation problems. We introduce therefore a new technique to solve monopolistically competitive models in the presence of indivisible goods.

3.1 The demand system with indivisible goods

Assume that a consumer with income h is simultaneously offered n different varieties of the manufactured good, denoted by $i = 1, \ldots, n$, at a given price vector $\mathbf{p} = (p_1, \ldots, p_j, \ldots, p_n)$, and the divisible good x_0 at unit price. She chooses the quantities $x_0 \in [0, \infty)$ and $x_i \in \{0, 1\}$ to maximize (1) subject to (2). The surplus that she derives from consuming one unit of good j at price p_j, given the prices of the other $(n-1)$ varieties and the unit price of the divisible good, is

$$
\begin{aligned}
S_j(h, n, \mathbf{p}) \quad = \quad & \left(\sum_{i \neq 0,j}^{n} x_i + 1 \right) u(1) + u \left(h - \sum_{i \neq 0,j}^{n} p_i x_i - p_j \right) \\
& - \left(\sum_{i \neq 0,j}^{n} x_i \right) u(1) - u \left(h - \sum_{i \neq 0,j}^{n} p_i x_i \right),
\end{aligned}
$$

where we have omitted the arguments of the demand functions $x_i = x_i(h, n, \mathbf{p})$ to save space.[8] The first two terms represent the consumer's total utility when she buys good j at price p_j and the third and fourth terms are total utility when she does not buy good j. Their difference is the surplus that accrues to the consumer if she buys one unit of good j. After simplification, the previous equation can be written in more compact form as

$$
S_j(h, n, \mathbf{p}) = u(1) + u \left(h - \sum_{i \neq 0,j}^{n} p_i x_i - p_j \right) - u \left(h - \sum_{i \neq 0,j}^{n} p_i x_i \right). \qquad (3)
$$

Notice that the concavity of $u(\cdot)$ implies that $S(\cdot)$ is increasing in h, decreasing in n, and decreasing in p_i, for all $i = 1, \ldots, n$.

[8] The variables x_i are used as indicator variables before $u(1)$, taking values of one when good i is consumed and zero otherwise; $\sum_{i \neq 0,j}^{n} x_i$ corresponds therefore to the number of manufactured varieties other than j, that are bought in positive quantity.

A consumer buys one unit of good j only if she derives a non-negative surplus from doing so.[9] Thus, for all j, demand is

$$x_j(h, n, \mathbf{p}) = \begin{cases} 1 & \text{if } S_j(h, n, \mathbf{p}) \geq 0 \\ 0 & \text{otherwise,} \end{cases} \tag{4}$$

and demand for the divisible good is

$$x_0 = h - \sum_{i=1}^{n} p_i x_i(h, n, \mathbf{p}) \geq 0. \tag{5}$$

3.2 Equilibrium

We next turn to the production side of the economy and find the equilibrium number and price of manufactured varieties. As usual in monopolistically competitive models, if a firm enters the market, it always does so by producing a variety that is not produced by other firms. Doing otherwise would force it to engage in stiff price competition with another producer of the same good, which would reduce operating profits to zero. Once a firm j has chosen the variety that it wants to produce, it maximises profits by charging the highest price, denoted by p_j^*, at which consumers are still willing to buy one unit of good j, given the vector $\mathbf{p}_{-j}^*$ of equilibrium prices charged by the other $(n-1)$ firms. By charging more it would lose all demand; and charging less would not maximize profits, since the quantity demanded by each consumer is fixed to unity and the firm can extract all the surplus. Therefore, for all j and given the number of active firms n, the vector $\mathbf{p}^* = (p_j^*, \mathbf{p}_{-j}^*)$ of profit maximizing prices must satisfy

$$S_j(h, n, p_j^*, \mathbf{p}_{-j}^*) = 0, \tag{6}$$

Given the assumption that consumers always buy a good when they are indifferent, at these equilibrium prices $x_i = 1$ for all i in (3), and we can write (6) for all j as

$$S_j(h, n, \mathbf{p}^*) = u(1) + u\left(h - \sum_{i \neq 0, j}^{n} {p^*}_i - {p^*}_j\right) - u\left(h - \sum_{i \neq 0, j}^{n} {p^*}_i\right) = 0.$$

[9] We assume that the consumer does actually buy the good when she is indifferent.

It can be shown that the only solution to this system of n equations in n variables is fully symmetric, with ${p^*}_j = p^*$ for all j.[10] That is, since all manufactured varieties enter utility symmetrically, are equally indivisible and do not differ in any other respect, their equilibrium prices are equal. The following condition always holds in an equilibrium with given number n of firms

$$S(h, n, p^*) = u(1) + u(h - np^*) - u(h - (n-1)p^*) = 0, \tag{7}$$

Equation (7) defines implicitly the equilibrium price p^* of manufactured varieties as a function of per capita income h, given the number n of varieties. Because $\partial p^*/\partial h > 0$, we have the intuitive result that, if no entry of new firms were possible, producers could charge higher prices and make higher profits in markets with richer consumers. However, in a free entry equilibrium, an increase in h cannot cause an increase in prices and the emergence of positive profits, but has instead the effect of triggering entry by new firms and of increasing thus the number of manufactured varieties in the market. Formally, in an equilibrium with free entry, price equals average cost [11]

$$p^* = 1 + f, \tag{8}$$

where $f \equiv (F/N)$ is the per capita fixed cost of each variety.[12] Using (8) we can write equation (7) as

[10]Define $P \equiv \sum_{i \neq 0}^{n} {p^*}_i$. For all j we must have $u(1) + u\,(h - P) = u\left(h - P + {p^*}_j\right)$; since $u(\cdot)$ is a strictly monotone function, this implies that ${p^*}_j = p^*$ for all j.

[11]In order to keep the exposition fluent, we abstract here from the fact that the number of firms n is an integer, and that there is therefore room for limited positive profits in equilibrium. This is a slightly less innocent assumption here than in other models with free entry, because the very way in which demand is obtained in equation (3) relies on the fact that each single variety has positive measure (assumed to be equal to one for simplicity there). Consistency with that framework requires therefore that we only consider discrete changes in n, which we do throughout the rest of the paper. This is however different from imposing that n be only defined on integers, which would substantially complicate the exposition without making the analysis any more rigorous. The solution of the model with n defined only on integers is available from the author on request.

[12]The fact that $p^* > 1$ implies that some positive amount of x_0 is always demanded and produced in the closed economy equilibrium, and thus the wage rate is indeed equal to unity in terms of x_0, as conjectured so far. To see this, assume that $x_0 = 0$ in (5), then (3) would become $S_j = u(1) - u(p_j)$, and no manufactured variety would be bought at $p^* > 1$. But for $h > 0$, the equilibrium consumption allocation $x_0 = 0$ and $x_j = 0$ for all j would be inconsistent with utility maximisation and can thus be ruled out.

$$u(h-(n-1)(1+f))-u(h-n(1+f))=u(1), \tag{9}$$

which implicitly defines n as a function of h and N. Notice that an equilibrium with industrialisation, i.e. with $n \geq 1$, exists if and only if $u(h-1-f) \geq u(h)-u(1)$, otherwise only agricultural production takes place. This condition is more likely to be satisfied for populous countries, i.e. for low f, and when the substitutability between manufactured varieties is low, i.e. $u(\cdot)$ is rather concave. Since we are interested in countries that have some, though perhaps limited, degree of industrialisation, and in goods that can meaningfully be considered different one from the other, we assume that this condition holds throughout the paper. Because equation (9) implies $\Delta n/\Delta h > 0$ and $\Delta n/\Delta N > 0$, both per capita income and population size have a positive effect on the equilibrium number of manufactured varieties. However, to see how these effects differ from standard general equilibrium monopolistically competitive models, we now turn to answering the central question of this section: is being populous a good substitute for being rich in per capita terms? Both observation of reality and intuition suggest that this is not the case. Perhaps rather unsurprisingly, our formal model confirms both this observation and this intuition. Keeping N constant, equation (9) implies

$$\frac{\Delta n}{\Delta h}=\frac{1}{1+f}. \tag{10}$$

A closer inspection of equation (9) reveals the intuition behind this result: consumers try to keep the marginal utility of consumption of the divisible good constant when their per capita income changes. That is, given the equilibrium price $(1+f)$ of manufactured varieties, a consumer with income h chooses n to keep $\Delta u(x_0(h,n))=u(1)$, and the comparative statics result in (10) obtains. Intuitively, this means that our consumers are willing to spend on additional indivisible "luxuries" only if this does not affect their marginal need for the divisible "necessities".

Taking into account that total GDP can be written as $L=Nh$, and that $\Delta L = N\Delta h$, we can write (10) as

$$\frac{\Delta n}{\Delta L}=\frac{1}{N+F}. \tag{11}$$

For given population size N, the number of manufactured varieties n is a linear function of GDP, L. The slope of this function is steeper the less populous the country is. This suggests that, all else equal, economic growth, in the form of increasing market size, has stronger effects on expanding product variety in those countries that are initially less populous and thus richer in per capita income terms and that, for given and sufficiently large total GDP, L, small and rich countries tend to have a larger number of products than large and poor ones, as shown in Figure 2.

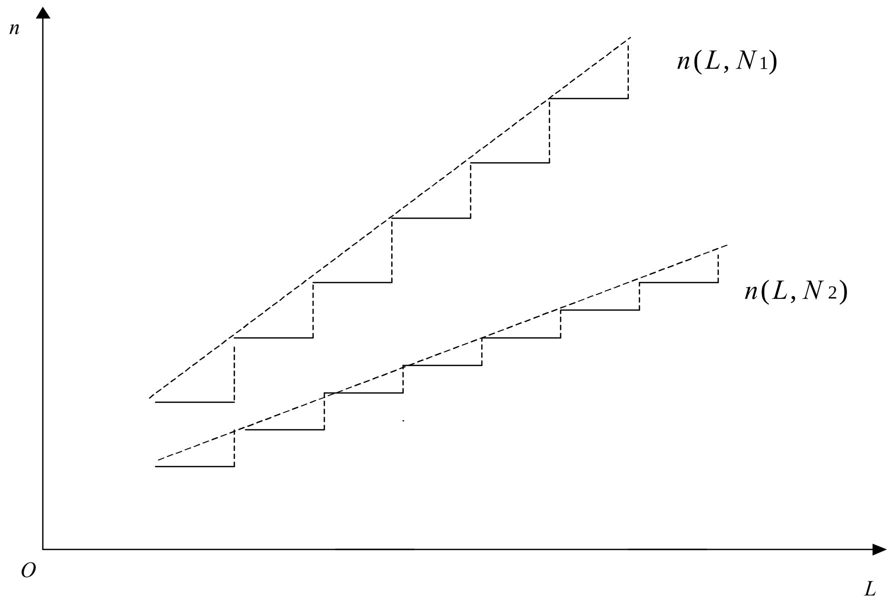

Figure 2: Closed economy, $N_1 < N_2$

We can summarise our main finding for the egalitarian closed economy of this section in the following proposition.

Proposition 1 *Consider two countries with identical and large enough total GDP. The country with the highest* per capita *income will have a larger number of goods produced under increasing returns to scale than the other country.*

Our result is driven by the fact that rich consumers are willing to pay more than poor consumers for the first unit of each manufactured variety that they decide to buy. Free entry ensures that, in equilibrium, this higher willingness of rich consumers to spend on differentiated products does not cause an increase in prices but is instead met by some new firms introducing some new products. If we were to relax the assumption of indivisibility in the consumption of manufactures, we would obtain the usual result according to which n depends exclusively on aggregate GDP, irrespective of population size and of per capita GDP.

4 International Trade in an Inegalitarian World

We now use the basic framework developed in the previous section to study how the level and the world distribution of per capita income affects international specialisation and the pattern and volume of international trade.[13]

Assume that the world is populated by N individuals with an aggregate supply of effective units of labor equal to L and is divided into two countries, the rich North and the poor South. The two countries are identical in all respects but for population size and per capita income.[14] In particular, we assume that the two countries have the same GDP. This assumption is made in order to control for well understood effects of market size on the volume of trade in an increasing returns world:[15] we want our results to be explained solely by differences in *per capita* income. In order to generate in the simplest possible way differences in per capita income between countries with identical aggregate GDP, we assume that they have the same total supply of effective units of labor, but different population sizes. Namely, we assume that the total labor supply in both countries is $L^N = L^S = L/2$ effective units, and that the North has a share $\theta \in (0, 1/2)$ of the world population. This implies that, denoting by $h^a \equiv L/N$ the average per capita income in the world, per capita income in the North is $\bar{h} = h^a/2\theta$, and is higher than per capita income in the South, which equals $\underline{h} = h^a/2(1-\theta)$. As

[13] Although in the previous and in this section we are forced to preserve perfect equality within each country in order to keep the analysis tractable, it will become apparent that the two country model that we introduce in this section can readily be reinterpreted to describe a closed economy populated by poor and rich consumers, the only difference being in the assumptions about factor mobility.

[14] Although we usually think of differences in wage rates as a crucial factor to understand production location decisions and thus trade, here we preserve the assumption of identical constant returns technology in agriculture in both countries, which implies equal wages, in order to offer a purely demand-driven explanation for our results.

[15] See Helpman (1987) on this point.

θ decreases, the North becomes less populated and richer in per capita income terms, whereas the South becomes more populated and poorer in per capita income terms. This set up is particularly convenient, since it allows us to use only the parameter θ as a measure of equality between countries while keeping their GDPs constant.

Imagine now that the North and the South can trade in an integrated world market, where firms set a unique price for their goods. We first derive the pattern of consumption in this integrated world economy, then determine the location of production and finally compute the bilateral volume of trade.

4.1 International equilibrium without trade costs

We now construct and analyse an equilibrium where consumers in the South consume fewer varieties than consumers in the North do, and where those varieties that are consumed only in the North have a higher price than those that are consumed in both countries. We also assume that all consumers in the South consume the same varieties of the indivisible good.[16] This assumption guarantees that the equilibrium that we study below is unique.

Consider the demand schedules, as given by the n equations in (4), of southern consumers, $x_j(\underline{h}, n, \mathbf{p})$, and of northern consumers, $x_j(\bar{h}, n, \mathbf{p})$. Profit maximization and free entry imply that the equilibrium must have the structure described in the following lemma.

Lemma 2 *Denote by n^W the number of firms that sell to all consumers in the world, by n^N the number of firms that sell only to consumers in the North, and by $n = n^W + n^N$ the total number of firms that are active in a free entry equilibrium. (a) Every profit maximising firm j charges either a price $\underline{p}_j^*$ such that $S_j(\underline{h}, n, \underline{p}_j^*, \mathbf{p}_{-j}^*) = 0$ or a price $\bar{p}_j^*$ such that $S_j(\bar{h}, n, \bar{p}_j^*, \mathbf{p}_{-j}^*) = 0$, with $\bar{p}_j^* > \underline{p}_j^*$. (b) Further, there is always a number $n^W > 0$ of firms selling to everybody in the world at a price $\underline{p}_j^* = p^W$, and possibly a number $n^N \geq 0$ of firms selling only to consumers in the North at a price $\bar{p}_j^* = p^N$.*

Proof. Part (a) can be easily proved, by observing that any profit that firm j can make by charging a price different from $\underline{p}_j^*$ or $\bar{p}_j^*$ can be improved upon by

[16] This assumption is not very restrictive: if we think that in reality goods have different degrees of indivisibility, then all consumers in the South would consume the same n most divisible goods. This would hold even if the differences in the degree of indivisibility across goods are infinitesimally small, a case which is approximated by our model.

switching to either of them. This is due to the fact that demand is completely rigid at unit quantity and thus producers do not want to leave any surplus to the group of consumers that they have decided to target.

We prove part (b) by contradiction. Assume that there exists a free entry equilibrium with $n^W = 0$ and that all $n = n^N$ active firms sell only to Northern consumers and charge $p_j{}^* = p^N$. By construction, this implies that $S_j(\bar{h}, n^N, \mathbf{p^N}) = 0$ for all $j = 1, \ldots, n^N$. Since the surplus function $S(\cdot)$ is increasing in h, it must be that $S_j(\underline{h}, n^N, \mathbf{p^N}) < 0$ for all $j = 1, \ldots, n^N$. However, $S(\cdot)$ is decreasing in n, which implies that there exists some $\hat{n} < n^N$ such that $S_i(\underline{h}, \hat{n}, \mathbf{p^N}) \geq 0$ for all $i = 1, \ldots, \hat{n}$. Therefore, given our assumption that all consumers in the South buy the same varieties of the manufactured good, a subset $\hat{n}$ of the n^N firms would sell to both rich and poor consumers, whereas a subset $(n^N - \hat{n})$ would sell only to rich consumers. Given the presence of fixed costs in production, this implies that the two subsets of firms would have different average costs. With all firms charging the same price, profits can not be equal (to zero) for all active firms. Therefore $n^W = 0$ and all $n = n^N$ active firms charging p^N is not an equilibrium.

To prove that n^N is strictly positive is not possible at the level of generality assumed here. To see why this is the case, assume that there exists an equilibrium with $n^N = 0$ and that all $n = n^W$ active firms maximise profits by charging $\underline{p}_j^* = p^W$. By construction, this implies that $S_j(\underline{h}, n^W, \mathbf{p^W}) = 0$ for all $j = 1, \ldots, n^W$. Since $S(\cdot)$ is increasing in h, it must be that $S_j(\bar{h}, n^W, \mathbf{p^W}) > 0$ for all $j = 1, \ldots, n^W$. Under free entry this would constitute an incentive for some new firm i to enter the market and sell its variety to consumers with income $\bar{h}$, which would destabilise the assumed equilibrium. However, firm i would sell its variety to a smaller number of consumers than the existing firms $j = 1, \ldots, n^W$ do, and it should therefore charge $p_i > p^W$ to break even. Without additional assumptions on the concavity of $u(\cdot)$ and on the level of the fixed cost, we are not guaranteed that the price p_i that drives the surplus $S_i(\cdot)$ to zero is high enough to make break-even possible. However, for the results to follow we do not need n^N to be strictly positive, even though this will be the case under most parameter configurations. $\square$

Lemma 2 says that in equilibrium some firms charge a lower price and cover the world market by selling to consumers in both countries, and possibly some other firms charge a higher price and sell only to the consumers in the rich North.

Profit maximisation implies that the equilibrium must satisfy

$$u(\underline{h} - (n^W - 1)p^W) - u(\underline{h} - n^W p^W) = u(1), \tag{12}$$

$$u(\bar{h} - n^W p^W - (n^N - 1)p^N) - u(\bar{h} - n^W p^W - n^N p^N) = u(1), \tag{13}$$

with $n^W > 0$ and $n^N \geq 0$. Further, in a free entry equilibrium prices must equal average cost

$$p^W = 1 + f, \qquad p^N = 1 + \frac{f}{\theta}, \tag{14}$$

where $f \equiv F/N$ now denotes per capita fixed cost taking the world population as a base. The equilibrium price p^N of the n^N goods consumed only in the North is higher than the price p^W of the n^W goods consumed in both countries because of the smaller quantity sold (θN instead of N) and of the ensuing higher average cost. Using (14) in (12) and (13)

$$u(\underline{h} - (n^W - 1)(1 + f)) - u(\underline{h} - n^W(1 + f)) = u(1), \tag{15}$$

$$\begin{aligned} &u(\bar{h} - n^W(1 + f) - (n^N - 1)(1 + f/\theta)) - \\ &\qquad u(\bar{h} - n^W(1 + f) - n^N(1 + f/\theta)) = u(1). \end{aligned} \tag{16}$$

Given world GDP and population, equation (15) determines the equilibrium number n^W of products that are consumed in both countries, solely as a function of per capita income in the South. Equation (16) uses this result to determine the number n^N of products that are consumed only in the North, when this is strictly positive. We can summarise our results in the following proposition.

Proposition 3 *In our stylised world economy, there exists a unique equilibrium, determined by (14), (15) and (16), in which a number $n^W > 0$ of manufactured varieties are consumed both in the North and in the South at a price $p^W = 1 + f$, and a number $n^N \geq 0$ are consumed only in the North at a price $p^N = 1 + f/\theta > p^W$. This result holds notwithstanding the perfect symmetry of all goods as regards indivisibility, preferences and technology.*

Proof. The equilibrium described in Proposition 3 is such if no active firm has an incentive to deviate and choose a different price, when it takes as given the equilibrium number and prices of all other active firms, and, at these equilibrium profit maximising prices, all active firms make zero profits.

If a firm selling only in the North raises the price of its product above $1 + f/\theta$ when all other firms keep their prices constant, it looses all demand and makes negative profits, since northern consumers drop its good from their consumption bundle; thus she does not want to do so. Next, if the same firm considers lowering its price below $1+f/\theta$, then Lemma 2 implies that it should choose $1+f$. However, if the firm lowered its price from $1 + f/\theta$ to $1 + f$, it would at best break-even and with positive probability would make a loss, since consumers in the South are already satiated in equilibrium by the n^W manufactures that they consume and would thus drop one of the $n^W + 1$ goods that they are now offered, possibly the one of the deviating firm itself. Since this firm would make zero profits with certainty by keeping its price at $1 + f/\theta$, it has no incentive to deviate.

By a similar line of reasoning we next show that a firm selling in both countries does not want to raise its price above $1 + f$. If it considers a deviation in this direction, Lemma 2 implies that it should set its price at $1 + f/\theta$. If it increased its price up to $1 + f/\theta$, consumers in the North would drop one of the $n^N + 1$ most expensive goods from their consumption bundle, possibly that of the deviating firm itself. The deviating firm would at best break-even and with some positive probability would be left with zero demand and make a negative profit. It has therefore no incentive to deviate from the initial equilibrium price $1 + f$, at which it breaks even with certainty. This proves that the equilibrium proposed in Proposition 3 exists. Further, since the loci (15) and (16) cross only once in the (n^W, n^N) space, this equilibrium is unique. As already observed, the uniqueness of the equilibrium depends on the assumption that all consumers in the South consume the same varieties of the differentiated good.□

Note that equation (15) and $\underline{h} = h^a/2(1-\theta)$ together imply

$$\frac{\Delta n^W}{\Delta\theta} = \frac{h^a}{2(1-\theta)(1-\theta-\Delta\theta)(1+f)} > 0. \tag{17}$$

Since $\theta < 1/2$ and we only focus on changes that leave the North the least populated country, i.e. $\Delta\theta < 1/2$, the number n^W of goods consumed by everybody in the world is an increasing function of the degree of equality between the two countries' per capita income levels.

4.2 Trade costs and specialisation

In the absence of any trade cost, the equilibrium number of goods, their equilibrium prices and the consumption patterns in the North and in the South are all unambiguously determined in our model, but the location of production is not. In order to study how demand influences specialisation, we follow Linder (1961) and Vernon (1966) in assuming that there is always a cost of producing far from demand. This could be an actual trade cost or simply a friction capturing the difficulty for a foreign entrepreneur of knowing exactly local demand and social atmosphere, to use Vernon's early verbal explanation of these issues. To our purpose, it is sufficient to assume that this cost $\epsilon > 0$ be arbitrarily small. As a consequence of this infinitesimal trade cost, production of all of the n^N goods takes place in the North, since it would be inefficient to produce them in the South where there is no demand for them. Thus the n^N goods become endogenously non-traded: they are both produced and consumed only in the North. Although our model has no dynamic structure and although our goods are intrinsically all the same, these n^N goods correspond closely to what Linder called "new goods".

Efficiency considerations also suggest that production of all of the the n^W goods should be located in the South, where there is larger demand for them than in the North.[17] However the availability of labor in the South could constitute a binding constraint: whereas we are guaranteed that the North will always be able to produce domestically the n^N endogenously non-traded goods, it is possible that for certain ranges of parameters the South does not have enough labor to produce all of the n^W goods sold in both countries. In order for the South to be able to produce all the n^W goods and some positive amount of x_0, we must have

$$n^W N(1+f) < \frac{L}{2}.$$

The left hand side of the previous inequality is the labor demand associated with the production of the entire set of n^W goods by the different n^W firms active in equilibrium, and is found by noting that one unit of each of these goods is bought by all the N consumers in the world. This labor demand must be strictly less than the effective labor supply in the South, $L/2$. Using the definition of world *average* per capita income, we can write this constraint as

[17] To see this, remember that we are assuming that the South has a larger population than the North. Since each consumer, no matter where he resides, buys one unit of each of the n^W goods, total demand for these goods is larger in the South than in the North.

$$n^W(\theta) < \frac{h^a}{2(1+f)}, \tag{18}$$

where the notation in the left hand side reminds that n^W is a monotonically increasing function of θ, as shown in (17). Inequality (18) says that, for all the production of the equilibrium n^W goods to be located in the South, countries must not be too equal in per capita income terms. This is because if they are, then n^W, and thus the associated labor demand, grows larger, whereas the total effective labor supply in the South remains constant, and eventually becomes binding. The range $(0, \bar{\theta})$ for which all n^W goods are produced in the South is determined by finding that $\bar{\theta}$ that solves (18) with equality and, using (15), is implicitly given by

$$u\left(\frac{\bar{\theta}h^a}{2(1-\bar{\theta})} + (1+f)\right) - u\left(\frac{\bar{\theta}h^a}{2(1-\bar{\theta})}\right) = u(1). \tag{19}$$

Given the concavity of $u(\cdot)$, (19) implies that $\bar{\theta}$ is increasing in the per capita fixed cost f, decreasing in the world's level of average per capita income h^a and increasing in the degree of substitutability between goods (i.e. $\bar{\theta}$ is larger for a less concave utility function).[18] When $\theta \in (0, \bar{\theta})$, the North imports all of the n^W goods from the South, offering good x_0 in exchange. If instead $\theta \in (\bar{\theta}, 1/2)$, then some of the n^W goods must be produced in the North. The North would now produce all three types of goods, and import those goods in n^W that are produced in the South in exchange for good x_0 and for the rest of the goods in n^W. This would imply that there is no production of good x_0 left in the South. However, since trade costs are arbitrarily small, a threat of entry by Northern firms prevents the wage rate in the South from rising above one in terms of x_0.[19] We can thus conclude that the number of varieties produced in the South and imported in the North, which we denote by $\tilde{n}^W$, is

[18] Numerical simulations of equations (15) and (16), carried out using a CES utility function, show that when the elasticity of substitution is high, the length of the interval $(0, \bar{\theta})$ is rather large for a very reasonable set of parameters (often larger than 0.5, implying that all n^W goods can be produced in the South, no matter the level of $\theta \in (0, 1/2]$).

[19] If the wage rate in the South were greater than one, the price of the goods produced there would be greater than $1+f$, and, given infinitesimal trade costs, it could be profitably undercut by a new entrant in the North, where the wage is equal to one.

$$\tilde{n}^W(\theta) = \begin{cases} n^W(\theta) & \text{if } \theta \in (0, \bar{\theta}] \\ h^a/2(1+f) & \text{if } \theta \in (\bar{\theta}, 0.5] \end{cases} \tag{20}$$

Figure 3 represents $\tilde{n}^W$ as a function of θ.

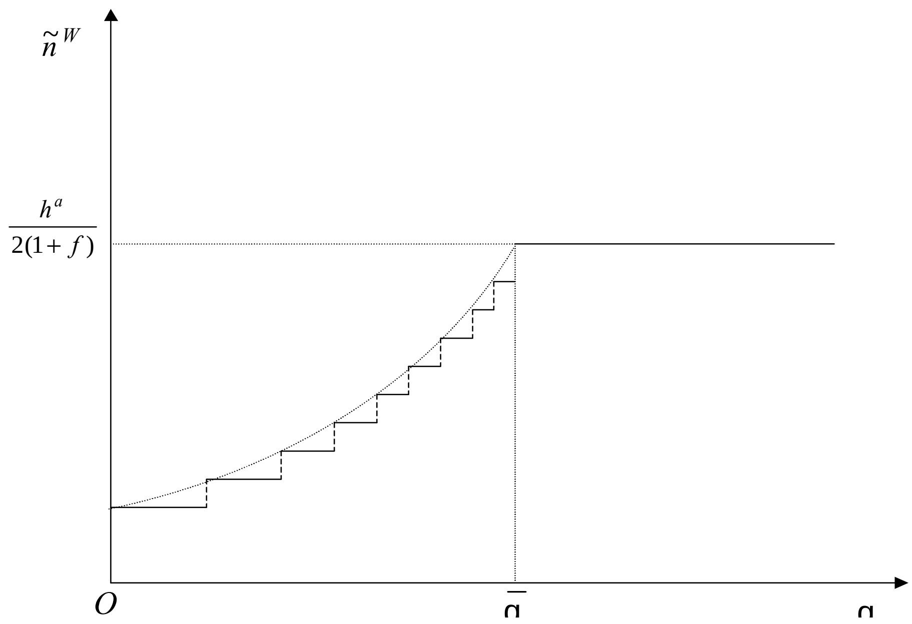

Figure 3: Number of varieties imported by the South.

4.3 The volume of trade

We now determine the volume of bilateral trade, expressed as the sum of the exports of the two countries. Balanced trade implies that the value of exports of the North is equal to the value of exports of the South, when expressed in a common numéraire. This allows us to write the volume of trade as twice the value in terms of good x_0 of the imports of the North. Since each consumer in the North consumes one unit of each of the $\tilde{n}^W$ different manufactures produced in the South, and there are θN such consumers, the volume of trade, measured in terms of units of good x_0, is

$$VT = 2(1+f)\theta N \tilde{n}^W(\theta).$$

In what follows we normalise the total volume of trade by the sum of the two countries' total GDP, which equals the world's GDP, and write[20]

$$vt = \frac{VT}{L} = \frac{2(1+f)\theta\tilde{n}^W(\theta)}{h^a}. \tag{21}$$

Since $\tilde{n}^W$ is non-decreasing in θ, we conclude that the volume of trade between the North and the South is unambiguously increasing in θ.

Proposition 4 *Consider two countries with identical total GDP. The volume of their bilateral trade as a share of their GDP is increasing in the similarity in their per capita incomes.*

This result is a simple formal restatement of the Linder's hypothesis: when two countries have more similar per capita income levels, they have more similar demand patterns and a larger number of the goods produced in each of them is actually traded, implying that the volume of trade between them increases. Note that in our model the increase in the volume of trade is caused by two distinct effects, that are captured by the terms θ and $\tilde{n}^W(\theta)$ in (21). The former effect is familiar in the literature on international trade under monopolistic competition and increasing returns: a higher θ means that consumers are distributed more evenly between the two countries and therefore that a larger number of units in each given product variety actually crosses the border. The latter effect is what really captures the essence of our argument: countries with more similar per capita income tend to have more similar consumption bundles and a larger number $\tilde{n}^W$ of varieties is actually traded between them.

Our model also yields another result that is supported by much evidence and that finds a verbal explanation in the Linder hypothesis: given total GDP and given a certain level of inequality in two countries' per capita incomes, the volume of bilateral trade tends to be larger between rich countries than between poor countries. To see this, notice that, for given and constant θ, equation (21) implies

[20]Since we assume balanced trade and identical total GDP in the two countries, vt is also equal to twice the share of trade in each country's total GDP.

$$\frac{\Delta vt}{\Delta h^a} = \begin{cases} \bar{h}(h^a + \Delta h^a)^{-1}(\underline{h} - (1+f)n^W) > 0 & \text{if } \theta \in (0, \bar{\theta}] \\ 0 & \text{if } \theta \in (\bar{\theta}, 0.5]. \end{cases} \tag{22}$$

Notice that $(\underline{h} - (1+f)n^W)$ is the quantity of agricultural good consumed by a Southern consumer, and we have already shown in section 3 that this is always positive. This leads us to the following proposition.

Proposition 5 *Consider two countries with a given ratio of per capita incomes (i.e., with given θ). If the two countries are sufficiently dissimilar, i.e. if $\theta \in (0, \bar{\theta}]$, the volume of their bilateral trade as a share of GDP is increasing in the average level of their per capita incomes.*

Proposition 5 can be interpreted as saying that, according to our model, we should indeed expect the volume of North-North trade to be larger than that of South-South trade. It therefore provides an explanation for the empirical observation, common to virtually all gravity estimations of the determinants of international trade, that the volume of bilateral trade flows depends positively and in a significant way on the level of per capita income of both the exporter and the importer, even if one controls for their total GDPs.[21]

5 Notes on Gains from Trade and Welfare

In this model, as in most models of product variety under increasing returns and free entry, both countries gain from trade. These gains accrue through scale effects in the production of the n^W goods: each of these goods is sold to a larger number of consumers under free trade than under autarky, and lower average costs imply lower equilibrium prices, allowing consumers in both countries to afford and enjoy larger variety. However, countries with different per capita income levels do not gain from trade to the same extent in our model. Given two countries with

[21] James Anderson (1979) imposes exogenous restrictions on the demand side of his model to obtain a gravity equation with this characteristics. However, he points out the importance of a better theoretical understanding of why and how per capita income and population size have this effect. The implications of different or nonhomothetic preferences for the derivation of gravity equations are also discussed in Alan Deardorff (1998)

identical total GDP, the country with lower per capita income gains relatively more than the other.[22] This is due to the fact that, whereas scale effects make the price of all the goods consumed in the South decrease, the price of those goods consumed only in the North is not affected by trade.

Further, our model also suggests that, when an inegalitarian economy opens to trade, different classes of consumers gain differently depending on the level of development of the trade partner. Assume that the North is populated by some rich and some poor consumers, and that the poor consumers in the North have the same level of per capita income as the consumers in the egalitarian South. Focusing attention on changes in consumers' welfare in the North, poor consumers gain relatively more than rich consumers, since the latter will not enjoy a reduction in the price of some of the goods that they consume, while all the goods consumed by the former become cheaper. Even though the special structure underlying this result suggests particular caution in interpreting it, this is an interesting way of reconsidering the distributional consequences of North-South trade. Since poor consumers in the North are usually associated with unskilled workers, Stolper-Samuelson effects make them particularly vulnerable to trade with the South. Notwithstanding the unresolved debate about the different causes for the increasing wage gap in developed countries, few would deny that such an effect could in principle be relevant. However, our model suggests that, due to different demand behavior, the poor are also those benefiting more *as consumers* from trade with the South, since the price index associated with their consumption bundle falls by more than that associated with the consumption bundle of the rich. Turning to inequality in the South and by a symmetric argument, one can see that the rich in the South gains relatively more than the poor in the South from trade with the rich North.

6 Conclusion

Economists and economic historians have long recognised that, besides the size of the market, also the level and the distribution of per capita income have important implications for the introduction of new products, the pattern of interna-

[22] This result complements that also obtained in standard models, where the country with smaller market size gains relatively more from trade, through a more dramatic increase in variety over what can be afforded in autarky.

tional specialisation and the volume of trade flows. These implications can not, however, be adequately captured by the existing literature on product variety under increasing returns and monopolistic competition. In this paper we tackled the issue using a simple model, that embeds the assumption of indivisible manufactured goods in an otherwise rather standard monopolistically competitive framework. The more realistic treatment of the demand side of the economy that follows from this assumption allowed us to derive what we think are intuitive and relevant results. A higher level of per capita income makes consumers demand larger variety, besides their consumption of the divisible good, and makes therefore the introduction of a larger number of manufactured goods possible. As a consequence, given two countries with similar total market size, as captured by GDP, a less populous and richer country will experience more innovation than a more populous and poorer country. This hints to a possibly profitable application of our model to growth theory: by clearly distinguishing between the effects of per capita income and of the number of people in the economy, our approach can help shed some light on the much debated importance of population size and scale effects for the process of economic development.[23]

The model has also strong implications for explaining the pattern of international specialisation and the volume of North-South trade, and offers a theoretical framework within which to analyse the Linder hypothesis. When two countries with different levels of per capita income can trade their goods in integrated world markets at some, even arbitrarily small, cost, some goods may be consumed and produced only in the North and may become endogenously non-traded. As the levels of and the similarity in the countries' per capita incomes increase, so do the number of product varieties that are actually traded and the bilateral volume of trade.

As concerns welfare considerations, the approach taken here suggests that countries at different levels of development gain from trade to a different extent, with poorer countries gaining relatively more than richer ones. Further, trade-induced changes in the welfare of poor and rich consumers within an inegalitarian country also depend on the level of development of the trading partner: all else equal, consumers with personal income levels more similar to those prevailing in the trading partner are those who gain relatively more from trade.

[23] Charles Jones (1999) reviews current research on this topic.

References

[1] **Anderson, James** (1979), "A Theoretical Foundation for the Gravity Equation", *American Economic Review 69*, No. 1, 106-16.

[2] **Davis, Donald** (1997), "Critical Evidence on Comparative Advantage? North-North Trade in a Multilateral World", *Journal of Political Economy*, Vol. 105, No. 5, 1051-60.

[3] **Davis, Donald** and **David Weinstein** (1998), "An Account of Global Factor Trade", NBER Working Paper Series, No. 6785.

[4] **Deardorff, Alan** (1998), "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" in Jeffrey Frankel (ed) *The Regionalization of the World Economy*, University of Chicago Press.

[5] **Helpman, Elhanan** (1981), "International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition: a Chamberlin-Heckscher-Ohlin Approach", *Journal of International Economics*, Vol. 11, 305-40.

[6] **Helpman, Elhanan** (1987), "Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries", *Journal of the Japanese and International Economies*, Vol. 1, March, 62-81.

[7] **Helpman, Elhanan** and **Paul Krugman** (1985), *Market Structure and Foreign Trade*, MIT Press.

[8] **Hunter, Linda** (1991), "The Contribution of Nonhomothetic Preferences to Trade", *Journal of International Economics*, Vol. 30, No. 3, 345-58.

[9] **Hunter, Linda** and **James Markusen** (1988), "Per Capita Income as a Basis for Trade", in Robert Feenstra (ed), *Empirical Methods for International Trade*, MIT Press, Cambridge, MA.

[10] **Jackson, Laurence F.** (1984), "Hierarchic Demand and the Engel Curve for Variety", *Review of Economics and Statistics 66*, 8-15.

[11] **Jones, Charles** (1999), "Growth: With or Without Scale Effects?", *American Economic Review, Papers and Proceedings*, Vol. 89 No. 2, May, 139-44.

[12] **Krugman, Paul** (1979), "Increasing Returns, Monopolistic Competition, and International Trade", *Journal of International Economics 9*, 4 (November), 469-79.

[13] **Krugman, Paul** (1980) "Scale Economies, Product Differentiation, and the Pattern of Trade", *American Economic Review 70*, 950-59.

[14] **Landes, David** (1969), *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present*, Cambridge: Cambridge University Press.

[15] **Linder, Staffan** (1961), *An Essay on Trade and Transformation*, Uppsala: Almqvist and Wiksells.

[16] **Markusen, James** (1986), "Explaining the Volume of Trade: An Eclectic Approach", *American Economic Review*, 76 No. 5, 1002-11.

[17] **Markusen, James** and **Randall Wigle** (1990), "Explaining the Volume of North-South Trade", *Economic Journal*, Vol. 100, No. 403 (December), 1206-1215.

[18] **Murphy, Kevin**, **Andrei Shleifer** and **Robert Vishny** (1989), "Income Distribution, Market Size, and Industrialization", *Quarterly Journal of Economics* 104(August), 537-64.

[19] **Vernon, Raymond** (1966), "International Investment and International Trade in the Product Cycle", *Quarterly Journal of Economics 80*, 190-207.