Putting per-capita income back into trade theory ☆

James R. Markusen

University of Colorado, Boulder, United States

ABSTRACT

A major role for per-capita income in international trade, as opposed to simply country size, was persuasively advanced by many early economists including Linder (1961), Kuznets (1966), and Chenery and Syrquin (1975). Yet this crucial element of their story was abandon by most later trade economists in favor of the analytically-tractable but counter-empirical assumption that all countries share identical and homothetic preferences. This paper presents a set of assumptions which produces multiple results when they hold jointly. Most of these results are novel, but several that are implicit or explicit in earlier literature are also noted for completeness. Adding non-homothetic preferences to traditional models helps explain such diverse phenomena as a growing skill premium, the mystery of the missing trade, home bias in consumption, the behavior of trade to GDP ratios, and the role of intra-country income distribution, from the demand side of general equilibrium. With imperfect competition, we can explain higher markups and higher price levels in higher per-capita income countries, and the puzzle that gravity equations show a positive dependence of trade on per-capita-incomes, aggregate income held constant. The model also predicts horizontal multinational activity is negatively related to per-capita income differences between countries.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

All international trade economists understand that many things can cause trade. However, our models and empirical analyses typically and appropriately tend to focus on one cause of trade at a time in order to understand how a particular basis for trade contributes to explaining trade patterns, determines gains from trade, and impacts on income distribution. That having been said, it seems that most trade theory focuses on production-side determinants of trade. It is typically assumed that consumers have identical and homothetic preferences within and across countries. Aggregate demand depends only on commodity prices and aggregate income, and it is independent of the distribution of income. I also believe that it is appropriate to suggest that no one thinks that this is a good empirical assumption and that it is made for analytical convenience and tractability.

If we control for differences in prices across countries, the observation of different budget shares can indicate either that preferences differ and/or that they are non-homothetic. Two pure cases can be distinguished: one in which countries have homothetic but non-identical preferences and one in which countries have identical but

non-homothetic preferences. I feel much more comfortable with the second alternative, which is the one I will explore here. Then demand differences are not only systematic but the hypothesis is testable and falsifiable.

The purpose of this paper is to add a generic model of identical but non-homothetic preferences to several standard production models, with specific assumptions about the relation between income elasticities of demand and production parameters such as factor intensities. In Sections 2 and 3, the preferences are presented and analyzed and then placed on top of a standard two-good, two-factor, two-country Heckscher–Ohlin model. Section 4 adds imperfect competition and increasing returns in one sector. A couple of my results have parallels to earlier work with a different focus, or in one or two cases are implicit in published papers. So as a first task, let me list eleven theoretical results that I will derive and try to note the originality of each. None of the results requires horizontal or vertical (quality) differentiation.

General points found in other literatures.

(1) Productivity growth versus neutral factor accumulation have quite different implications for aggregate demand (found in older development literatures).
(2) Higher intra-country inequality leads to a higher aggregate demand for a high-income elasticity good, with implications for trade volumes and partners (related results found in the product-quality literature, e.g., Hallak 2010).

Tied to a positive correlation between skill intensity and income elasticity of demand.

(3) Neutral productivity growth in all countries in all sectors leads to a rise in the relative wage of skilled labor in all countries (new result).

(4) Adding non-homotheticity to standard HO helps explain "missing trade", or the tendency for HO to over-predict the volume of trade (implicit in Markusen, 1986, identified empirically in Hunter, 1991 though no production side in her model).

(5) Adding non-homotheticity to HO gives an alternative source of "home bias", defined as a positive correlation between a country's specialization in production consumption (implicit in Markusen, 1986).

(6) Trade between a high and a low-income country will be reduced by higher inequality in the high-income country, but increased by higher inequality in the low-income country (new result).

(7) Given two countries with equal growth in total incomes but only one growing in productivity, the trade to GDP ratio will rise over time if it is the poor country that is growing in productivity (new result).

The high income-elasticity good is produced with increasing returns under imperfect competition (do not depend on the factor-intensity, income elasticity correlation).

(8) Markups are higher in higher per-capita-income countries (found in Simonovska, 2010 and in product-quality papers, but little modeling of general-equilibrium).

(9) With free entry however, a secular rise in per-capita incomes does not lead to a secular rise in markups contrary to what (8) may suggest (new result).

(10) The volume of trade will be higher between high per-capita-income countries (found in Markusen, 1986; Bergstrand, 1990 and Fieler, 2011: results rely on differentiated goods, not previously noted for homogeneous goods).

(11) Horizontal multinationals will exist for a narrower range of differences in countries' per-capita incomes and relative endowments than under homothetic demand (new result).

Several of the results, notably those on trade volumes and trade partners, have parallels in earlier papers focusing on somewhat different issues. I'll comment briefly on some of these here, returning to a literature review after deriving my results. A number of papers, obviously beginning with Linder, focused on product differentiation which I do not need to derive my results here. Papers by Markusen (1986), Bergstrand (1990), and Francois and Kaplan (1996) draw out implications for intra-industry and total trade volumes. Matsuyama (2000) uses a competitive Ricardian model in which the South's comparative-advantage goods are low-income-elasticity-of-demand goods to derive results similar to some here. Fieler (2011) uses a Ricardian approach ala Eaton and Kortum (2002), which yields outcomes related to those from monopolistic competition. There is a dispersion of technologies across goods and a variability of labor efficiency across countries. High income elasticity goods have a higher dispersion and are produced in high-income countries. This higher dispersion leads to more trade among the high-income countries relative to low-income countries.

Markusen (1986) is a three-region model with "east–west" trade among identical high-income (north) countries and "north–south" trade between the high and low per-capita-income countries. High-income-elasticity goods are both capital-intensive and differentiated, while the homogeneous low-income elasticity good is labor intensive. The volume of east–west (north–north) trade is then higher than north–south trade relative to identical and homothetic preferences. Fieler (2011) makes substantial theoretical progress on this sort of multi-country prediction in her Ricardian model and deals with south–south trade as well.

Estimates for broad categories of consumption goods from Hunter and Markusen (1988) suggest income elasticities from about 0.45 (food) to 1.90 (medical care). Hunter (1991) shows that the influence of non-homotheticity is in the direction of reducing the volume of trade, production held constant (there is no production side to her estimation). A counter-factual analysis neutralizes the estimated non-homotheticity and finds that the effect of imposing homotheticity is to raise trade flows by 29%.

Cassing and Nishioka (2010) use a neutralization exercise similar to Hunter's and find that developing countries consume relatively more labor-intensive goods than under preference homogeneity. Second, they find that preference biases between rich and poor countries explain a larger proportion of missing factor trade than do differences in technology, though preference *differences* are not distinguished from non-homotheticity.

Bernasconi (2010) has an interesting alternative story, which is that high-per-capita-income consumers/countries consume a broader range of goods, and this in turn increases the volume of north–north trade. Martinez-Zarzoso and Vollmer (2010) show a strong and positive relationship between trade volumes and per-capita income, and trade volumes and income inequality, with the latter relationship stronger for more sophisticated goods, both consistent with the model adopted below. As in some of the papers just mentioned, there is no explicit modeling of the production side of general equilibrium and no integration of production and consumption.

Some of these results contrast with Bowen et al. (1987) and Trefler (1995) who do introduce non-homothetic preferences into their analyses and get weak value added from doing so. Neither paper addresses non-homotheticity as a cause of missing trade or home bias (Trefler does find it helps solve the "endowment paradox"). Reimer and Hertel (2010) find that non-homothetic preferences play only a small role in missing trade over broad categories of goods. Rather, they find that, as income grows, it is directed toward the relatively capital-intensive version of a given good.

Results in the section introducing imperfect competition are similar to those found in Wong (2003), Coibion et al. (2007), Hummels and Lugovskyy (2009) and Simonovska (2010) which is that markups and hence the price level will be higher in the high per-capita-income country. Simonovska gets strong empirical support for this relationship. I should also note that Simonovska carefully considers identical products, which eliminates quality issues which could be an alternative explanation for systematic price differences by per-capita income. Essentially the same result was found by Wong for pricing of identical pharmaceutical products. None of these papers integrate the demand side with the product side as I do here. None allow for free entry and hence leave a worry that rising per-capita incomes are predicted to lead to a secular rise in markups.

Many results here depend on the positive correlation between a good's income elasticity of demand and its skilled-labor intensity in production. Preliminary findings in Caron et al. (2013) give strong support to this link.

An area where per-capita income does play an important role is in the analysis of product quality: the quality demanded is likely to depend on per-capita income. This makes the average level of per-capita income important for trade but also the intra-country distribution of income matters for inter-country trade. I am the first to acknowledge that these issues are of great interest and importance. But it became clear to me that dealing with them is far beyond the scope of one paper. A good place to start on this literature is a recent paper by Hallak (2010) which also notes the contributions of many earlier papers.

2. A generic model

The preferences I will use are variation on a standard Stone–Geary utility function, to be introduced shortly. The production side of the model is deliberately Heckscher–Ohlin to permit an easy comparison with traditional results. There are two good (X and Y), two factors of production (K and L) and two countries home and foreign (h and f).

Throughout the paper, the following assumptions are made.

(1) Good X is relatively capital/skill intensive, and Y is relatively labor intensive.
(2) Good X has an income elasticity of demand greater than one.
(3) Good X is the increasing-returns good if there is one (Section 4).
(4) The labor supply is proportional to the number of households, implying that the capital-abundant country must be the high-per-capita-income country.
(5) Country h is relatively capital abundant when relative endowments differ.
(6) Country h has higher productivity when productivities differ across countries.[1]

Most of these assumptions are without loss of generality, but the *intersection* of (1)–(4) matters; in particular, that the capital/skill-intensive good has the high income elasticity of demand. Matsuyama (2000) uses an equivalent assumption in his Ricardian model: the South's comparative advantage goods are low-income-elasticity goods. Fieler's (2011) theory is also Ricardian, and the theory and empirical evidence deliver a related result: the south has a comparative advantage in low-income elasticity standardized goods while the north has an advantage in high-income-elasticity goods whose production technologies are more variable across countries. The best support for the crucial link between (1) and (2) is Caron et al. (2013), who find that the correlation between income elasticity and skill intensity exceeds 50%, even after accounting for trade costs.

Since we will focus on a limited number of experiments, some short-hand terminology is used throughout. *Productivity advantage* or growth, or higher productivity refers to an equal proportional Hicks-neutral productivity advantage or growth in *both* sectors in one country (always country h) or in both countries. *Factor accumulation* refers to a equal proportional ('neutral') growth in the endowments of *both* factors of one or both countries: factor accumulation increases the number of households in the same proportion to total income.

Lower-case letters denote per-household quantities. In addition to x and y, there is a parameter $z > 0$ at the household level. Preferences or utility (u) are given as follows.

$$u = (x+z)^\beta y^{1-\beta}. \tag{1}$$

We could interpret z as an endowment good and assume that *households cannot buy or sell z*. x could be televisions and z could be watching a sunset (non-rivaled and non-excludable). The assumption that x and z are additive is not crucial to any results in this paper, but has the advantages that (a) there is a simple analytical solution for demand and (b) aggregate demand does not depend on the distribution of income if inequality is small (distribution matters if inequality is high, noted below).

It is more common to see Stone-Geary written with $(y - z)$ instead of $(x + z)$, with $z > 0$ then referred to as a "minimum consumption requirement". But this leads to a problem if income is insufficient to purchase the minimum consumption requirement. In addition, our formulation in Eq. (1) will mean that the price elasticity of demand for X will be falling in per-capita income, a property exploited in Wong and in Simonovska.

Engel's curve: Oy₀A
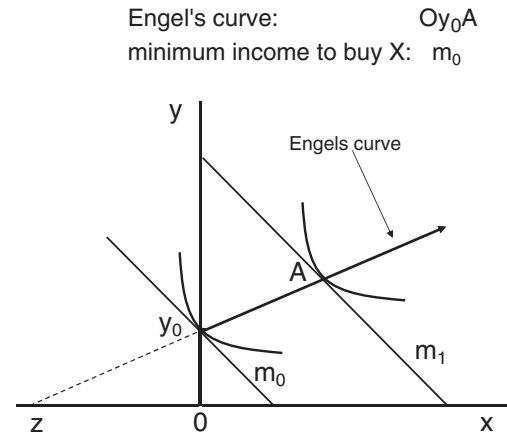minimum income to buy X: m₀

Fig. 1. Preferences and their properties.

Let m^i denote the income of household i from capital and labor, and let p_x and p_y denote the prices of X and Y. The households budget constraint is given by:

$$m^i = p_x x + p_y y. \tag{2}$$

Maximization of Eq. (1) subject to Eq. (2) gives the following Marshallian demand functions.

$$x^i = \max\left[0,\ (\beta-1)z + \frac{\beta m^i}{p_x}\right] \quad y^i = \min\left[\frac{m^i}{P_y},\ \frac{(1-\beta)\left(m^i + p_x z\right)}{P_y}\right]. \tag{3}$$

$$x^i > 0 \quad iff \quad m^i > \frac{(1-\beta)}{\beta} p_x z \equiv m^0. \tag{4}$$

At low levels of income, the household buys only good Y, and above the threshold income indicated in Eq. (4) by m^0, begins to buy X. Properties of the preferences are illustrated in Fig. 1. The Engels curve (prices constant) is given by $0y_0A$: up to income m^0, given by Eq. (4) with equality, the household consumes only good Y and then has a constant marginal propensity to consume X and Y as income rises.

Let L denote the number of households, so that $Z = zL$ denotes the economy-wide "endowment" of Z: z is a *parameter*, while Z is strictly proportional to the number of households. If inequality (4) holds for all households, aggregate demand for X depends on total income and is independent of the distribution of income across households. Aggregate demand is given by[2]

$$X = \sum_{i=1}^{L} x^i = (\beta-1)Z + \frac{\beta M}{p_x} \quad Z = zL \quad M = \sum_{i=1}^{L} m^i. \tag{5}$$

Now consider the income elasticity of demand for X and assume that per-capita income grows (e.g., through a Hicks-neutral productivity increase), holding the number of households L and therefore Z

constant. Assume all households have the same per-capita income, denoted m.

$$\left[\frac{M}{X}\frac{dX}{dM}\right]_{dZ=0} = \frac{\beta M}{\beta M + (\beta-1)p_x Z}$$
$$= \frac{m}{m-m^0} > 1 \text{(growth through productivity improvement)}.$$

$$(6)$$

If growth instead occurs through neutral factor accumulation, Z is proportional to M.

$$\left[\frac{M}{X}\frac{dX}{dM}\right]_{dZ/Z=dM/M} = 1 \quad \text{(growth through neutral factor accumulation)}$$

$$(7)$$

Using $dX/dp_x = -\beta M/p_x^2$, the Marshallian price elasticity, defined as positive, is

$$\varepsilon \equiv -\left[\frac{p_x}{X}\frac{dX}{dp_x}\right] = \frac{\beta M}{\beta M + (\beta-1)p_x Z} = \frac{m}{m-m^0} > 1. \quad (8)$$

Thus the per-capita income and the price elasticities of demand for X are (locally) the same.

The properties of aggregate demand for the economy holding prices constant are shown in Fig. 2. Let Z_0 denotes the initial value of Z. Hold Z constant but allow aggregate income to vary either through productivity or through capital accumulation, holding L constant. This leads to an Engels income–consumption curve that starts at the origin and moves up the Y axis (consuming only Y) to point Y_0 after which higher income will result in positive X demand. At incomes above that which allows point Y_0 to be reached, the Engels curve is linear through A at income level M_0 and reaching B at income level M_1.

Consider point A and income level M_0 in Fig. 2. Now suppose instead we let the economy grow through proportional factor accumulation, adding households in strict proportion to the increase in income, then from Eq. (5) aggregate demand grows in the same proportion as M. Now the Engels curve beyond A will be given by a ray from the origin and through points A and C, and aggregate demand is homothetic with respect to aggregate income. Fig. 2 gives a result found in older development literatures: a growing economy will look very different depending on whether growth is through productivity or capital accumulation on the one hand, or neutral factor accumulation on the other (aggregate income and households grow in strict proportion).
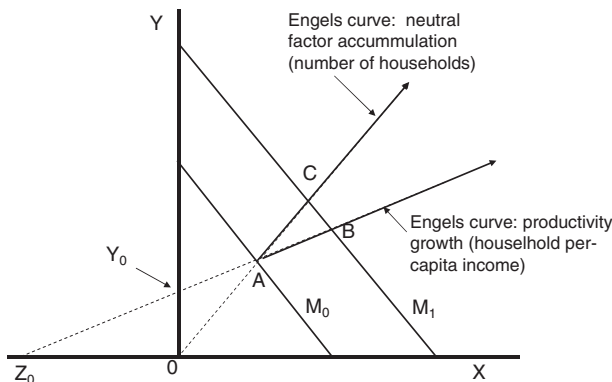

Fig. 2. Growth through productivity versus neutral factor accumulation (growth in the number of households).
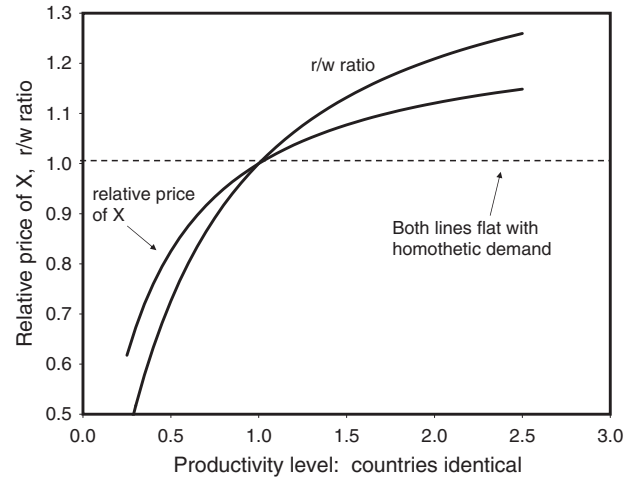

Fig. 3. Skill premium from the demand side (identical countries).

3. Skill premium, missing trade, home bias, and trade-to-GDP ratios

Several of the results I will now present follow from the assumption that the skill/capital intensive good has a high income elasticity of demand, combined with the well-known Stolper–Samuelson and Rybczynski theorems which hold in our Heckscher–Ohlin production structure. For several of these results, I believe some simple diagrams (though derived from actual numerical simulations) are sufficient. Other results need some algebra. The qualitative properties of all results have no dependence on the specific parameters or other assumptions used in these specific examples. The initial "calibration" point for all diagrams is as follows: at benchmark productivity, the income and price elasticity are 1.333 and the share of X in consumption is 0.5; the value of $\beta = 2/3$ is used in this example and throughout the paper.

The first application of the model is to the skill-premium question. With the neutral and equal productivity growth in both sectors, the production frontier of the economy is growing radially, but demand is shifting toward good X. This generates a movement around the frontier toward X, so the relative price of X rises as shown in Fig. 3. But this generates the usual Stolper–Samuelson effect on relative factor prices, so the rental (r)–wage (w) ratio r/w is rising as shown in Fig. 3. Suppose we interpret capital as skilled labor or human capital and L as unskilled labor. A neutral productivity growth generates an increase in the wage gap between skilled and unskilled labor. Thus we can get a wage gap (skill premium) phenomenon driven by the demand side of the general-equilibrium model without appealing to trade or to skill-biased technical change.[3]

Now consider differences in relative endowments, beginning with the two countries identical, under the assumption of costless trade. Move capital from f to h and labor from h to f, implying the Z rises in f and falls in h by an equal and opposite amount. If inequality (4) continues to hold, then aggregate world demand is unchanged at constant prices. The Engels curves will move apart in Fig. 2 but they remain parallel. Fig. 4 shows the effect of widening the endowment differences. It graphs the share of world consumption and production of X in each country. The linearity of the production shares follows from the Rybczynski theorem and the fact prices are unchanged up to the point of specialization. The consumption shares in this exercise would be constant at 0.5 under homothetic demand.

<hr/>

[3] An extension possibly relates to the Prebisch (1950), Singer (1950) hypothesis. If the countries differ in relative endowments (standard Heckscher–Ohlin), then neutral productivity growth in both countries will lead to a terms-of-trade deterioration for the labor-abundant country: the "south".
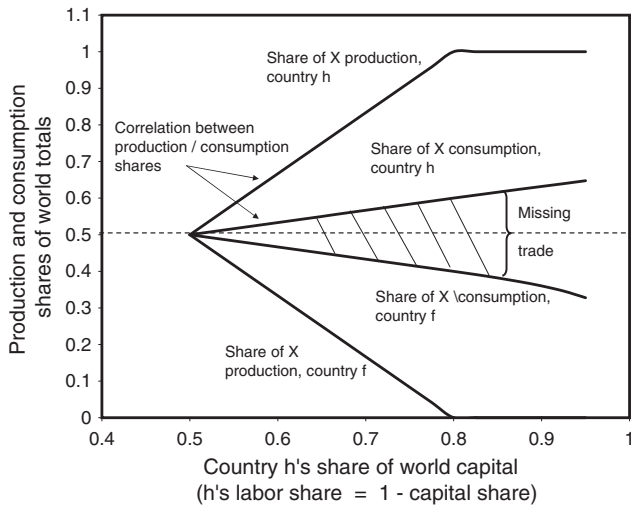
Fig. 4. Home bias and the mystery of the missing trade.

But under our assumption that the capital intensive good is the high-income-elasticity good, the consumption shares are positively correlated with their respective good's production share.

Fig. 4 gives a demand-side explanation for two phenomenon that have previously been identified and attributed to production-side causes. The positive correlation between production and consumption shares has been one (of several) definition of "home bias". Secondly, the volume of trade is less under our assumptions than is predicted under a standard Heckscher–Ohlin model and thus offers a demand-side explanation for the empirical puzzle of "missing trade" in Trefler's (1995) terminology. The amount of missing trade is identified in Fig. 4 and note that it continues to grow in importance once countries are specialized: production specialization cannot continue to increase but consumption specialization can. As noted earlier, non-homotheticity as a cause of missing trade was noted theoretically by Markusen (1986) and empirically verified in Hunter (1991). Closely related points in the Ricardian context are found in Matsuyama's (2000) theory and in Fieler's (2011) theoretical and empirical paper.[4]

Missing trade is a static, "cross-section" question. Another area where an inclusion of non-homothetic preferences and per-capita income may help our understanding involves the question of the growth of world trade relative to total income. Referring back to Eqs. (3) and (5), the aggregate demand for X in country i (assuming positive purchases of X) is

$$X_i = \left[(\beta - 1)z + \beta \frac{m_i}{p_x}\right]L_i. \tag{9}$$

Assumed that p_x is equalized across countries by free trade. Now consider a clear, though special case. Suppose that we choose factor endowments so that each country is just specialized, country h in X and country f in Y, and both countries have the same total income $m_i L_i$. Consider a compensated experiment in which there is a Hicks-neutral productivity increase in one country, but the number of households L falls such that total income $m_i L_i$ remains constant (the endowment of physical factors falls in the same proportion as productivity increases) and there is an equal but opposite change in the other country. At initial prices, neither the world production nor consumption of X and Y will change under these assumptions.

Specifically, note that there will be a zero change in the world demand for X and also for Y: the positive increase of $(\beta - 1)zL_i$ in one country in Eq. (9) cancels out the negative effect in the other country and $m_i L_i$ is constant in both countries by assumption.

With no change in aggregate world demands for X and Y, prices will remain constant and so we can normalize both goods prices at one. We can then drop the price of X out of Eq. (9), and m_i becomes just the productivity of one worker in country i in that country's comparative-advantage industry. Consider first country f, which does not produce X, so Eq. (9) give country's import demand for X, denoted IX. Differentiate Eq. (9) with respect to m_f and L_f.

$$dIX_f = \beta L_f dm_f + \left[(\beta - 1)z + \beta m_f\right]dL_f. \tag{10}$$

Express this in proportional terms.

$$dIX_f = \beta m_f L_f \frac{dm_f}{m_f} + \left[(\beta - 1)zL_f + \beta m_f L_f\right]\frac{dL_f}{L_f}. \tag{11}$$

Under the "compensation" assumption that we are holding total income constant, the proportional changes in L_i and m_i are equal and opposite. Thus Eq. (11) can be written as

$$dIX_f = (1 - \beta)zL_f \frac{dm_f}{m_f}. \tag{12}$$

Now consider country h, the exporter of good X. The exports of X by country h are production minus consumption, but production is just total income, $m_h L_h$. Thus the exports of X by h are given by

$$EX_h = m_h L_h - (\beta - 1)zL_h - \beta m_h L_h = (1 - \beta)zL_h + (1 - \beta)m_h L_h. \tag{13}$$

Differentiating Eq. (13), we get

$$dEX_h = (1 - \beta)L_h dm_h + [(1 - \beta)z + (1 - \beta)m_h]dL_h. \tag{14}$$

Which can be written in proportional terms as

$$dEX_h = (1 - \beta)m_h L_h \frac{dm_h}{m_h} + [(1 - \beta)zL_h + (1 - \beta)m_h L_h]\frac{dL_h}{L_h}. \tag{15}$$

Since the proportional changes in m_h and L_h are equal and opposite, then we get

$$dEX_h = -(1 - \beta)zL_h \frac{dm_h}{m_h} = dIX_f = (1 - \beta)zL_f \frac{dm_f}{m_f} \tag{16}$$

which is equal to the change in import demand by country f, given they are identical initially ($L_h = L_f$) and their productivities change in equal and opposite directions proportionally.

This gives the following result. If country f is the country with increasing productivity (and falling household numbers), then trade increases. Country f with the rising productivity wants to buy more of the high-income-elasticity good X, its import good, total income held constant. Country h has a falling per-capita income in this case, and wants to sell more X, total income held constant. Trade increases faster than total income (constant here). The opposite case arises if country h is the one with increasing productivity. Country h wants to spend more on its export good X and export less, total income held constant and country f, with falling per-capita income, also wants to spend and therefore import less.

This result generalizes to rising total incomes and a simulation is shown in Fig. 5. Both countries are specialized as in the above example (factor-endowment ratios are equal to the factor-intensity ratios in X and Y for countries h and f respectively). Both countries have neutral growth, either through equal proportional increases in K

---

[4] Markusen (1986) and Fieler (2011) explicitly explain large "north–north" versus small "north–south" (and south–south in Fieler) trade volumes. An entirely different explanation is advance in Markusen and Wigle (1990): north–south and south–south trade is small because the south is poor and because the pattern of wold protection discriminates against north–south and south–south trade.
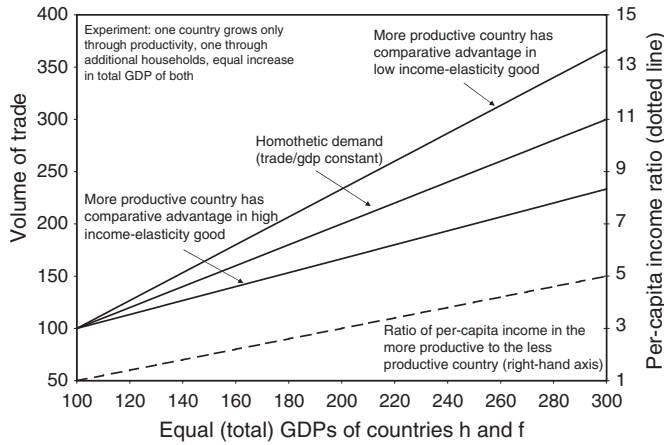
Fig. 5. Asymmetric productivity growth between countries and the volume of trade.

and L or through equal Hicks-neutral technical progress in both X and Y. But one country's increase in total income is entirely due to increased productivity and the other's increase is due to a fall in productivity and a rise in K and L. I know that the following sounds a little contorted, but I want a case in which the rise in total GDP, the equality of each country's GDP, and the relative outputs and prices of X and Y are preserved with and without non-homotheticity to provide a valid interpretation of trade changes.

This can be achieved by the following "compensated" experiment, beginning with both countries identical. Suppose, for example, that we double total incomes. In one country, the initial productivity that gives per-capita income m^0 increases sufficiently to give a per-capita income of $2m^0$. In the other country, productivity falls such that per-capita income falls to $(2/3)m^0$ and the number of households increases to $3L^0$. Then both countries total incomes double ($2m^0 = (2/3)m^0 3L^0$). Importantly, the total world demand for X and Y increases by the factor of two, since the number of household in the world doubles under my compensated changes, from $2L^0$ to $4L^0$. Thus with and without homotheticity, the world demands for X and Y both double, prices continue to equal one, and both countries have the same total incomes.

This growth plus compensated change scheme is simulated to produce Fig. 5. Countries are identical on the left-hand side of Fig. 5, where they have initially-equal relative per-capita incomes, shown by the dotted line (plotted on the right-hand vertical axis). If preferences are homothetic, growth results in trade expanding in strict proportion to total income. If the country specializing in the low-income-elasticity good is the one with increasing productivity (country f), then trade expands faster than total GDP. If the country specializing in the high-income-elasticity good is the one with increasing productivity (country h), trade increases less than in proportion to income. On the right-hand edge of Fig. 5, total incomes have grown by a factor of 200% and the ratio of per-capita incomes, rich over poor, is five. Trade grows 267% if f has the productivity growth, 133% if country h has the productivity growth, and 200% with homothetic demand.

These results might have some explanatory power. For example, if China has high productivity growth but specializes in low-income elasticity goods, then the model predicts that trade volume will rise faster than income. China will want to consume proportionately less of its own export goods and proportionately more foreign imports relative to income.

As a final exercise with the competitive case, briefly consider the role of intra-country income distribution which has been noted before.[5] If each consumer in a country has enough income as given in

Eq. (4) to want positive amounts of X, then the linear property of the Engels curve means that redistribution of income within the country (subject to Eq. (4) continuing to hold for all households) does not affect aggregate demand. But if redistribution puts some households on the vertical section of the curve in Fig. 1 or 2 where they only buy Y (points below y^0 or Y^0), then it does matter.

Let there be two sets of households, denoted with superscript p (poor) and r (rich). There are L^p poor households and L^r rich households, $L = L^p + L^r$ with per-capital incomes m^p and m^r respectively. m^a will denote the average income. Assume that a household with average income would purchase positive amounts of X but poor households do not. With reference back to the minimum income condition in Eq. (4), we assume that

$$m^a = \frac{m^p L^p + m^r L^r}{L} \quad m^p < \frac{(1-\beta)}{\beta} p_x z = m^0 < m^a. \tag{17}$$

When there are just these two household types, only the rich ones will purchase X. Suppose on the other hand, that all household types have the average per capita income. Aggregate demand X^r and X^a (everyone has the average income) in these two scenarios are given as follows.

$$X^r = (\beta-1)zL^r + \frac{\beta m^r L^r}{p_x} \quad X^a = (\beta-1)zL + \frac{\beta m^a L}{p_x}. \tag{18}$$

Subtract the second equation of Eq. (18) from the first, and substitute for m^a from the first equation of Eq. (17). The difference in aggregate demand is

$$X^r - X^a = (1-\beta)zL^p - \frac{\beta m^p L^p}{p_x} > 0 \quad \frac{X^r - X^a}{L} = \beta \left[\frac{m^0 - m^p}{p_x} \right] \frac{L^p}{L} > 0. \tag{19}$$

where the inequalities hold by assumption (the income of poor households is too low to purchase X). Perfect aggregation does not hold with a wide distribution of household income and, for two countries with the same average income, aggregate demand for the luxury will be higher in the country with the more unequal distribution (those Mercedes in Africa).

The implications of this for trade volumes are straightforward and don't require more algebra. Suppose we have a high and a low per-capita income country trading with one another. (a) If income inequality increases in the high-income country, this shifts consumption toward the skill or capital-intensive good, which is the export good. This will lead to a reduction in the volume of trade, loosely analogous to our home-bias result above. (b) If instead income inequality increases in the poor country, consumption is shifted there toward the skill or capital intensive good, which is the import good. This will lead to an increase in the volume of trade. Thus the effect of an increase in income inequality in one country on the volume of trade depends on which country is experiencing the increasing inequality.

4. Imperfect competition, prices, markups and horizontal multinationals

In this section, we add scale economies, imperfect competition, and free entry and exit of firms in the X industry in a standard model of Cournot competition, continuing with the assumption that X is a homogeneous good. Y is produced with constant returns under perfect competition. We assume segmented markets simply because the results are more interesting and in line with Simonovska for example, so the model is similar to Venables (1985) or Markusen and Venables (1988), the latter contrasting segmented and integrated markets cases.

---

[5] The role of the intra-country distribution of income for inter-country trade is an important focus of the literature on product quality. Again, Hallak (2010) is a recent paper that references and explains much earlier literature.

To keep matter manageable, we will concentrate on the case of per-capita income differences arising from productivity differences, but the qualitative results are identical to the case where countries differ in endowment ratios. Suppose that there is just a single factor of production, L, and distinguish between the household count and the "effective" or productivity-adjusted supply of labor in each of the two countries. One unit of Y uses one unit of effective labor supply and X uses c units of effective labor for marginal costs and F units for fixed costs. The two countries could have identical aggregate incomes but different per-capita incomes: one country can have higher productivity but proportionately lower household count.

Good Y is used as numeraire. Revenue (R_{ij}) for a Cournot firm in country i and selling in country j is given by the price in j times quantity of the firm's sales. Price is a function of all firms' sales.

$$R_{ij} = p_j(X_j)X_{ij} \quad X_{ij} \text{ is total sales in market } j : X_j = \sum_i X_{ij}.$$

Assume zero trade costs and segmented markets, with c and F having the same value across countries. Then any firm that operates will sell in both markets and will sell the same in each market as any other firm regardless of that particular firm's home country: $X_{ii} = X_{ji}, X_{jj} = X_{ij}$. n will then denote the total number of firms from both countries active in equilibrium, where n is determined by the usual free-entry zero-profit conditions. This zero-profit condition for a firm from i is as follows, with a corresponding condition for a firm from j.

$$p_i X_{ii} + p_j X_{ij} - c(X_{ii} + X_{ij}) - F = 0 \quad \text{zero profits}. \tag{20}$$

The result that gives the Cournot markup of a firm is fairly well known and I will not re-derive it here: the markup in j (defined on price p_j) is given by the firm's market share divided by the price elasticity of demand. With zero trade costs and equal marginal costs, each firm in selling in a market has the same market share as any other firm regardless of home country. So the market share is always just $1/n$ and the markup is $1/(n \varepsilon_j)$.

$$mr_{jj} = mr_{ij} = p_j\left[1 - \frac{1}{n\varepsilon_j}\right] = c \text{ or } p_j = \left[\frac{n\varepsilon_j}{n\varepsilon_j - 1}\right]c \quad \text{or Cournot pricing}. \tag{21}$$

Market clearing in country j is given from earlier results, similarly for i.

$$p_j nX_{ij} + p_j nX_{jj} = \beta(M_j - M_j^0) \qquad M_j^0 \equiv \frac{(1-\beta)}{\beta}p_j zL_j \quad \text{market clears}. \tag{22}$$

The elasticity of demand ε is given from Eq. (8) above. Also use Eq. (21) to replace p in m^0.

$$\varepsilon_j = \frac{m_j}{m_j - m_j^0} \qquad m_j^0 = p_j\frac{1-\beta}{\beta}z = \frac{n\varepsilon_j}{n\varepsilon_j - 1}\frac{1-\beta}{\beta}zc. \tag{23}$$

Using the second equation of Eq. (23), the first becomes

$$\varepsilon_j = \frac{m_j}{m_j - \frac{n\varepsilon_j}{n\varepsilon_j - 1}\frac{1-\beta}{\beta}zc} \tag{24}$$

which in turn reduces to

$$\left[\frac{n\varepsilon_j - 1}{n\varepsilon_j}\right]\left[\frac{\varepsilon_j - 1}{\varepsilon_j}\right] = \frac{1-\beta}{\beta}\frac{zc}{m_j} \quad \varepsilon_j \text{ is decreasing in } m_j, n \text{ constant}. \tag{25}$$

Recall that the number of firms n is common between i and j. We then get a "cross-section" result from Eq. (25): comparing two countries, the higher per-capita income country will have a lower price elasticity, higher markup and higher price level.

This result raises an awkward question however: will a secular rise in productivity lead to a secular rise in markups? We can answer this question by allowing for free entry and exit in the model. Add the zero-profit conditions for the representative firms in i and j in Eq. (20) together. There are four Cournot pricing Eq. (21) for the two market supplies for the representative firm from each country. Multiply both sides of the four pricing Eq. (21) by the relevant outputs and set to zero (move c terms to the left-hand side). Add these four together and subtract them from the sum of the two zero profit Eq. (20). This will yield the condition that markup revenues equal fixed costs:

$$\frac{p_j(X_{jj} + X_{ij})}{n\varepsilon_j} + \frac{p_i(X_{ii} + X_{ji})}{n\varepsilon_i} = 2F(\text{markup revenues equal fixed costs}). \tag{26}$$

Use the market-clearing equations in Eq. (22) to substitute for the revenue terms in Eq. (26).

$$\frac{\beta(M_j - M_j^0)}{n^2\varepsilon_j} + \frac{\beta(M_i - M_i^0)}{n^2\varepsilon_i} = 2F \tag{27}$$

and replace ε_i and ε_j with Eq. (23) ($m_i/(m_i - m_i^0) = M_i/(M_i - M_i^0)$). Eq. (27) becomes

$$\frac{\beta(M_j - M_j^0)^2}{n^2 M_j} + \frac{\beta(M_i - M_i^0)^2}{n^2 M_i} = 2F. \tag{28}$$

Solving for n, we have

$$n = \left[\left(\frac{(M_j - M_j^0)^2}{M_j} + \frac{(M_i - M_i^0)^2}{M_i}\right)\left(\frac{\beta}{2F}\right)\right]^{\frac{1}{2}} \quad \text{and} \tag{29}$$

$$n\varepsilon_j = \left[\left(\frac{(M_j - M_j^0)^2}{M_j} + \frac{(M_i - M_i^0)^2}{M_i}\right)\left(\frac{\beta}{2F}\right)\right]^{\frac{1}{2}}\left[\frac{M_j}{M_j - M_j^0}\right]. \tag{30}$$

Consider two identical countries with equal aggregate incomes $M = M_i = M_j$

$$n\varepsilon = \left[\left(2\frac{(M - M^0)^2}{M}\right)\left(\frac{\beta}{2F}\right)\right]^{\frac{1}{2}} + \left[\frac{M}{M - M^0}\right]$$
$$= \left(\frac{\beta}{F}\right)^{\frac{1}{2}}\left[\frac{M - M^0}{M^{1/2}}\right]\left[\frac{M}{M - M^0}\right] = \left(\frac{\beta M}{F}\right)^{\frac{1}{2}} \tag{31}$$

which (when inverted) gives a simple formula for the common markup.

$$\frac{1}{n\varepsilon} = \left[\frac{F}{\beta M}\right]^{\frac{1}{2}} = \text{common markup for identical countries}. \tag{32}$$

The markup falls with a growth in *aggregate* income due to the pro-competitive effects of entry (Venables, 1985; Markusen and Venables, 1988). But the interesting thing about Eq. (32) is that non-homotheticity washes out. Holding aggregate income constant, increase *per-capita* income (increase productivity offset by fewer households). This lowers the price elasticity of demand but this is exactly offset in this special case by more entry. Recognizing that this

last result is derived for identical economies only, we can thus suggest that non-homotheticity does not have a "time-series" effect on markups as per-capita income grows over time, but does show up in the "cross-section" comparison between countries with different per-capita incomes.

Results for this section are illustrated in Figs. 6 and 7. The "cross-section" result is shown in Fig. 6. The two-countries are identical at a value of 0.5 on the horizontal axis. Then productivity increases in h and falls in f holding aggregate incomes constant and equal (household numbers move inversely with productivity). With the price of Y equalized between countries, this means that the price index is greater in country h as shown in Fig. 6. The results on prices and markups are consistent with those in Wong (2003), Hummels and Lugovskyy (2009), and Simonovska (2010). Qualitatively, the same result occurs if we maintain equal productivities equal but transfer K from f to h and L from h to f.

A volume-of-trade result is shown in Fig. 7 where the two countries are identical. Productivity is rising along the horizontal axis and absolute endowments are lowered to maintain identical and constant aggregate incomes. The higher per-capita incomes moving to the right lead to a shift in consumption to X and to an increase in intra-industry trade, inter-industry trade being zero. Thus trade volume increases relative to aggregate income. The same result will of course hold under monopolistic competition (Markusen, 1986; Bergstrand, 1990; Fieler, 2011). A consequence is that gravity equations should predict more trade between two high-income countries, aggregate income held constant.

Now consider an extension of this model to include horizontal multinational firms. Trade costs are added to the model outlined above, and firms can invest in a foreign plant for an added fixed cost G less that the initial fixed cost F. Parameter $\tau > 1$ will denote gross trade costs. First, I do a single-factor example consistent with this section so far, and then I'll show a general-equilibrium simulation. We can let marginal cost c be identical and constant across countries as we did above.

Consider first a domestic firm located in country i, which exports to country j. The double subscript on a variable, such as X_{ij} indicated that the firm is producing in country i and selling in country j. Previous results for demand and in Eq. (21) imply that we can write the firm's optimization condition for domestic and exports sales, and demand as:

$$p_i\left(1-\frac{X_{ii}}{X_i}\frac{1}{\varepsilon_i}\right)=c \quad p_j\left(1-\frac{X_{ij}}{X_j}\frac{1}{\varepsilon_j}\right)=c\tau \quad X_i=\frac{\beta\left(M_i-M_i^0\right)}{p_i} \tag{33}$$
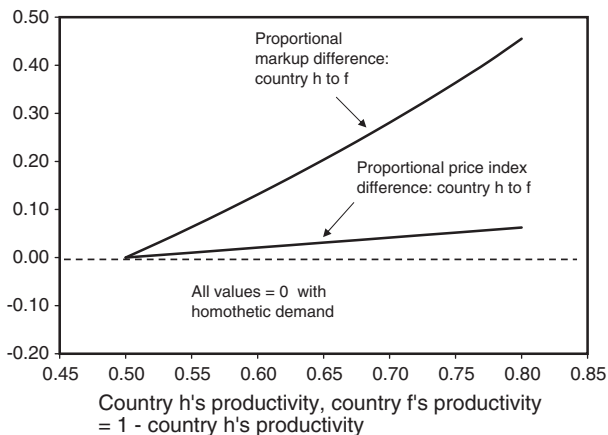

Fig. 6. Markups and price level: productivity differences (aggregate income held constant).
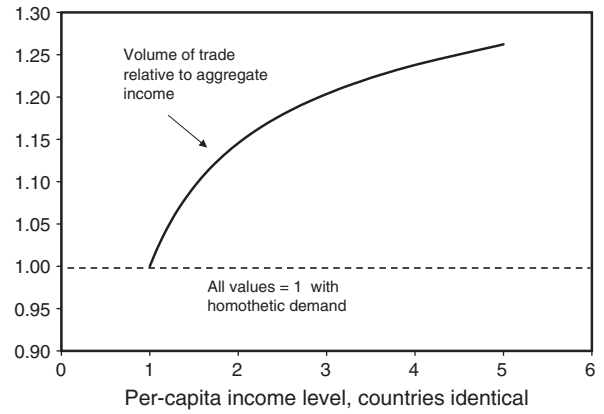
where the first equations can be written as

$$X_{ii}=\frac{(p_i-c)\varepsilon_i}{p_i}X_i \quad X_{ij}=\frac{\left(p_j-c\tau\right)\varepsilon_j}{p_j}X_j. \tag{34}$$

Use the last equation of Eq. (33) to substitute for total demand in i and j in Eq. (34)

$$X_{ii}=\beta\left(M_i-M_i^0\right)\frac{(p_i-c)\varepsilon_i}{p_i^2} \quad X_{ij}=\beta\left(M_j-M_j^0\right)\frac{\left(p_j-c\tau\right)\varepsilon_j}{p_j^2}. \tag{35}$$

Let the markups of firm i selling in i and j be denoted by η_{ii} and η_{ij}. Markup revenues per unit are: $p_i\eta_{ii}=(p_i-c)$, $p_j\eta_{ij}=(p_j-c\tau)$. Using this together with Eq. (35), allows us to write total markup revenue on domestic and export sales as:

$$p_i\eta_{ii}X_{ii}=\beta\left(M_i-M_i^0\right)\left[\frac{p_i-c}{p_i}\right]^2\varepsilon_i \quad p_j\eta_{ij}X_{ij}$$
$$=\beta\left(M_j-M_j^0\right)\left[\frac{p_j-c\tau}{p_j}\right]^2\varepsilon_j. \tag{36}$$

Our earlier result on the price elasticity of demand in Eq. (8) allows this to be simplified to

$$p_i\eta_{ii}X_{ii}=\beta M_i\left[\frac{p_i-c}{p_i}\right]^2 \quad p_j\eta_{ij}X_{ij}=\beta M_j\left[\frac{p_j-c\tau}{p_j}\right]^2 \quad \text{since } \varepsilon_i=\frac{M_i}{M_i-M_i^0}. \tag{37}$$

As noted earlier, profits in this type of free-entry and exit model allow us to write profits as markup revenues minus fixed costs. Let Π denote profits and Π_i^d denote the profits of a domestic firm located in market i. Let s_{ii}^d, s_{ij}^d be the market shares of a firm located in i in markets i and j. With the Cournot markup formula given by the ratio of market share to the price elasticity of demand, profits of a domestic firm from i are given by:

$$\Pi_i^d=\beta M_i\left[\frac{p_i-c}{p_i}\right]^2+\beta M_j\left[\frac{p_j-c\tau}{p_j}\right]^2-F$$
$$=\beta M_i\left[\frac{s_{ii}^d}{\varepsilon_i}\right]^2+\beta M_j\left[\frac{s_{ij}^d}{\varepsilon_j}\right]^2-F. \tag{38}$$

Similarly, let s_i^m, s_j^m denote the market shares of a multinational firm in markets i and j (a multinational is not identified with a specific market in this simple model). We can replace the price elasticity in

Fig. 7. Volume of trade related to per-capita income (aggregate income held constant).

Eq. (38) with: $\varepsilon_i = M_i/(M_i - M_i^0)$ and express the profits of all three firm types as.

$$\Pi_h^d = \beta \frac{\left[s_{hh}^d\left(M_h - M_h^0\right)\right]^2}{M_h} + \beta \frac{\left[s_{hf}^d\left(M_f - M_f^0\right)\right]^2}{M_f} - F \quad \text{domestic firm in } h$$
(39)

$$\Pi_f^d = \beta \frac{\left[s_{fh}^d\left(M_h - M_h^0\right)\right]^2}{M_h} + \beta \frac{\left[s_{ff}^d\left(M_f - M_f^0\right)\right]^2}{M_f} - F \quad \text{domestic firm in } f$$
(40)

$$\Pi^m = \beta \frac{\left[s_h^m\left(M_h - M_h^0\right)\right]^2}{M_h} + \beta \frac{\left[s_f^m\left(M_f - M_f^0\right)\right]^2}{M_f} - F - G \quad \text{multinational}$$
(41)

where the market share of a multinational firm in market i will be the same as the market share of domestic firm from i selling i because they have the same marginal cost and no trade cost.

Now assume that the countries are initially identical, so that

$$s_{ii}^d = s_{jj}^d = s_i^m = s_j^m > s_{ij}^d = s_{ji}^d, \quad \varepsilon_i = \varepsilon_j, \quad M_i = M_j.$$
(42)

Pick parameters such that Eqs. (39) to (41) all equal zero, so that all three firm types can just break even. Essentially, the trade cost which reduces revenues for the domestic firms is just offset by the higher fixed cost of the multinational firms.

Now make the technology in h a little more productive, lowering the number of households (or total factor endowment) to hold total income M_h constant, and do the opposite in country f: $dM_h^0 = -dM_f^0 < 0$, $dM_h = dM_f = 0$. Consider the impact of this, holding the outputs and market shares in each market of each firm type constant. A multinational's profits are unaffected. The profits of a domestic firm located in h go up while those of a domestic firm located in f go down. This is due to the market-share weights in Eqs. (39)–(41): the domestic firm in h benefits from added markup revenues in its high-sales domestic market and loses less in its low-sales foreign market. The opposite is true for firm f. Thus we have

$$\Pi_h^d > \Pi^m = 0 > \Pi_f^d.$$
(43)

This compensated experiment, holding total incomes constant and equal across countries would have no effect with homothetic demand. But here it does: it redistributes demand toward the higher per-capita-income country. This gives an advantage to domestic firms located in that country. More generally, and with all general-equilibrium changes accounted for, we expect that multinationals will be more important between countries which are more similar in per-capita incomes. The range of difference in per-capita incomes that will support multinationals will be smaller with non-homothetic preferences.

Fig. 8 shows the results of a general-equilibrium simulation of this model with two-factor economies as in my earlier Heckscher–Ohlin Section 2, making the model similar to that of Markusen and Venables (1998). Both the fixed costs and marginal costs of X production are capital intensive. In the simulation, the fixed costs of a two-plant horizontal multinational are 1.4 times that of a single-plant national firm and trade cost are 15%. The exercise shown in Fig. 8 is similar to that in Fig. 4, in that the countries relative endowments are distributed relative to the center of the horizontal axis of Fig. 8 where the countries are identical (the horizontal axis is the NW–SE diagonal of the world Edgeworth box). The per-capita income of country h is higher to the left and that of country f is higher to the right. The vertical axis gives the share of multinational firms as a share of all firms active in equilibrium.
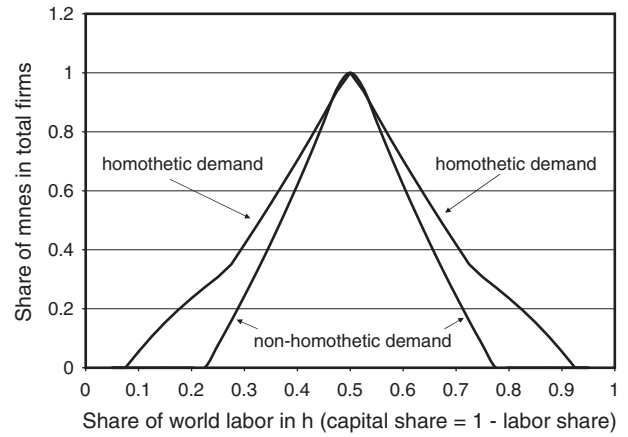

Fig. 8. Share of multinationals in total firm numbers.

As shown in Markusen and Venables (1998) multinationals arise when the countries are relatively similar. When their relative endowments differ significantly, production costs will lead production to be concentrated in national (single plant) firms located in the capital abundant country. The simulation produces the curve labeled "homothetic demand" in Fig. 8.

Now make preferences non-homothetic, with a high income-elasticity of demand for the capital-intensive X good as before. Demand will be concentrated in the capital-abundant country, which reinforces the production cost advantage of single-plant national firms located in the capital abundant country. Except where the countries are nearly identical in Fig. 8, the share of horizontal multinationals will be less in case of non-homothetic demand for any difference in per-capita (relative endowment) differences. Non-homotheticity concentrates horizontal multinational firms even more among countries with similar per-capita incomes. Comments on how this should guide and inform empirical work are postponed until the next section.

5. Brief comments on the relation to empirical results

A short literature review was provided in the introduction to the paper, but it think it is worthwhile recapping the theoretical findings in this paper in relation to empirical literature. The first point to address is that many of the results here relate to the correlation between a good's income elasticity of demand and its skill or capital intensity in production. If this does not hold empirically, this is not much of a paper. Early empirical evidence that non-homotheticity acts to reduce trade is found in Hunter (1991), but she has no production side in her analysis.

More recently, a much more complete analysis using much better data is given in Caron et al. (2013) and we find very strong support for this key relationship. Correlations between skill intensity and income elasticity are in the order of 0.30 to 0.50. We find, by counter-factual general-equilibrium simulation of the structural model, that an equal rise in productivity in all sectors and all countries leads to an increase in the skill premium in all countries. To the best of my knowledge, the point that this correlation gives us an alternative explanation for a rising skill premium in all countries, not just high-income countries, as incomes grow has not been advanced before.

With respect to the issue of missing trade, there is a long history of fitting Heckscher–Ohlin theory (Leamer, 1980; Maskus, 1985; Bowen et al., 1987; Staiger (1988), Harrigan (1997), Davis and Weinstein, 2001; Hakura, 2001; Trefler, 1995). Much of the effort has gone into improving the production side of the model by including technical differences, trade costs, non-factor-price equalization and so forth. Good progress has been made, but I am arguing here that the demand side

of general equilibrium also deserves a look. In Caron et al. (2013), our estimations imply that we can explain about one-third of missing trade.

In addition to the general issue of missing trade, there is the issue of who trade with whom and, in particular, findings that high income countries trade a lot with one another. I have not dealt with that a lot here, except in the section on imperfect competition, since dealing thoroughly with two countries has proved enough for one paper. The findings of Bergstrand (1990), Cassing and Nishioka (2010), and Fieler (2011) give good support to the role of demand and new evidence is also found in Caron et al. (2013), though product differentiation is crucial to the results in these papers. Gravity equation estimation in papers such as Frankel et al. (1998), Bernasconi (2010) and Martinez-Zarzoso and Vollmer (2010) consistently find that higher per-capita-income countries trade more with one another, total incomes held constant, though these papers generally lack general-equilibrium foundations which integrate production and demand. Analyses of product quality lead to a related result about trade volume: high-income countries product high-quality products which they trade with other high-income countries.

Results in the section introducing imperfect competition are supported in Wong (2003), Coibion et al. (2007), Hummels and Lugovskyy (2009) and Simonovska (2010) which is that markups and hence the price level will be higher in the high per-capita-income country. While Bergstrand (1990) and Francois and Kaplan (1996) do not have endogenous markups, they find that intra-industry trade volume does rise with per-capita income. Manova and Zhang (2012) find that firms set higher prices in richer export markets, though their explanation focuses on product quality as do those of several papers just mentioned.

Papers adopting gravity-type equations to estimate multinational activity, whether by investment stock or by affiliate sales, consistently tend to find that GDP per-capita increases multinational activity holding total GDP constant for the parent and host. However, this is difficult to relate to my results here insofar as GDP per capita may be tracking factor endowments such as skilled labor or productivity factors, and thus have a positive effect on FDI though a production channel. I do not know of any studies that have results that directly relate to the hypothesis I have here. Carr et al. (2001) show multinational activity falls as countries' GDPs diverge holding their combined GDP constant, but they do not consider differences in GDP per capita.

Davies et al. (2008), Lawless (2009), Eicher et al. (2011), and Blonigen and Piger (2012) perhaps come closer, in that they have GDP per-capita variables as well as other factors such a skill and education measures. though only Blonigen and Piger have a GDP per-capita-difference variable. I interpret Davies et. al.'s, Eicher et. al.'s and Blonigen and Piger's results to suggest that an increase in the GDP per-capita difference between parent and host countries has a negligible effect on FDI, holding each of their total incomes constant. I interpret Lawless (2009) as finding that an increase in the per-capita income difference does indeed reduce FDI which is consistent with my prediction here though, again, she does not consider this explicitly. More research is needed in this area.

6. Summary

While there has been some analysis of the role of per-capita income in determining trade volumes and trading partners, there does not seem to exist a systematic theoretical model that integrates the demand and supply sides of general equilibrium. I offer a "generic" model that I hope might prove useful for graduate teaching, a sort of all-in-one model that offers new, testable results, and also nests several earlier contributions.

The model imposes a variant of Stone-Geary preferences on top of a traditional $2 \times 2 \times 2$ Heckscher–Ohlin model. Maintained hypotheses are that labor endowments in the HO model are proportional to the number of households and that the skill/capital-intensive good in the HO model is the high income-elasticity-of-demand good. The latter assumption is testable and falsifiable. Results from the model offer a strictly demand-side explanation for a range of phenomena including (a) home bias in consumption, (b) the mystery of the missing trade, (c) a growing skill premium in an environment of growing productivity, (d) trade/gdg ratios in a growing world, and (d) a role for the intra-country distribution of income similar to that found in the product-quality literature (higher inequality — more demand for luxury goods).

I then assume increasing returns to scale in high-income-elasticity industry with free entry and exit of firms, Cournot pricing and segmented markets: a common framework in the so-called new trade theory and strategic trade-policy literatures. This generates some interesting and testable results that do not rely on the skill-intensity, income-elasticity correlation. In particular, there are higher markups and higher price levels in higher per-capita-income countries, and more trade between higher per-capita-income countries, aggregate income held constant. Horizontal multinational activity should be higher between countries with similar, high incomes, total incomes constant. As in the case of the competitive examples, some of the implications have already received good empirical support, but structural analyses integrating production and consumption are generally lacking.

In both competitive and imperfect-competition cases, the effects of growth are quite different depending on whether it is growth in productivity or in neutral factor accumulation. This is potentially quite important in forecasting forward using econometric or CGE models: who would have predicted ten years ago that China would now be the world's largest car market.

Finally, new econometric results on the crucial (to some theoretical results) relationship between a good's skill and capital-intensity in production and its income elasticity of demand in consumption were noted. The estimates indicate a positive and economically and statistically significant relationship (a causal relationship is neither assumed nor implied at this point). Those results affirm the empirical relevance of the present model, which offers much needed insights into most of the issues such as skill premiums, missing trade and cross-country differences in markups.

References

Bergstrand, Jeffrey H., 1990. The Heckscher–Ohlin Samuelson model, the Linder hypothesis and the determinants of bilateral intra-industry trade. The Economic Journal 100, 1216–1229.
Bernasconi, Claudia, 2010. New evidence for the Linder hypothesis and the two extensive margins of trade. Working Paper. University of Zurich.
Blonigen, Bruce A., Piger, Jeremy, 2012. Determinants of foreign direct investment. working paper.
Bowen, Harry P., Leamer, Edward E., Sveikauskas, Leo, 1987. Multicountry, multifactor tests of the factor abundance theory. American Economic Review 77, 791–809.
Caron, Justin, Fally, Thibault, Markusen, James R., 2013. Skill Premium and Trade Puzzles: A Solution Linking Production and Preferences.
Carr, David, Markusen, James R., Maskus, Keith E., 2001. Estimating the knowledge-capital model of the multinational enterprise. American Economic Review 91, 693–708.
Cassing, James, Nishioka, Shuichiro, 2010. Per capita income and the mystery of missing trade. working paper.
Chenery, Hollis, Syrquin, Moshe, 1975. Patterns of Development 1950–70. Oxford University Press.
Coibion, Olivier, Einav, Liran, Hallak, Juan-Carlos, 2007. Equilibrium demand elasticities across quality. International Journal of Industrial Organization 25, 13–30.
Davies, Ronald B., Ionascu, Delia, Kristjánsdóttir, Helga, 2008. Estimating the impact of time-invariant variables on FDI with fixed effects. Review of World Economics 144, 381–407.
Davis, Donald R., Weinstein, David E., 2001. An account of global factor trade. American Economic Review 91, 1423–1453.
Deaton, Angus, Muellbauer, John, 1980. Economics and Consumer Behavior. Cambridge University Press, Cambridge.
Eaton, Jonathan, Kortum, Samuel, 2002. Technology, geography, and trade. Econometrica 70, 1741–1779.
Eicher, Theo, Helfman, Lindy, Lenkoski, Alex, 2011. Robust FDI determinants: Bayesian model averaging in the presence of selection bias. working paper.
Fieler, Ana Cecília, 2011. Non-homotheticity and bilateral trade: evidence and a quantitative explanation. Econometrica 79, 1069–1101.

Francois, Joseph F., Kaplan, S., 1996. Aggregate demand shifts, income distribution, and the Linder hypothesis. The Review of Economics and Statistics 78, 244–250.

Frankel, Jeffrey, Stein, Ernesto, Wei, Shang-Jin, 1998. Continental trading blocs: are they natural or super-natural? In: Frankel, Jeffrey (Ed.), The Regionalization of the World Economy. University of Chicago Press, Chicago, pp. 91–113.

Hakura, Dalia S., 2001. Why does HOV fail? The role of technological differences within the EC. Journal of International Economics 54, 361–382.

Hallak, Juan-Carlos, 2010. A Product Quality View of the Linder Hypothesis. Review of Economics and Statistics 92, 453–466.

Harrigan, James, 1997. Technology, factor supplies, and international specialization: estimating the neoclassical model. American Economic Review 87, 475–494.

Hummels, David, Lugovskyy, Volodymyr, 2009. International pricing in a generalized model of ideal varieties. Journal of Money, Credit, and Banking 41, 3–33.

Hunter, Linda, 1991. The contribution of non-homothetic preferences to trade. Journal of International Economics 30, 345–358.

Hunter, Linda, Markusen, James R., 1988. Per-capita income as a determinant of trade. In: Feenstra, Robert (Ed.), Empirical Methods for International Economics. MIT Press, Cambridge, pp. 89–109.

Kuznets, Simon, 1966. Modern Economic Growth: Rate, Structure and Spread. Yale University Press.

Lawless, Martina, 2009. Tax complexity and inward investment. Research Technical Paper 5/RT/09. Central Bank and Financial Services Authority of Ireland.

Leamer, Edward E., 1980. The Leontief paradox reconsidered. Journal of Political Economy 88, 495–503.

Linder, Staffan B., 1961. An Essay on Trade and Transformation. Almqvist & Wiksell, Stockholm.

Manova, Kalina, Zhang, Zhiwei, 2012. Export prices across firms and destinations. Quarterly Journal of Economics 127, 379–436.

Markusen, James R., 1986. Explaining the volume of trade: an eclectic approach. American Economic Review 76, 1002–1011.

Markusen, James R., Venables, Anthony, 1988. Trade policy with increasing returns and imperfect competition: contradictory results from competing assumptions. Journal of International Economics 24, 299–316.

Markusen, James R., Venables, Anthony J., 1998. Multinational firms and the new trade theory. Journal of International Economics 46, 183–204.

Markusen, James R., Wigle, Randall, 1990. Explaining the volume of North–south trade. The Economic Journal 100, 1206–1215.

Martinez-Zarzoso, Inmaculada, Vollmer, Sebastian, 2010. Bilateral trade flows and income-distribution similarity. working paper.

Maskus, Keith E., 1985. A test of the Heckscher–Ohlin–Vanek theorem: the Leontief commonplace. Journal of International Economics 19, 201–212.

Matsuyama, Kiminori, 2000. A Ricardian model with a continuum of goods under non-homothetic preferences: demand complementarities, income distribution, and North–south trade. Journal of Political Economy 108, 1093–2000.

Prebisch, Raul, 1950. The Economic Development of Latin American and its Principal Problem. United Nations, New York.

Reimer, Jeffery J., Hertel, Thomas W., 2010. Nonhomothetic preferences and international trade. Review of International Economics 18, 408–425.

Simonovska, Ina, 2010. Income differences and prices of tradeables. Working Paper.

Singer, Hans, 1950. The distribution of gains between investing and borrowing countries. American Economic Review 40.

Staiger, Robert W., 1988. A specification test of the Heckscher–Ohlin theory. Journal of International Economics 25, 129–141.

Trefler, Daniel, 1995. The case of missing trade and other mysteries. American Economic Review 85, 1029–1046.

Venables, Anthony J., 1985. Trade and trade-policy with imperfect competition — the case of identical products and free entry. Journal of International Economics 19, 1–19.

Wong, Eina, 2003. Pharmaceutical Drug Prices in the International Market. unpublished PhD thesis University of Colorado, Boulder.