Income Effects in the Theory of Monopolistic Competition and International Trade

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Abstract

We present a model of monopolistic competition and international trade in which income effects play a crucial role. It is assumed that consumers have "0/1 preferences" (i.e. decide whether or not to purchase a given variety). This provides us with a simple and tractable framework in which prices and mark-ups of monopolistic producers are determined by consumers' income levels.

Our results are in stark contrast to the standard "New Trade Theory" and reminiscent of the famous "Linder hypothesis". First, we find that all goods are traded when countries are very similar, whereas countries remain in autarky when they are very dissimilar. For intermediate income differences only a subset of goods is internationally traded. Second, we find that the gains from trade liberalization (a reduction of transport costs) may be divided very unequally between countries. When transportation costs are relatively high, rich and poor country gain from trade liberalization. However, when transportation costs are below a certain threshold, the poor country may loose and oppose further trade liberalization.

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1 Introduction

This paper presents a model of monopolistic competition and international trade in which income effects play a crucial role. The potential importance of income effects has been emphasized by many previous writers, most notably by Staffan Burenstam Linder (1961). In his influential and frequently quoted essay on "*Trade and Transformation*," he argues "*... the more similar the demand structures of two countries, the more intensive, potentially, is the trade between these two countries.*" He then adds "*... the similarity of average income levels could be used as an index of similarity of demand structures.*"

While the relevance of income effects is undisputed and supported by a number of empirical studies, "new trade theory" models provide little room for such effects. To illustrate the point consider two countries, A and B. Country A has 100 million inhabitants and a per-capita income of 10; country B has 10 million inhabitants and a per-capita income of 100, hence aggregate income of the two countries is the same. Assume there are no differences in any other respect. In the canonical model of "new trade theory" these two countries are essentially identical. Due to the assumption of homothetic preferences, it is the level of *aggregate* income that is relevant for the determination of (aggregate) equilibrium variables. There is no separate role for *per-capita* income. In this sense, the standard model rules out income effects and cannot appropriately address the Linder hypothesis – which stresses the relevance of similarities in per-capita incomes for the intensity of trade.

In the present model consumers have "0/1 preferences". Due to indivisible products, consumers either purchase one unit of a certain good or do not purchase it at all. Under this assumption, the households choose the optimal number of consumed goods while there is no choice about the quantity per consumed variety.[1] This seemingly minor change in assumptions has major implications for general equilibrium outcomes. *First*, the range of products will be high where the average consumer is rich and will be small where the average consumer is poor. These different consumer behaviors are mirrored in patterns of international trade. When countries are very dissimilar no trade will take place. In the autarky equilibrium firms supply a broad

[1] One way to look at the implied differences in consumer behavior between the model proposed here and the standard (new trade theory) model is this: In the standard model consumers choose the quantity consumed per variety but have no choice about the number of goods. (Homothetic preferences force them to purchase *all* supplied varieties). In contrast, consumers in our model choose the number of goods, but have no choice about the quantity per consumed variety. In this sense, the assumption on consumer preferences adopted in this paper is equally general (or special) than the assumption of homothetic preferences in new trade theory models.

range of products in the country with a high per-capita income and a narrow range in the country with a low per-capita income. In contrast, when countries are very similar, trade emerges. In that case, all goods produced in the world economy will be consumed in both countries, and home and foreign consumers will be better off. For intermediate differences in per-capita incomes, the equilibrium outcome features a situation where product variety is narrow in the poor country and broad in the rich country. Only a subset of the goods produced worldwide will be internationally traded.

A *second* main result that emerges from our analysis relates to the gains from trade and the distribution of welfare between countries. When countries are sufficiently similar so that all goods are traded, then the poorer country gains more than the rich country. The reason is that richer consumers have a higher willingness to pay for the various products so prices and mark-ups are higher. As a result, consumers in the rich country bear a relatively larger share in the fixed cost generating a bias in the gains from trade in favor of the poor country. However, both countries gain in absolute terms and a reduction in transportation costs (e.g. a trade liberalization) is beneficial for both home and foreign consumers.

When countries are more dissimilar (but not too dissimilar to rule out trade at all), a different situation emerges. Both countries are still better off under openness than under autarky but the gains from trade may be quite differently distributed. When trade occurs between a very rich and a very poor country, producers can no longer take full advantage of the higher willingness to pay of rich-country consumers. The reason is a threat of parallel imports which puts a pressure on prices in the richer country,[2] and benefits rich-country consumers. In such a situation it turns out that the rich country gains disproportionately from a reduction in transportation costs where poor country will be even worse off. As a result, the poor country may oppose a trade liberalization.

In sum, our paper shows that allowing for income effects may have quite strong implications for general equilibrium outcome. Of course, whether such effects are relevant or not is an empirical question. There are at least three pieces of empirical evidence that underline the potential importance of income effects for international trade flows. First, Hunter and Markusen (1988) and Hunter (1991) find that demand systems that allow for varying expenditure shares perform significantly better in explaining the composition of bilateral trade flows. Second, there is the

[2] When US firms charge high prices at home and sell the same product cheaply in Brasil, an arbitrageur could purchase goods in Brasil, ship it back to the US and sell it cheaply there. Such parallel imports discipline price setting for US producers.

empirical fact of "zeros" in bilateral trade statistics. Helpman, Melitz, and Rubinstein (2006) highlight that for only about 50 percent of all possible bilateral trade relations in their 161 country sample trade actually occurs. While one can rule this out by assuming fixed costs of opening up trade, in our view, an explanation relying on income effects is at least as plausible. A third fact is the explanatory power of income distribution in predicting trade flows. Francois and Kaplan (1996) and Dalgin, Mitra, and Trindade (2006) investigate this issue empirically. The latter for example estimate that the US being as equal as Canada would lead to 9-13% lower luxury imports and 13-19% higher imports of necessities. If elasticities were constant, distribution did not matter for the aggregate outcome. In contrast, our 0/1 preferences imply that income levels affect firms' pricing behavior and hence the incentives to trade goods internationally.

There are various theoretical papers to which the present paper is related. Sauré (2006) incorporates quasi-homothetic (Stone-Geary) preferences into Krugman's (1980) workhorse model. He provides a closed form solution for the case of symmetric countries, but can only prove existence and uniqueness in the case of unequal economies. Our model in contrast is able to deliver explicit solutions when countries have different per-capita incomes and therefore allows us to formalize in detail the role of income effects and the Linder hypothesis for patters of international trade.

Further papers considering nonhomothetic preferences in trade models include the seminal paper of Markusen (1986), which combines differences in factor endowments, monopolistic competition, and quasihomothetic preferences in order to explain North-South and East-West trade. Neary (2003a) considers quadratic utility in a general oligopolistic equilibrium (GOLE). He uses the GOLE model in Neary (2003b) to study various aspects of globalization. Chung (2005) used quasihomothetic preferences to address Trefler's (1995) missing trade puzzle. Mitra and Trindade (2005) use nonhomothetic preferences over the industry aggregates to explain the role of the demand side - and related with that inequality - in determining the trade patterns. Their model has been incorporated into a gravity equation by Bohman and Nilsson (2006). Flam and Helpman (1987) consider qualitative product differentiation in a North-South model. This model has been extended by Choi, Hummels, and Xiang (2006), who focus on the role of income distribution in determining the trade patterns. In the empirical part of their work they find that income distribution plays an important role in shaping a country's import demand. Mountford (2006) uses quasihomothetic preferences in a dynamic Heckscher-Ohlin model to address the

issue of the East-Asian growth miracles. Nonhomothetic preferences with indivisibilities were used by Matsuyama (2000) in a Ricardian context. Krishna and Yavas (2005) used consumption indivisibilities in combination with labor market imperfection to explain possible losses from trade in transition economies.

The paper is organized as follows. In the next section we present the model. Section 3 describes the equilibrium and derives the main results. In Section 4 we considers welfare and the social planner's solution. Section 5 discusses the differences to the CES-case and Section 6 concludes.

2 The Model

Population. The model is set up in a static two country frame work. The world consists of the home country and the foreign country. The foreign country's variables are denoted with an asterisk. Labor is the only production factor and it is immobile. L and L^* are the aggregate labor endowments of the home country and the foreign country respectively. Throughout the main part of this paper we will work with representative agents, i.e. we normalize the population sizes to one. In the appendix we will demonstrate that the qualitative results do not change when we allow for different population sizes. Without loss in generality we assume that the home country features the higher labor endowment $L > L^*$.

Technology and Instustry Structure. There is one single industry[3], where a continuum of monopolists produce differentiated consumer goods using a increasing returns to scale technology. In order to produce x units of a given product j one needs a total labor input of

$$l\left(x\left(j\right)\right) = F + \frac{x\left(j\right)}{a},$$

whereas F denote the fixed setup costs, and a is the productivity parameter. This technology is internationally available, but the potentially differing aggregate labor endowments, L and L^*, imply that the country with the higher labor endowment is able to make better use of the

[3]Helpman and Krugman (1985) introduced a second industry with constant return to scale (CRS) technology and perfect competition - agriculture. They assumed the homogenous good that is produced in that industry is costlessly tradeable. This approach has been used by many subsequent papers. Yet Davis (1998) demonstrated that the assumption of a costlessly tradeable agricultural good is unrealistic. When one assumes equal transportation costs for all goods, trade in the CRS good never occurs. As we are able to solve the model without such a numéraire good, we forbear from introducing a second industry.

technology. Entry is free ensuring that in equilibrium no non-zero profits prevail. The labor market is perfectly competitive, which implies that per economy there is one unique wage rate.

Trade costs. In principal the producers are allowed to sell their goods on whatever market they want, i.e. there are no political restrictions to trade. The sole restriction is the presence of transportation costs in international trade. We model these costs with the standard iceberg approach - if a producer ships $\tau \geq 1$ units, only 1 unit arrives at the destination.

Preferences. An agent's consumption decision for a given variety j is restricted to a binary choice - either he consumes one unit or zero units[4]. The aggregate utility then is

$$U = \int_{j=0}^{\infty} c(j)\, dj + \int_{j^*=0}^{\infty} c(j^*)\, dj^*,\ c(j) \in \{0,1\},\ c(j^*) \in \{0,1\}.$$

The respective first order conditions are $1 \geq \lambda p(j)$, where λ denotes the marginal utility of income for given prices and income. The corresponding individual demand curve for variety j is depicted in Figure 1. We assume without loss in generality that the goods are numbered in a way that leads the agents to consume along the indices j and j^*, i.e. if two varieties are similarly priced, the agents will first go for the low index variety and only if income remains, they will consume the high index variety as well.

Because the intensive margin is restricted to a binary choice, the producers do not need to trade off quantity and price effect in their profit maximizing pricing decisions, but only need to find the maximal price at which the consumers are still willing to buy the good. This corresponds to the inverse of the marginal utility of income as we see from the FOC and from Figure 1.

3 The Equilibrium

Later on we will see that parallel imports have some important implications. In order to enhance tractability we will first rule out parallel imports. In Section 3.2 we will allow for them and analyze the respective effects.

[4] 0/1-preferences exhibit three particular properties. First, the marginal utility in the origin is bounded, i.e. $v'(0) = 1 < \infty$. Second, the resulting demand is nonhomothetic, i.e. expenditure shares vary with income, and third, the intensive margin reduces to a binary choice. Whereas the first two properties are desireable and clearly more realistic than the in the CES-case, the third property's main purpose is to give the model enough structure in order to find a closed form solution.

3.1 The Equilibrium without Parallel Imports

To start we rule out the possibility of parallel imports and exports respectively. This implies that the producers are free to price discriminate between the two countries. Moreover, we assume that the parameters are such that all producers find it profitable to supply both markets. Later on we will derive the condition for such an equilibrium.

In equilibrium we have $(N + N^*)$ active producers, where N denotes the products spectrum of the home country and N^* the respective spectrum of the foreign country. As all producers supply both markets, the two representative agents will consume one unit of each available variety. In the home country the producers will charge a price $p = 1/\lambda$ and in the foreign country $p^* = 1/\lambda^*$.

Now we can write the budget restrictions

$$\frac{1}{\lambda}(N + N^*) = WL \tag{1}$$

$$\frac{1}{\lambda^*}(N + N^*) = W^*L^*. \tag{2}$$

Because of symmetry the producers of one country feature all the same zero profit conditions. The zero profit conditions for the home and the foreign country producers respectively are

$$\frac{1}{\lambda} + \frac{1}{\lambda^*} = W\left(F + \frac{1+\tau}{a}\right) \tag{3}$$

$$\frac{1}{\lambda} + \frac{1}{\lambda^*} = W^*\left(F + \frac{1+\tau}{a}\right) \tag{4}$$

and the resource constraints of the two economies are

$$L = N\left(F + \frac{1+\tau}{a}\right) \tag{5}$$

$$L^* = N^*\left(F + \frac{1+\tau}{a}\right). \tag{6}$$

Equations (1) - (6) together define the general equilibrium. From the zero profit conditions (3) and (4) we see that the wage rates are equal. For what follows we choose the wage rate as the numéraire, $W = W^* \equiv 1$. The resource constraints (3) and (4) define the product spectra, $N = L/\left(F + (1+\tau)/a\right)$ and $N^* = L^*/\left(F + (1+\tau)/a\right)$. Inserting this into the budget constraints yields the equilibrium prices $1/\lambda = L/\left(L + L^*\right)\left(F + (1+\tau)/a\right)$ and $\frac{1}{\lambda^*} = L^*/\left(L + L^*\right)\left(F + (1+\tau)/a\right)$. Note that the optimal price differential that a monopolist chooses is

$$\frac{p}{p^*} = \frac{1/\lambda}{1/\lambda^*} = \frac{L}{L^*}. \tag{7}$$

In New Trade Theory models the gains from trade originate from fixed costs degression thanks to higher output levels per firm. The following proposition considers the distribution of these gains from trade.

Proposition 1 *The rich country consumer pays on average higher markups than the poor country consumer, which implies that the gains from trade are asymmetrically distributed in favor of the poor country consumer.*

Proof. The markup is defined as the price charged on a specific market divided by the marginal costs of supplying that market. Therefore, the markup charged by a home country producer in his local market is $\mu_H = a/\lambda = aL/\left(L + L^*\right)\left(F + (1+\tau)/a\right)$. The markup he charges abroad is $\mu_H^* = a/\left(\tau\lambda^*\right) = a/\tau L^*/\left(L + L^*\right)\left(F + (1+\tau)/a\right)$. For a foreign country producer's markups we get $\mu_F = a/\left(\tau\lambda\right) = a/\tau L^*/\left(L + L^*\right)\left(F + (1+\tau)/a\right)$ and $\mu_F^* = a/\left(\lambda^*\right) = aL^*/\left(L + L^*\right)\left(F + (1+\tau)/a\right)$. The average markup paid by a home country consumer is the weighted average of the markup he pays to the home country producer and the markup he pays to the foreign country producer, $\mu = \mu_H N/\left(N + N^*\right) + \mu_F N^*/\left(N + N^*\right)$. The respective average markup that the foreign country producer pays is $\mu^* = \mu_H^* N/\left(N + N^*\right) + \mu_F^* N^*/\left(N + N^*\right)$. Dividing these two average markups by each other and substituting for the endogenous variables yields

$$\frac{\mu}{\mu^*} = \frac{\frac{L}{L^*} + \frac{1}{\tau}}{\frac{L^*}{L} + \frac{1}{\tau}},$$

which implies that the home country pays a higher markup as long as $L > L^*$, i.e. as long as it is the richer country. ■

In equilibrium zero profits prevail, which implies that the markups are used to cover fixed costs and iceberg losses during transportation. As the home country consumer pays higher markups he covers a larger part of the expenses, which do not directly originate from production. This implies that his gains from trade are smaller than what the poor country agent gains. Indeed the markups are so asymmetric that in equilibrium the utilities perfectly converge, $U = U^* = N + N^*$. This somewhat strong prediction clearly hinges on the absolute saturation that steps in after having consumed one unit. Using a continuous utility function with relative saturation, i.e. demand elasticity falls with rising income, would yield a similar convergence tendence, albeit welfare would not completely equalize. This is because the rich country agents would be able to exploit his wealth on the intensive margin as well. Nevertheless a convergence tendence prevails, as the rich agents have a lower demand elasticity and therefore the producers still charge higher

markups in the rich country.

For the producers it is optimal to charge the willingness to pay. Now it could be that the poor country is so poor that its consumer's willingness to pay is not sufficient to cover the production and transportation costs, i.e. $p^* < \tau/a$. In this case the home country producers decide not to export. As we consider a static model, the balance of payments needs to be equalized, which implies that the foreign country producer does neither export - the world lives in endogenous autarky. The following proposition states the condition for the emergence of a trade equilibrium.

Proposition 2 *If the parameter values are such that*

$$L^* \left(F + \frac{1}{a} \right) \geq L \frac{\tau}{a}, \tag{8}$$

then the resulting equilibrium is a trade equilibrium.

Proof. If the additional revenue from exporting is higher than the additional costs, $p^* > \tau/a$, then a home country producer decides to export. Substituting for p^* yields $L^*/\left(L + L^*\right)\left(F + (1+\tau)/a\right) > \tau/a$. Rearranging this expression gives us the trade condition (8). This is a sufficient condition as $p > p^*$, which implies that the export condition for the foreign country producer, $p > \tau/a$, always holds if the condition for the home country producer holds. ■

Note that for higher setup costs F the trade condition is ceteris paribus more likely to hold, which reflects the fact that high fixed costs make trade more beneficial. Contrarily, for higher transportation costs a trade equilibrium becomes less likely. Strong divergence in the relative labor endowments make the trade condition (8) less likely to hold. This is because the optimal price differential (7) eventually becomes so large that the foreign country price p^* is no more high enough to cover the additional costs τ/a.

Note that $L/L^* = \mu_H/\mu_F^*$. Substituting for the labor endowments in the trade condition yields $\mu_F^*\left(F + 1/a\right) > \mu_H \tau/a$. $(F + 1/a)$ are the costs that accrue in autarky. Therefore the condition states that for a trade equilibrium to emerge the share of the autarky costs in the foreign country that are covered by the foreign consumer must be larger than the share of additional costs in the home country that are covered by the home country consumer. In addition using $\mu_H/\mu_F^* = \mu_F/\mu_H^*$ we can write $\mu_H^*\left(F + 1/a\right) > \mu_F \tau/a$, i.e. the share of autarky costs at home that is covered by the foreign agent must be larger than the share of additional

costs for the foreign producer borne by the home consumer[5]. These observations suggest the guess that in a trade equilibrium no agent is worse off than in the autarky equilibrium. The proof to the next proposition demonstrates this formally.

Proposition 3 *In the trade equilibrium all agents are at least as well off as in autarky.*

Proof. The utility of a home agent in autarky is $U|_{closed} = N|_{closed} = L/(F + 1/a)$. If trade made him worse off, $N|_{closed} > N + N^*$ must hold. In exogenous variables this is equal to $L/(F + 1/a) > (L + L^*)/(F + (1 + \tau)/a)$. Rearranging this condition yields $L\tau/a > L^*(F + 1/a)$. But this is exactly the autarky condition, which proofs that in a trade equilibrium the home country agent is always at least as well off as in autarky. The previous deliberations are sufficient for an improvement of the foreign country agent's utililty as $N|_{closed} > N^*|_{closed}$. ■

If the producers find it profitable to export, the fixed costs can be split amongst more consumers. This leads to higher profits, but due to free entry no profits prevail and in equilibrium all the benefits go to the workers in the form of higher wage rates, which in turn allows them to buy more goods and finally makes them better off. In the marginal case where the additional revenue from exporting to the foreign market just covers the additional costs $\frac{\tau}{a}$ we wage rate does not rise and the trade equilibrium utility of the home agent is just equal to his autarky equilibrium. Nevertheless, the foreign agent is better off, as he now consumes a broader spectrum.

3.2 The Equilibrium with Parallel Exports

If we allow for parallel imports[6] the producers face an upper bound for their international price discrimination scheme[7]. If a producer chooses a pricing scheme such that $p_0 > \tau p^*$, it is profitable for an arbitrageur to buy goods in the foreign market at a price p^* and sell them in

[5] Note that for the foreign country consumer the two conditions are

$$\begin{aligned} \mu_H\left(F + \frac{1}{a}\right) &> \mu_F^* \frac{\tau}{a} \\ \mu_F\left(F + \frac{1}{a}\right) &> \mu_H^* \frac{\tau}{a}. \end{aligned}$$

As $\mu_F^* < \mu_H$ and $\mu_H^* < \mu_F$, these conditions always hold if the trade condition holds.

[6] Actually, when speaking of parallel imports we speak of two trade flows. On the one hand we address reimports, and on the other hand we consider parallel exports.

[7] Corsetti and Dedola (2005) analyze the effects of real and monetrary shocks in a general equilibrium with international price discrimination.

the home market for $p_0 - \varepsilon$. The resulting profit would be $p_0 - \varepsilon - \tau p^*$. This clearly cannot be an equilibrium, as other arbitrageurs would come up and drive the price down until $p = \tau p^*$.

(7) implies that for a high enough endowment differential the optimal pricing decision of a producer would be such that parallel imports were profitable, i.e. if $L/L^* > \tau$. But as we have seen before, the unconstrained pricing decision cannot be an equilibrium. Either the producers voluntarily restrict their price differential to $p/p^* = \tau$ or they sell only on the local market and international trade is entirely dominated by arbitrageurs. Both cases are equivalent, but in what follows we will solve the model in the spirit of the former logic, i.e. the producers take the transportation costs as an upper bound for their price discrimination scheme.

Assume that the relative labor endowments are such that $L/L^* > \tau$. Then the optimal feasible pricing strategy for an internationally active producer is $p_T/p^* = \tau$, where p_T is the price he charges on the home country market. But in this case the home agents still have some remaining income after having consumed one unit of each internationally traded good. Thus, it becomes a profitable strategy for additional home country producers to sell only on their local market at a higher price $p_N > p_T$. The world now is in a partial trade equilibrium and we observe in the home country production two spectra of goods, N_T, which is the set of traded goods, and N_N, which is the set of non-traded goods. Note that as the consumers buy along the indices, the goods of N_N are one the uppermost level of the hierarchy.

The budget restrictions are now

$$p_T \left(N^* + N_T\right) + p_N N_N = WL \tag{9}$$

$$p^* \left(N^* + N_T\right) = W^* L^*. \tag{10}$$

The zero profit conditions of the internationally active producers are

$$p^* + p_T = W\left(F + \frac{1+\tau}{a}\right) \tag{11}$$

$$p^* + p_T = W^*\left(F + \frac{1+\tau}{a}\right). \tag{12}$$

The zero profit condition of the producers specializing on the home country market is

$$p_N = W\left(F + \frac{1}{a}\right). \tag{13}$$

And the resource constraints are

$$L = N_T\left(F + \frac{1+\tau}{a}\right) + N_N\left(F + \frac{1}{a}\right) \tag{14}$$

$$L^* = N^*\left(F + \frac{1+\tau}{a}\right). \tag{15}$$

Together with the now binding pricing restriction $p_T/p^* = \tau$ (9) - (15) define the general equilibrium. These are eight equations with eight endogenous variables, namely p_T, p_N, p^*, N_T, N_N, N^*, W, and W^*. The balance of payments is $N_T p^* = N^* p_T$. Inserting the pricing restriction yields $N_T = N^*\tau$. (15) already defines the foreign spectrum $N^* = L^*/\left(F + (1+\tau)/a\right)$. Using the balance of payment restriction to substitute for N^* gives us the traded home spectrum $N_T = \tau L^*/\left(F + (1+\tau)/a\right)$. The non-traded spectrum then follows from the home country resource constraint, $N_N = \left(L - \tau L^*\right)/\left(F + 1/a\right)$. The prices and the wage rates follow immediately.

The equilibrium utilities now are $U = N^* + N_T + N_N$ and $U^* = N^* + N_T$. Note that welfare does not fully converge any more, but that the home agent is better off. Crucial for that outcome is the level of the transportation costs. In order to further investigate the role of the transportation costs we write the equilibrium utilities as a function of the transportation costs. For very high transportation costs we are in an endogenous autarky equilibrium. If the transportation costs fall trade eventually emerges. Rewriting (8) tells us when this happens, i.e. at $\tau_{crit} = L^*/L\left(aF+1\right)$. For now assume that $\tau_{crit} > L/L^*$, which is equivalent to $\left(L/L^*\right)^2 < aF + 1$. This implies that for $\tau \in [L/L^*, L^*/L\left(aF+1\right)]$ we are in the situation of Section 2.2. If we now consider lower transportation costs parallel imports become relevant. Thus the equilibrium utility of a home agent and a foreign country agent respectively can be written as

$$U(\tau) = \begin{cases} N|_{closed} & = L/\left(F + \frac{1}{a}\right) & if\ \tau > \frac{L^*}{L}\left(aF+1\right) \\ N + N^* & = \left(L + L^*\right)/\left(F + \frac{1+\tau}{a}\right) & if\ \frac{L^*}{L}\left(aF+1\right) \geq \tau \geq \frac{L}{L^*} \\ N_N + N_T + N^* & = \frac{L - \tau L^*}{F + \frac{1}{a}} + \frac{(1+\tau)L^*}{F + \frac{1+\tau}{a}} & if\ \frac{L}{L^*} > \tau > 1. \end{cases}$$

$$U^*(\tau) = \begin{cases} N^*|_{closed} & = L^*/\left(F + \frac{1}{a}\right) & if\ \tau > \frac{L^*}{L}\left(aF+1\right) \\ N + N^* & = \left(L + L^*\right)/\left(F + \frac{1+\tau}{a}\right) & if\ \frac{L^*}{L}\left(aF+1\right) \geq \tau \geq \frac{L}{L^*} \\ N_T + N^* & = \frac{(1+\tau)L^*}{F + \frac{1+\tau}{a}} & if\ \frac{L}{L^*} > \tau > 1. \end{cases}$$

If $\tau_{crit} \leq L/L^*$ the transport cost interval for which welfare fully converges vanishes. In Figure 2 we plot the equilibrium utilities as functions of the transportation costs.

Proposition 4 *The home agent's prefers free trade, i.e. $\tau = 1$, whereas the preferential transportation costs of the foreign agent are higher than zero, namely $\tau = L/L^* > 1$ for the case of $\left(L/L^*\right)^2 \leq aF + 1$ or $\tau = L^*/L\left(aF+1\right)$ for $\left(L/L^*\right)^2 > aF + 1$.*

Proof. Follows directly from the preceding deliberations. ■

Here we can see the crucial role that the presence of international transportation costs plays for welfare[8]. If the transportation costs are sufficiently high and therefore allow the monopolies to effectively discriminate prices, we observe full convergence in welfare. But if the threat of parallel imports constrains the monopolies' scope for price discrimination, then welfare does not converge fully.

The discrete jump in welfare suggests that there must be some scope for a social planner to enhance welfare. This issue is considered in the next section.

4 Welfare

In both cases - with and without parallel exports - the equilibrium utilities feature some discrete jumps when plotted as a function of transportation costs. This suggests that it should be possible for a social planner to achieve world welfare improvements - at least around these jumps. In the following I consider the case with parallel exports. It will turn out that the respective social planner solution can directly be applied to the case without parallel exports.

In order to solve the social planner's problem we need to specify the planner's welfare function. In the first section we will assume a utilitarian welfare function, where the only objective is to maximize aggregate world utility. Then, in the second section we will assume that the social planner maximizes aggregate welfare subject to the fact that all improvements must be pareto-improvements.

Moreover, we assume that $(L/L^*)^* < aF + 1$, i.e. we are in a situation corresponding to Figure 2a). If the inequality goes the other way the following analysis need only to be slightly modified and we omit the respective deliberations, as they do not deliver any additional insight.

4.1 Maximizing Aggregate World Welfare

If the social planner cares only about the aggregate world welfare, he wants to attain an as broad as possible goods spectrum and let both representative agents consume one unit of each variety, because this leads to a maximal fixed costs dispersion. Thus his welfare function is $V_{sp} = 2(N + N^*)$. He maximizes V_{sp} subject to the economies' resource constraints and the fact that international transportation costs of course prevail, which implies that for high enough

[8] Baldwin and Forslid (2004) consider the effects of trade liberalization in a New Trade Theory model with heterogeneous firms.

transportation costs even the social planner favors the autarky equilibrium. Inserting the resource constraints into the welfare function yields aggregate world welfare when all producers manufacture for both markets

$$V_{sp} = U + U^* = 2\frac{L + L^*}{F + \frac{1+\tau}{a}}. \tag{16}$$

The welfare function in autarky is

$$V_{sp}|_{closed} = N|_{closed} + N^*|_{closed} = \frac{L + L^*}{F + \frac{1}{a}}. \tag{17}$$

>From (16) we see that for large enough transportation costs the aggregate world welfare with producers supplying both markets is lower than the autarky welfare. By setting (16) and (17) equal I evaluate the critical level of transportation costs

$$\tilde{\tau} = aF + 1.$$

Figure 3a) plots welfare attained by the social planner vs. aggregate utility in the decentral equilibrium. The social planner's solution could be induced by taxational measures. One possibility is to tax income in the home country and to subsidize exports to the poor country. Then, producers still find it profitable to export although the willingness to pay of the foreign country agent is lower than the additional costs from exporting.

4.2 Pareto-Improvement relative to Decentral Solution

If the social planner's welfare function is restricted to be a pareto-improvement with respect to the decentral solution, he can only achieve an improvement on $L^*/L\,(aF+1) < \tau < \infty$. The additional constraint is $N_{soc} \geq N|_{closed} = L/\,(F + 1/a)$.

To start, assume that the home producer is exactly indifferent between trading and autarky, i.e. $\tau = L^*/L\,(aF+1)$. If the transportation costs are now slightly higher the decentral equilibrium is autarky. Nevertheless it should be possible for a social planner to let almost all firms produce for both markets. So as not to lower the home agent's utility, he then assigns γL units of the home endowment to produce solely for the home market. The social planner chooses γ such that $N|_{closed} = N^* + \tilde{N}_T(\gamma) + \tilde{N}_N(\gamma)$, where $\tilde{N}_N(\gamma) = \gamma L/\,(F + 1/a)$ and $\tilde{N}_T(\gamma) = (1-\gamma)\,L/\,(F + (1+\tau)/a)$. Solving for γ yields

$$\gamma = 1 - \frac{1}{\tau}\frac{L^*}{L}\,(aF+1). \tag{18}$$

Note that for $\gamma = 0$ we are exactly in the case where decentral case just emerges, i.e. $\tau = L^*/L\,(aF+1)$. Of course we need as well that the foreign agent is always at least as well off as in autarky, i.e. $N^*|_{closed} \leq N^* + \tilde{N}_T\,(\gamma)$. Solving for the critical γ yields

$$\gamma = 1 - \tau \frac{L^*}{L} \frac{1}{aF+1}. \tag{19}$$

As γ in (18) is strictly rising in τ (on the relevant interval $1 \leq \tau < \infty$), whereas in (19) it is falling, there must be a unique level of transportation costs for which the social planner switches to prefer autarky. By equalizing (18) and (19) we find the critical level $\tau = aF + 1$. Note that this is the same level as in the case of an unconstrained social planner, who is only concerned about aggregate world welfare.

Figure 3b) plots welfare attained by the social planner vs. aggregate utility in the decentral equilibrium. Again, a consumption tax in the rich country could be used to subsidize exports and therewith the social planner's solution could be reproduced.

5 Discussion

Our model has generated several interesting result that constitute a major deviation from the standard models of the new trade theory which rely on homothetic (CES) preferences. The crucial mechanism that drives our results with 0/1-preferences are the optimal pricing decisions of firms. With CES-preferences the demand elasticity is constant and therefore the firms choose a constant markup over their marginal costs of supplying the market. This basically phases out the demand side, as the only determinand of prices are costs. In contrast to that 0/1-preferences point out the role of the demand side, as now the optimal pricing decision of the firms is to charge the willingness to pay of the agents.

The finite marginal utility at zero allows for endogenous autarky equilibria. With rising inequality between countries, lower setup costs, or higher transport costs such equilibria become more likely. This finding is in line with the Linder hypothesis claiming that more similar (with respect to per capita income) countries trade more. Moreover it allows to explain the presence of zeros in trade statistics. Because of the asymmetric markups we observe a bias in the relative gains from trade towards the poor country.

The demand side driven pricing decisions make situations possible where parallel imports would be worthwhile. This starkly contrasts with the CES-case, where the optimal pricing differential is always equal to the level of the transportation costs. When we account in our

model for the emergence of parallel imports partial trade equilibria emerge. As the monopolists loose their ability to freely price discriminate, some producers find it profitable to entirely specialize on the rich marketwhere they sell their merchandise at a higher price than traded goods.

Because now the poor country consumers can not anymore afford all goods, they are worse off than with higher transportation costs. Therefore the poor country prefers incomplete integration with some positive level of transportation costs (such that the monopolist is free to discriminate), whereas the rich country favors free trade, i.e. perfect integration.

The welfare analysis showed that the decentral equilibrium is not always welfare maximizing nor pareto-optimal. The partial trade equilibria and some endogenous autarky equilibria (for $\tau < (aF + 1)$) do not maximize welfare. The respective endogenous autarky equilibria are neither pareto-optimal as a social planner could choose to let most firms produce for both markets. Nevertheless he needed some firms selling exclusively on home market such that the home agents are as well off as in the endogenous autarky equilibrium.

6 Conclusions

In this paper we have presented a model of monopolistic competition and international trade in which income effects play a crucial role. The argument that average income levels are potentially important determinants international trade has a long tradition in the theoretical debate and dates back at least to Linder (1961) who has argued that per-capita incomes are an important determinant for the intensity of trade between countries. Moreover, numerous empirical studies have unequivocally supported the relevance of income levels as a determinant of the volume and the patterns of international trade.

We have argued that, due to the homotheticity of preferences assumed in the canonical model of new trade theory, the notion of income effects remains unclear in this framework of analysis. In contrast, income effects have a precise meaning in the present context. Rather than sticking to CES-preferences we have assumed have "0/1 preferences". This specification of preferences is meaningful when consumer goods are indivisible and households face a 0/1 choice: either one unit of a good is consumed or it is not consumed at all. In such a context the consumer's problem is to choose the number of goods, while there is no choice about the quantity per consumed variety. This is different from the standard model where consumers

choose the quantity consumed per variety but have essentially no choice about the number of goods (because homothetic preferences force them to purchase *all* supplied varieties). In this sense, the assumption on consumer preferences adopted in this paper is equally general (or special) as the assumption of homothetic preferences in the standard model.

Two main results emerge from our analysis. The *first* result is that our model provides a precise formulation of the Linder hypothesis in the context of an otherwise standard new trade theory model. We find that, when countries are very dissimilar, no trade will take place. In contrast, when countries are very similar, trade emerges and all goods that are produced in the world economy will be traded and consumed in both countries. For an intermediate degree of similarity, the equilibrium outcome features a situation where product variety is narrow in the poor country; broad in the rich country; and only a subset of the goods produced worldwide will be internationally traded.

A *second* main result that emerges from our analysis relates to the gains from trade and the distribution of welfare between countries. We find that, when countries are sufficiently similar, so that all goods are traded the poorer country gains more than the rich country. The reason is that consumers in the rich country bear a relatively larger share in the fixed cost in production. This result is driven by the fact that richer consumers are willing to pay more for the various goods which allows firms to charge high prices and mark-ups. When countries are more dissimilar (but not too dissimilar to rule out trade at all), producers in the rich country can no longer take full advantage of the higher willingness to pay of rich-country consumers. The reason is a threat of parallel imports which disciplines firms' price-setting behavior. We show that, in such a situation the rich country gains disproportionately from a reduction in transportation costs whereas poor country will be harmed. As a result, the poor country may oppose a trade liberalization.

Our model could be extended along various lines. One obvious extension is to allow for income inequality within countries. This would generate further interesting insights as the non-homotheticity of "0/1-preferences" leads to a situation where price-setting behavior is not only affected by between-country inequality but also by the distribution of income within countries. A second potentially interesting direction for future research concerns political economy issues of international trade. Whether trade liberalization policies can be implemented will crucially depend on the distribution of trade gains between countries. A detailed analysis of the involved conflicts of interest implied by income effects may yield potentially important insight into the

political economy of international trade negotiations.

A Different Population Sizes

In the main part of this paper we made the assumption that the population sizes of the two countries are equal. This has some convenient notational effects. On the one hand we can then normalize population to one and the explicit notion of population becomes therewith redundant. Moreover the wage rates equalize, which again gives some notational ease. The purpose of this section is to scetch out the - purely notational - effects of differing population sizes.

Let $\mathcal{P}$ denote the population size in the home country and $\mathcal{P}^*$ population abroad. Then the zero profit conditions are

$$\frac{1}{\lambda}\mathcal{P} + \frac{1}{\lambda^*}\mathcal{P} = W\left(F + \frac{\mathcal{P} + \tau\mathcal{P}^*}{a}\right) \tag{20}$$

$$\frac{1}{\lambda}\mathcal{P} + \frac{1}{\lambda^*}\mathcal{P} = W^*\left(F + \frac{\mathcal{P}^* + \tau\mathcal{P}}{a}\right). \tag{21}$$

This implies that now the wage rates differ $W/W^* = \left(F + \left(\mathcal{P}^* + \tau\mathcal{P}\right)/a\right) / \left(F + \left(\mathcal{P} + \tau\mathcal{P}^*\right)/a\right)$.The budget constraints are

$$W\frac{L}{\mathcal{P}} = \frac{1}{\lambda}\left(N + N^*\right) \tag{22}$$

$$W^*\frac{L^*}{\mathcal{P}^*} = \frac{1}{\lambda^*}\left(N + N^*\right). \tag{23}$$

and the corresponding resource constraints are

$$L = N\left(F + \frac{\mathcal{P} + \tau\mathcal{P}^*}{a}\right) \tag{24}$$

$$L^* = N^*\left(F + \frac{\mathcal{P}^* + \tau\mathcal{P}}{a}\right). \tag{25}$$

(20) - (25) together describe the general equilibrium with the endogenous variables λ, λ^*, W, W^*, N, and N^*. The relative prices are now

$$\frac{p}{p^*} = \frac{1/\lambda}{1/\lambda^*} = \frac{W}{W^*}\frac{L}{L^*}\frac{\mathcal{P}^*}{\mathcal{P}} = \frac{F + \frac{\mathcal{P}^* + \tau\mathcal{P}}{a}}{F + \frac{\mathcal{P} + \tau\mathcal{P}^*}{a}}\frac{L}{L^*}\frac{\mathcal{P}^*}{\mathcal{P}},$$

which points to the fact that the high price country is now determined by a mix of relative per capita endowment and relative population size. Based on the relative prices one can derive the trade condition and the point for which parallel exports become an issue. From here one an proceed identically as in the main part.

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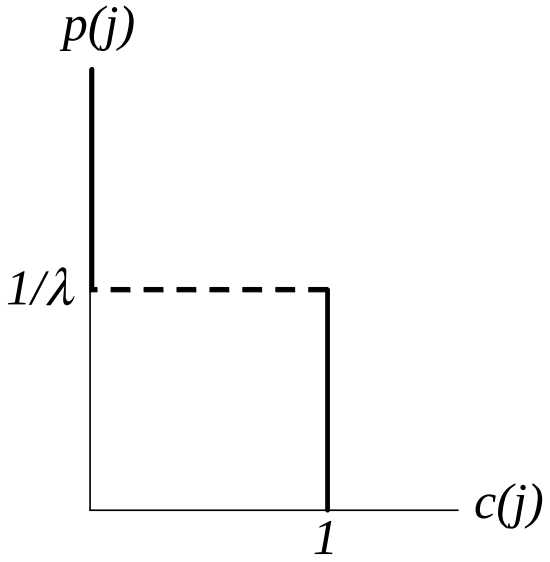

Figure 1: The microeconomic demand function for variety j.

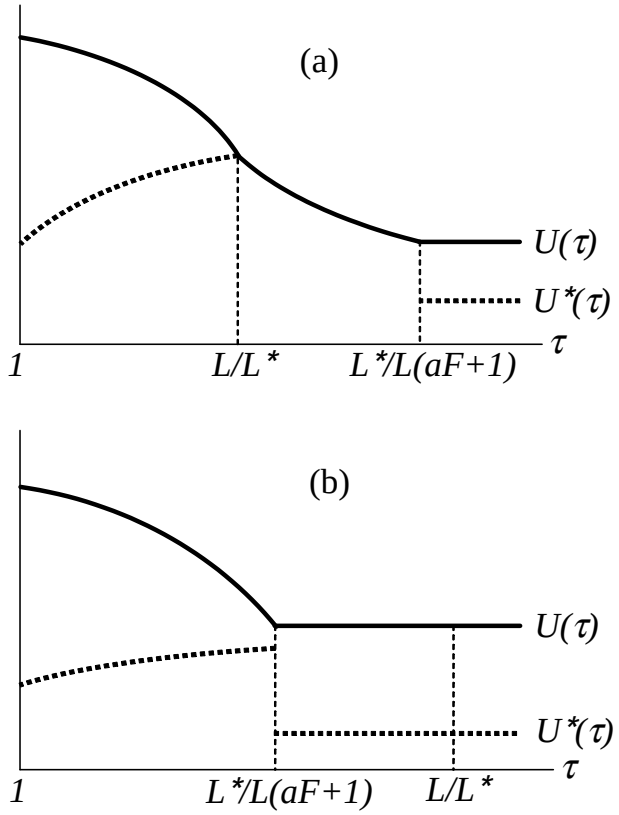

Figure 2: Equilibrium utilities of the home agent (solid line) and of the foreign agent (dotted line) as a function of the transportation costs. Situation (a) depicts the case where $(L/L^*)^2 < aF+1$ and (b) the case of $(L/L^*)^2 > aF+1$.

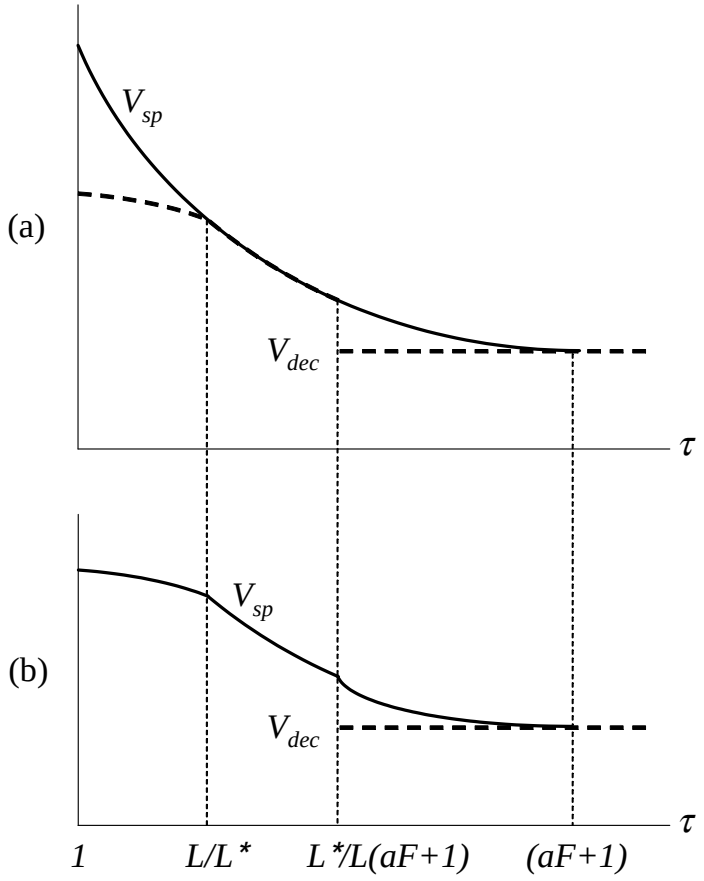

Figure 3: Aggregate world utility in the decentral equilibrium (dashed line) vs. aggregate welfare in the social planner's solution. (a) Social planner is unconstrained, (b) Social planner is constrained to pareto-improvements.