The Home Market Effect in Models with Multinational Enterprises

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Abstract

Trade patterns in New Trade Theory models and agglomeration patterns in New Economic Geography models crucially depend on the effect that a higher local demand for products leads to a larger share of production of these products, namely the home market effect. Multinationals could exploit higher foreign demand without incurring transport costs by setting up a plant abroad, which destroys the driving force of the home market effect. This paper demonstrates that in the presence of multinationals the home market effect reappears via a different channel, relying on the repatriation of profits rather than on interindustry trade.

Key words: Home market effect; Multinationals; Transport costs

JEL classification: F12; F23

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1 Introduction[1]

The home market effect (HME) suggests that in a world with transportation costs and increasing returns to scale, a country has a proportionally larger share of production in those products for which it has a higher local demand. This effect was mostly shown in models with two sectors, one homogeneous goods sector and one differentiated goods sector with increasing returns to scale, where only the latter incurs transport costs (see for example Fujita et al., 1999; Helpman and Krugman, 1985; Krugman, 1980; Neary, 2001). In these models, the HME determines the pattern of trade: the location with the larger home market exports the differentiated good. Krugman (1980) shows in a model with two differentiated sectors that the country with the larger number of consumers of an industry's good will run a trade surplus in that industry.[2]

As argued by Head et al. (2002), the HME is important for three reasons. First, it is used to discriminate empirically models of increasing returns against alternative models based on constant or decreasing returns (see for example Chung, 2002; Davis and Weinstein, 1999, 2003; Hanson and Xiang, 2002; Trionfetti, 1999, 2001; Weder, 2003). Second, imposing balanced trade, the home market effect leads to lower factor prices in the smaller country (see for example Krugman, 1980; Weder, 1995). Third, as pointed out by Fujita et al. (1999), the HME is a building block for the theory of new economic geography.

Helpman and Krugman (1985) state that the HME is quite pervasive, even though they have only worked with very specific examples. Given the importance of the HME, the pervasiveness was tested in various directions. Head et al. (2002) infer the robustness in a number of models and conclude that the HME does not require product differentiation[3], is robust to relaxing the assumption that

[1]I am grateful to Peter Egger, Stefan Gruber, Michael Pfaffermayr and participants at a research seminar in Innsbruck 2003 for helpful comments, and Daniela Leitgeb for help in revising the language of the paper.

[2]Weder (1995) extended the model from Krugman (1980) and shows that a country is a net exporter of that group of goods where it has a comparative home-market advantage, whereas absolute differences in domestic demand are reflected in the relative wage rate.

[3]The same result was obtained by Brander (1981) in a model with homogeneous goods in both sectors and Cournot competition.

transport costs take the iceberg form, and does not depend on the Dixit-Stiglitz model's lack of price responsiveness to the proximity of competitors. However, they also find that Armington (1969) type assumptions or varieties linked to nations instead to firms can reverse the HME even in models with firm mobility (see for similar results the models of Markusen and Venables, 1988 or Head and Ries, 2001).[4]

Yu (2000) argues that the assumption of constant income shares between sectors is too restrictive. He endogenizes the income share by introducing a constant elasticity of substitution function as upper tier in the utility function. In this case, a HME appears if the elasticity of substitution between sectors is greater than one, and is reversed if it is smaller than one.

One widely discussed case where the HME disappears is illustrated by Davis (1998). He abandons the assumption of zero transport costs in the homogeneous sector, which was expected to be harmless, and proofs that with equal transport costs in both sectors the homogeneous good will not be traded and therefore production of the differentiated goods sector is in proportion to country size. Thus, the HME does not generalize in this respect, and the statement of Helpman and Krugman (1985) on the pervasiveness has to be relaxed. Krugman and Venables (1999) replied to Davis (1998) with a model of constant returns to scale products which are differentiated. Using this setup, the HME reappears even if transport costs are symmetric for both types of goods.

Though the HME has been investigated in a lot of different models from the mid 1980's up to now, one important type of extension is missing so far: the analysis in models with multinational enterprises (MNEs). The growing importance of foreign direct investment (FDI) in the last decades is well known, and therefore this appears to be an important extension. Markusen (2002) is an exception. He defines a HME depending on the size of markups in a knowledge-capital model with oligopolistically competing firms . In this framework, the small and/or skilled-labor-scarce country will have a higher markup and, if relative factor prices

[4]A reversed HME is also able to occur in a model with Cournot competition and homogeneous goods only, as was shown by Feenstra et al. (2001).

are equalized between countries, this will lead to lower real wages for the smaller country. This effect is labelled HME by Markusen.

However, the literature investigating the HME mainly uses the assumption of large group monopolistic market structure, where this channel is not at work since markups are constant. We also stick to this form of market competition and introduce horizontal MNEs, that is firms with one headquarter and plants in both countries. To be as close as possible to the empirical facts, we want that trade and FDI coexist in all our experiments and therefore introduce besides capital and unskilled labor a third factor, namely skilled labor.[5] This suits especially for OECD countries which are relatively equal with respect to relative factor endowments, but differ considerably in absolute size.

Summing up the main results, our framework leads to a HME even if trade costs in both sectors and the countries' relative endowments are equal. In these cases the homogeneous good is not traded, hence our results suggest a different source of the HME, relying on the repatriation of profits rather than on interindustry trade. Furthermore, factor intensity assumptions in the differentiated goods sector production turn out to be crucial. In contrast to previous findings, the HME stemming from the repatriation-of-profits channel depends positively on the share spent in the differentiated goods sector and negatively on the elasticity of substitution. Furthermore, we demonstrate that a reversed HME is possible within this framework.

2 The Model

2.1 Households

We model consumer preferences as a nest of homogeneous Z-goods and differentiated X-goods, assuming Dixit-Stiglitz preferences (Dixit and Stiglitz, 1977) for

[5] With only two factors of production, the model would be more sensitive concerning the firm-regime. Therefore, a specialization of the smaller country in homogeneous goods production and a specialization in differentiated goods production of the larger country would occur. By introducing a third factor, the presence of this specialization pattern is (nearly) ruled out.

the inner nest of X-varieties:

$$W_i = \left[(n_i + m_i + m_j) x_{ii}^{\frac{\sigma-1}{\sigma}} + n_j \left(\frac{x_{ji}}{1+t_x} \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma\alpha}{\sigma-1}} (Z_{ii} + Z_{ji})^{1-\alpha}, \tag{1}$$

where W_i is country i's welfare level ($i = 1, 2$), α denotes the Cobb-Douglas expenditure share for differentiated products, $\sigma > 1$ is the elasticity of substitution between varieties and t_x are iceberg transport costs in the X-sector. $n_i(n_j)$ is the number of national firms in $i(j)$, $m_i(m_j)$ are multinationals with headquarter in $i(j)$. Quantities are indexed twice, with the first subscript indicating the good's country of origin, and the second one referring to the country where the good is consumed.

Utility maximization leads to the following demand equations for X-varieties:

$$x_{ii} \geq p_i^{-\sigma} s_i^{\sigma-1} \alpha E_i \quad \perp \quad p_i \geq 0, \tag{2}$$

$$x_{ij} = p_i^{-\sigma} (1+t_x)^{1-\sigma} s_j^{\sigma-1} \alpha E_j, \tag{3}$$

$$Z_{ii} + Z_{ji} \geq \frac{1-\alpha}{q_i} E_i \quad \perp \quad q_i \geq 0, \tag{4}$$

where $\perp$ indicates that at least one of the adjacent conditions has to hold with equality. p denotes the price of X-varieties, and q that of Z-goods. Noteworthy, prices are only indexed once, since all (indigenous and foreign) homogeneous goods consumed at one location must face the same price. Therefore, q_i is the price of homogeneous goods *consumed* in i. Further, p_i is the price of differentiated goods *produced* in i. Accordingly, the price of X-goods originating from i and exported to j amounts to $p_i(1+t_x)$. All varieties *produced* and *consumed* at the same location sell at the same price because of equal marginal costs. $E_i(E_j)$ is GDP in country $i(j)$, and s_i is the price index in country i which reads:

$$s_i = \left[(n_i + m_i + m_j) p_i^{1-\sigma} + n_j ((1+t_x) p_j)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \tag{5}$$

2.2 Factor Markets and Production

In order to ensure that in (nearly) all of our experiments MNEs and NEs coexist in both countries and the homogeneous good is not traded, we introduce three

factors of production[6], i.e., unskilled labor (L), capital (K), and skilled labor (S).[7] Furthermore it is feasible in this model to disentangle physical capital flows (FDI) and investment of human capital (skilled labor) in firm-specific-assets. The most capital-intensive activity is setting up plants abroad, followed from setting up plants at home. Firm specific fixed costs are assumed to be very skilled labor intensive.

We assume that the homogeneous sector only needs unskilled labor, and take the price of the perfectly competitive good in country 1 as the numéraire (q_1=1), so that the wage in country 1 (w_1) is also equal to one. Variable unit costs (i.e., marginal costs) c_{zi} satisfy

$$c_{zi} \geq w_{Li} \quad \perp \quad Z_{ii} \geq 0, \tag{6}$$

This implies

$$c_{zi}(1+t_z) \geq q_j \quad \perp \quad Z_{ij} \geq 0, \tag{7}$$

where t_z denotes transport costs in the Z-sector.

The fixed markup over marginal costs in the differentiated sector is given by:

$$p_i = \left(\frac{\sigma-1}{\sigma}\right)\left(a_{Lx}w_{Li} + a_{Kx}w_{Ki} + a_{Sx}w_{Si}\right), \tag{8}$$

where a_{Lx} is the fixed unit unskilled labor input coefficient in X-production, similarly a_{Kx} denotes the unit capital input coefficient, and a_{Sx} is the unit input coefficient of skilled labor.[8] $w_{Ki}(w_{Si})$ is the factor price of capital (skilled labor).

We assume that for setting up a plant and running a NE, one unit of capital as well as one unit of skilled labor is required. Assuming free entry and exit of firms, profits are zero and therefore fixed costs have to equal markups (Chamberlinian tangency solution). This condition determines the number of NEs:

$$w_{Si} + w_{Ki} \geq \frac{p_i x_{ii} + p_i x_{ij}}{\sigma} \quad \perp \quad n_i \geq 0. \tag{9}$$

[6]See Egger and Pfaffermayr (2003). The coexistence of national and multinational firms as well as the fact that the homogeneous good is not traded, helps us to demonstrate our point more clearly.

[7]$L = 100$, $K = 60$ and $S = 30$ if nothing else is mentioned.

[8]$a_{Lx} = 0.6$, $a_{Kx} = 0.3$, $a_{Sx} = 0.1$ if nothing else is mentioned.

MNEs require $1+\delta$ units of skilled labor[9] and $2+\gamma$ units of capital[10] to set up a plant at home and abroad and run the multinational network. Thus, the following condition has to hold:

$$(1+\delta)w_{Si} + (2+\gamma)w_{Ki} \geq \frac{p_i x_{ii} + p_j x_{jj}}{\sigma} \quad \perp \quad m_i \geq 0. \tag{10}$$

Factor market clearing implies:

$$\begin{aligned} K_i &\geq a_{Kx}\left(\left(n_i + m_i + m_j\right)x_{ii} + n_i x_{ij}\right) + n_i + (2+\gamma)m_i \\ &\perp \quad w_{Ki} \geq 0. \end{aligned} \tag{11}$$

$$\begin{aligned} L_i &\geq a_{Lx}\left(\left(n_i + m_i + m_j\right)x_{ii} + n_i x_{ij}\right) + Z_{ii} + Z_{ij}(1+t_z) \\ &\perp \quad w_{Li} \geq 0. \end{aligned} \tag{12}$$

$$\begin{aligned} S_i &\geq a_{Sx}\left(\left(n_i + m_i + m_j\right)x_{ii} + n_i x_{ij}\right) + n_i + (1+\delta)m_i \\ &\perp \quad w_{Si} \geq 0. \end{aligned} \tag{13}$$

2.3 Income and Balance of Payments

We assume that all factors are owned by households. The equivalence of total factor income and demand in each economy implicitly balances international payments (BOP), which is given by

$$BOP = n_i p_i x_{ij} + \left(\frac{1}{\sigma} p_j x_{jj} m_i\right) - n_j p_j x_{ji} - \left(\frac{1}{\sigma} p_i x_{ii} m_j\right) + Z_{ij} q_j - Z_{ji} q_i. \tag{14}$$

2.4 The Home Market Effect

The HME refers to the phenomenon, that the larger country will have a proportionately larger share of manufacturing. In our model, this can formally be stated as follows[11]:

$$HME = \frac{\frac{(n_i+m_i+m_j)x_{ii}+n_i x_{ij}}{(n_j+m_i+m_j)x_{jj}+n_j x_{ji}}}{\frac{\phi}{1-\phi}}, \tag{15}$$

[9] δ is set equal to 0.01 if nothing else is mentioned.

[10] γ is set equal to 0.2.

[11] See for example Krugman (1980), Helpman and Krugman (1985), Neary (2001), Fujita et al. (1999).

where ϕ measures the size of country i. In order to avoid relative changes of endowment, we vary all three factors of production by the same relative magnitude, i.e. we assume that the countries' relative endowment with each factor compared to each other is equal for all three factors.[12] Therefore ϕ is equal for all three factors, and we could as well write $\frac{L_i}{L_j}$, $\frac{K_i}{K_j}$ or $\frac{S_i}{S_j}$ instead of $\frac{\phi}{1-\phi}$.

Due to nonlinearities induced by transport costs, it is impossible to derive an analytical solution for the HME.[13] Therefore we will solve the model numerically for particular parameter values and assess the robustness with respect to the parameter choice.

3 The Home Market Effect with National Firms Only

So far, the HME is mostly analyzed in models with two sectors, one homogeneous, perfectly competitive sector, and a second sector with monopolistically competitive firms, which can export goods to the other country. Taking this model as a starting point, we analyze the reaction of the HME on changes of the share spent in the differentiated sector, and on changes of the elasticity of substitution.[14] In order to produce a HME, we have to assume different transport costs in the Z-sector and in the X-sector.[15]

Figure 1 shows the HME for different levels of α. It is obvious that the HME becomes larger the lower the share spent in the differentiated sector is. This can be explained by analyzing the driving forces of the HME. The larger country becomes more attractive for X-production, because of the importance of the proximity to market through transport costs and the possibility of concentration

[12] We assume that we are on the diagonal from the bottom left corner to the upper right corner in the Edgeworth-cube.

[13] If we assumed that, as in Z-production, X-production only requires unskilled labor, we could analytically solve for the number of firms (cf. Egger and Pfaffermayr, 2003). But even under this assumption it is not possible to analytically solve for the *quantities* produced.

[14] With the chosen factor endowments, skilled labor is very abundant if only national firms exist. This leads to a relative factor price of skilled labor near zero and therefore Figures 1 and 2 could have been produced with a two factor model where only capital is used to set up plants.

[15] It was shown by Davis (1998) that the HME disappears in this model when transport costs in both sectors are equal.

of production. In order to balance trade, the smaller country is forced to export Z-goods. If consumers spend only a small fraction of their income on homogeneous goods (α is high), then concentration of X-production is limited by the balance of trade condition, as Z-goods imports are small. On the other hand, if the Z-sector is important, exchange of X-goods against Z-goods between the larger and the smaller country is possible at a larger scale. We call the HME based on the exchange of differentiated goods versus homogeneous goods the *interindustry-trade-channel*.

– Figure 1 –

Next we want to show the reaction of the HME on changes of the elasticity of substitution (σ). From Figure 2 we see that a higher σ implies a larger HME, since it makes the X-goods market more competitive. This lowers markups and prices, since we assume large-group monopolistic competition in this sector, which is crucial for the effects on the HME. With lower prices of X-varieties a larger amount of X-goods can be exported in exchange for Z-goods, since the value of one X-good exported is now lower. This means that a higher substitutability of varieties leads to a stronger HME because of shrinking X-goods prices.

– Figure 2 –

The analysis above suggests the following result:

Result 1: *If there are only national firms and trade costs are equal in both sectors, there is no HME (see Davis, 1998). Allowing for different trade costs in the two sectors leads to a HME based on the exchange of products from different industries (interindustry-trade-channel), which depends negatively on the share of income spent in the differentiated sector and positively on the elasticity of substitution between varieties.*

4 The Home Market Effect with Multinational Firms Only

As the importance of FDI is growing, an essential question is whether the results above are affected if we allow firms to produce in both countries, i.e. introduce horizontal multinational firms. As a first step, we assume that only horizontal MNEs are allowed, but no NEs exist. We choose the relative endowment with skilled labor in such a manner, that it is abundant enough to drive the factor price to zero in both countries $w_{Si} = w_{Sj} = 0$. We could instead have equally well chosen capital so abundant that $w_{Ki} = w_{Kj} = 0$. Only one of these two assumptions is necessary, what can be seen by inspecting the factor market clearing conditions for capital and skilled labor (equations (11) and (13)). Those conditions only differ by the fixed input coefficients and the amount of factor requirement for firm establishment on the right-hand side. It is therefore very unlikely that both conditions are satisfied simultaneously at equilibrium values of m_i, m_j and x_{ii}. Furthermore, these two factors are used in fixed proportions in X-sector production, so that it is impossible to shift to the more abundant factor in production. The factor market clearing condition which does not hold with equality will lead to a zero factor price by the complementary slackness condition. The factor market clearing equation will not hold with equality for the more abundant factor - whereby the assumption is justified.[16]

Given this assumption, we can show that the factor price for capital is equalized in both countries by proving that the left-hand side of equation (10) is equal in both countries. In view of the equality of the right-hand side of equation (10) and the knowledge of a factor price of zero for skilled labor, we immediately see that the price for capital has to be equalized ($w_{Ki} = w_{Kj} = w_K$).

Let us make a last assumption: The price for unskilled labor is equalized between countries ($w_{Li} = w_{Lj} = w_L$). Consequently the homogeneous good will not be traded if transport costs are positive ($t_z > 0$).

[16]Indeed, with only horizontal MNEs one factor is slack and we could therefore say that we are left with a two factor model.

If there is factor price equalization in all factors, the price of X-goods has to be equal in both countries ($p_i = p_j$, see equation (8)). Furthermore, the income ratio simplifies to:

$$\frac{E_i}{E_j} = \frac{w_L L_i + w_K K_i}{w_L L_l + w_K K_j} = \frac{\phi(w_L L + w_K K)}{(1-\phi)(w_L L + w_K K)} = \frac{\phi}{1-\phi}. \tag{16}$$

Taking the ratio from the demand equations (2) for both countries leads to:

$$\frac{x_{ii}}{x_{jj}} = \frac{E_i}{E_j} = \frac{\phi}{1-\phi}. \tag{17}$$

This implies that the ratio of the number of multinationals is also equal to the share of world factor endowments. Thus, there is no HME.

The result above will only hold if there is no trade in Z-goods and unskilled labor wages are equalized across countries. So far we merely applied the demand equations and the zero-profit conditions. It remains to be demonstrated that our assumptions of unskilled labor wage equalization and non-trade of Z-goods are consistent with the factor market clearing conditions. To this end we take the factor market clearing conditions for capital[17], and solve for the number of MNEs:

$$m_i = \frac{K_i - a_{Kx}(m_i + m_j)x_{ii}}{2+\gamma}. \tag{18}$$

The ratio of m_i and m_j firms is thus given by:

$$\begin{aligned} \frac{m_i}{m_j} &= \frac{K_i - a_{Kx}(m_i+m_j)x_{ii}}{K_j - a_{Kx}(m_i+m_j)x_{jj}} = \frac{\phi K - \overbrace{\frac{\phi a_{Kx}(m_i+m_j)x_{jj}}{1-\phi}}^{\text{using } x_{ii}=\frac{\phi x_{jj}}{1-\phi}}}{(1-\phi)K - a_{Kx}(m_i+m_j)x_{jj}} = \\ &= \frac{\frac{\phi}{1-\phi}\left[(1-\phi)K - a_{Kx}(m_i+m_j)x_{jj}\right]}{(1-\phi)K - a_{Kx}(m_i+m_j)x_{jj}} = \frac{\phi}{1-\phi}. \end{aligned} \tag{19}$$

The calculation demonstrated that the ratio of the number of MNEs is exactly in proportion to the share of world factor endowment, ϕ, as stated above. We can therefore conclude that the assumption of equal unskilled labor wages is consistent with factor market clearing for capital, and leads to an equilibrium.

[17]The same argument applies to unskilled labor.

Summing up, the HME disappears if only horizontal MNEs exist, formally:

$$HME = \frac{\frac{(m_i+m_j)x_{ii}}{(m_i+m_j)x_{jj}}}{\frac{L_i}{L_j}} = \frac{\frac{x_{ii}}{x_{jj}}}{\frac{L_i}{L_j}} = 1. \tag{20}$$

Result 2: *If only horizontal MNEs are allowed, the share of production at home equals the share of endowments, signifying that the HME disappears.*

5 The Home Market Effect with National and Multinational Firms

Now what happens if both types of firms are active? Figure 3 shows the HME, if transport costs in both sectors are identical, but their value varies. We see that the HME becomes stronger, the larger the transport costs are, and vanishes if transport costs are close to 1%.[18] This result is surprising, as Result 1 states that with NEs only and equal transport costs the HME disappears and Result 2 says that there will be no HME if merely MNEs are active. Allowing coexistence of both firm types again leads to a HME. It is even more astonishing that in (nearly) none of the situations plotted in Figure 3, trade in the homogeneous sector occurs.[19] Nevertheless we find that the differentiated goods sector is more than proportionally larger in the bigger country.

– Figure 3 –

One reason for the more than proportionally larger share of production of X-goods in the larger country is that the firms there are able to produce at a larger scale, which leads to a lower price. The lower price stimulates demand which again stimulates production. Due to the larger home market, it is easier to set up horizontal MNEs in the larger country as the absolute amount of fixed costs

[18]The kink for trade costs equal to 10% results because there are no longer horizontal MNE headquarters in the larger country and there is homogeneous goods exports from the smaller to the larger country.

[19]This result also holds in a model with only two factors of production, where both factors are needed to cover fixed costs. However, for regions which differ substantially with respect to size, homogeneous good trade occurs. In order to ensure that homogeneous goods are not traded in most situations, we stick to a three factor model (remember that homogeneous goods trade is the usual force of the HME).

is equal in both countries. However, normalizing to the symmetric equilibrium and comparing the relative number of NEs to MNEs, we see that this ratio is greater than one for the larger country and less than one for the smaller country (see Figure 4). Hence, in small countries we observe relatively more MNE headquarters as compared to the symmetric case. The reason is, that a small foreign market renders exporting more attractive, since only a small share of production has to be shipped to the foreign country. In other words, horizontal MNEs are more attractive if countries are quite similar (see Carr et al., 2001).

– Figure 4 –

Having a closer look at the balance of payments, we find that the smaller country is a net-exporter of X-goods and a net-importer of headquarter services (remember that Z-goods are not traded). This seems to be in contradiction with the fact that the relative number of exporting firms to multinationals is higher in the smaller country. However, if national and multinational firms coexist, the larger country can take advantage of the scale effect at home, leading to lower prices of differentiated products and therefore, foreign affiliates' profits of MNEs headquartered in the larger country can be higher than those from the smaller country. Balancing of the BOP then requires exports of X-varieties from the smaller to the larger country.

The HME arises, because the small country exports the expensive varieties produced at home, which the foreign country can afford, and imports cheaper varieties from abroad. Therefore, the *value* of exports is higher for the smaller country, due to the fact that the larger country produces at a higher scale and hence has a lower relative price for X-varieties. Comparing *quantities* ($n_i x_i$ and $n_j x_j$, respectively), we see that the exports of X-varieties from the larger to the smaller country and the production of foreign affiliates in the smaller country are larger compared to export quantities from the smaller to the larger country and foreign affiliate production in the large country. This fact enables us to conclude that the BOP is balanced by repatriation of profits (as foreign affiliate

sales are valued at the high price in the small country), what together with the higher production level in the larger country explains the HME. Note, that this is a different reasoning of the existence of the HME, which we want to label *repatriation-of-profits-channel*. Usually, the specialization in homogeneous goods production of the smaller country and in differentiated goods production of the larger country as a result of the economies of scale is the reason for the HME (interindustry-trade-channel).

Let us now investigate how the HME based on the repatriation-of-profits-channel reacts on changes of α, the income share spent on differentiated goods. From Figure 5 we see that the HME becomes stronger, the more important the differentiated sector is.[20] The reason is that the scale effect in the large home market becomes stronger because of the increasing importance of the X-sector. This favors MNEs in the larger country and raises net-exports of X-goods from the smaller country, strengthening the driving forces for the HME explained above. Remember that the reaction of the HME in the model with NEs allowed only was exactly the opposite: an increase of the share spent on differentiated products led to a reduction of the HME. This difference is caused by an increased importance of the differentiated sector leading to a smaller import demand of homogeneous goods from the larger country, which forces the smaller country to reduce Z-goods production and to become more self-sufficient. In the case of the repatriation-of-profits channel, the smaller country gets involved in more trade, as it is now able to export more of its X-varieties and the larger country can even further exploit the economies of scale.

– Figures 5 and 6–

Concerning the repatriation-of-profits-channel, the dependence of the HME on the share of income spent in the X-sector reverses in sign, if either NEs or MNEs do not exist any longer. In Figure 6, we see that if α is very large, the HME can even vanish. In such a situation, in neither country MNEs exist because capital

[20] We postpone the discussion of the reversed HME that occurs when α is very low until the next section. Note that this result holds in a two factor model.

is needed in X-sector production and is too expensive to be used for setting up a plant abroad as the foreign market is better served via exports. Thus the driving force of the HME is destroyed - namely the greater scale at which the larger country can produce.

From Figure 7 we see that the HME depends negatively on the elasticity of substitution. The higher the elasticity of substitution, the lower are markups and therefore profits earned from MNEs abroad and afterwards repatriated. This explains the negative relationship, since repatriated profits are the main force evoking the HME.[21] Again the opposite prediction occurs if only national firms are allowed. In the latter case, lower prices of X-varieties imply that a larger amount of X-goods can be exported in exchange for Z-goods, as the value of one X-good exported is now lower.

– Figure 7 –

Result 3: *The coexistence of national and multinational firms leads to a HME, but it is based on repatriation of profits rather than on interindustry trade (repatriation-of-profits channel). The larger country is able to exploit economies of scale and to afford expensive X-varieties from abroad. The HME relying on the repatriation-of-profits channel depends positively on trade costs and the income share spent in the differentiated sector and negatively on the elasticity of substitution between varieties.*

6 A Reversed Home Market Effect

As pointed out in the introduction, some models predict a reversed HME. In our model with both types of firms, a reversed HME can also occur. We show two sources of a reversed HME.

[21] In a two factor model this relationship is difficult to show, as changes in the elasticity of substitution lead to strong firm-regime changes. If the elasticity of substitution is low, only NEs exist. On the other hand, a high elasticity of substitution leads to MNEs' dominance. In our three factor model, national and multinational firms from both countries are present over the whole range of factor endowments plotted in Figure 7.

First, in Figure (5) at $\alpha = 0.1$ a reversed HME occurs. If the importance of the differentiated sector shrinks to a low level, the relative number of MNEs from the smaller country in comparison to MNEs from the larger country lowers. Nevertheless, foreign affiliate production of MNEs from the larger country relative to foreign affiliate production of MNEs from the smaller country, weighted with the relative size of a country measured by their share of world endowments, becomes smaller. Furthermore, we have to note that the quantity of one variety produced is proportionally larger in the smaller country. This is due to the fact that there is less competition in the smaller country because there are fewer firms which are able to stay in the market in the long run. If α becomes very low, MNEs become more and more attractive as the factor price for capital and skilled workers falls.[22] This leads to a proportionally larger share of production from multinationals in the smaller country and reverses the HME.

Second, we change the factor intensities in X-sector production. More precisely, we assume $a_{Kxi} = 0.1$ instead of 0.3 and $a_{Sxi} = 0.3$ instead of 0.1. World factor endowments are set to $L = 80$, $K = 25$ and $S = 30$ in order to ensure that both firm types are active in the symmetric case. Everything else remains unchanged.

Now we investigate how the HME reacts at different levels of δ, the additional fixed costs that have to be incurred if MNEs are set up. At $\delta = 0$, we see that there is a reversed HME (see Figure 8): production of X-goods is proportionally larger in the smaller country. This reversed HME vanishes at larger values of δ.

– Figure 8 –

There are two main driving forces of this reversed HME. (i) Capital is only required in a small proportion in production. The absolute endowments are $K = 25$ and $S = 30$, thus capital is abundant compared to skilled labor[23], leading to a relatively low price for capital. (ii) Skilled labor is the scarcest

[22] Remember that the homogeneous good is produced with unskilled labor only. In a two factor model, which uses capital and unskilled labor to cover fixed costs, this reversed HME would not occur.

[23] If we had chosen a higher value for capital (say above 40), only MNEs would exist. On the other hand, a lower value of capital (say below 20) would lead to an equilibrium with national firms only.

factor. At $\delta = 0$, there is no difference between national and multinational firms in the use of skilled labor. Since the demand for a variety of X-goods is higher in the larger country, demand for skilled labor is also larger. As fixed costs for setting up a firm are identical in both countries, there is less need for skilled labor in the smaller country because there are less firms. Furthermore, for the small country it is relatively more attractive to set up MNEs, because the small country faces a large foreign market and foreign affiliate production helps avoiding transport costs. Saving transport costs implicitly releases the scarcity of skilled labor, as they consist of 30% skilled labor (same intensities as X-goods). Taking these arguments together, we see that the scarcity of skilled labor in the smaller country is less severe than in the larger one, and therefore, the factor price for skilled labor is lower.

Both, the abundance of capital and the scarcity of skilled labor, lead to a lower price for X-goods in the smaller country. The lower price rises relative domestic demand and finally causes to the reversed HME.

If δ rises, national firms become more attractive. If one country is relatively large compared to the other, only national firms exist (and the HME vanishes). If they are not too different or if δ is not too high, only the larger country runs MNEs. Since the change from exporters to MNEs saves transport costs, it reduces the demand for skilled labor in the larger country and lowers the relative factor price for skilled labor. Now the price for X-varieties is lower in the larger country and we obtain again a HME as in the previous section.

To sum up, the HME depends on the factor intensity in production and even can be reversed if X-goods production is more skilled labor intensive than capital intensive. This finding may be useful for future empirical work, since it suggests to introduce skilled labor to capital endowment ratios in regressions trying to find evidence for the HME. The hypothesis is that the coefficient of this variable should be negative if the ratio is greater than one, and positive otherwise.

Result 4: *A reversed HME effect can occur in two different ways. (i) If the share of income spent in the differentiated sector is low. (ii) If X-production becomes*

more skilled labor intensive and less capital intensive, moreover the additional skilled labor needed to set up MNEs is sufficiently small and/or countries are quite similar.

7 Conclusions

The HME is a building block in the models of new economic geography and was lately used to discriminate empirically between models of constant returns to scale and increasing returns to scale. So far, the HME was only discussed in models with one type of firms, namely firms producing in one country and exporting to the other one. Furthermore, in a lot of models it was assumed that the homogeneous good is costlessly tradeable and only differentiated goods' trade incurs transport costs.

In a model with horizontal MNEs and exporting firms, we show that a HME can even occur if transport costs in both sectors are equal and the homogeneous good is not traded, due to the repatriation-of-profits-channel. In contrast to the HME relying on the trade of products of different sectors (interindustry-trade-channel), the HME based on the repatriation-of-profits channel depends positively on the share spent in the differentiated goods sector and negatively on changes in the elasticity of substitution. This finding is important for empirical tests, since it can be used to distinguish between sectors where horizontal MNEs are crucial and sectors dominated by exporters. The HME depending on the repatriation-of-profits channel furthermore implies that factor intensities in X-goods production are fundamental and even can reverse the HME.

References

Armington, P. (1969): "A Theory of Demand for Products Distinguished by Place of Production," *IMF Staff Papers*, 16, 159–176.

Brander, J. (1981): "Intra-industry Trade in Identical Commodities," *Journal of International Economics*, 11(1), 1–14.

Carr, D., J. Markusen, and K. Maskus (2001): "Estimating the Knowledge-Capital Model of the Multinational Enterprise," *American Economic Review*, 91(3), 693–708.

Chung, C. (2002): "Nonhomothetic Preferences and the Home Market Effect: Does Relative Market Size Matter?," *mimeo*.

Davis, D. (1998): "The Home Market, Trade, and Industrial Structure," *American Economic Review*, 88(5), 1264–1276.

Davis, D., and D. Weinstein (1999): "Economic Geography and Regional Production Structure: An Empirical Investigation," *European Economic Review*, 43(2), 379–407.

——— (2003): "Market Access, Economic Geography and Comparative Advantage: An Empirical Test," *Journal of International Economics*, 59(1), 1–23.

Dixit, A., and J. Stiglitz (1977): "Monopolistic Competition and Optimum Product Diversity," *American Economic Review*, 67(3), 297–308.

Egger, P., and M. Pfaffermayr (2003): "Trade, Multinational Sales, and FDI in a Three-Factors Model," *Review of International Economics*, forthcoming.

Feenstra, R., J. Markusen, and A. Rose (2001): "Using the Gravity Equation to Differentiate Among Alternative Theories of Trade," *Canadian Journal of Economics*, 34(2), 430–447.

Fujita, M., P. Krugman, and A. Venables (1999): *The Spatial Economy - Cities, Regions, and International Trade*. The MIT Press, Cambridge, Massachusetts.

Hanson, G., and C. Xiang (2002): "The Home Market Effect and Bilateral Trade Patterns," *NBER Working Paper No. 9076*.

Head, K., T. Mayer, and J. Ries (2002): "On the Pervasiveness of the Home Market Effects," *Economica*, 69(275), 371–390.

Head, K., and J. Ries (2001): "Increasing Returns Versus National Product Differentiation as an Explanation for the Pattern of U.S.-Canada Trade," *American Economic Review*, 91(4), 858–876.

Helpman, E., and P. Krugman (1985): *Market Structure and Foreign Trade - Increasing Returns, Imperfect Competition and the International Economy*. The MIT Press, Cambridge, Massachusetts.

Krugman, P. (1980): "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review*, 70(5), 950–959.

Krugman, P., and A. Venables (1999): "How Robust is the Home Market Effect?," *mimeo*.

Markusen, J. (2002): *Multinational Firms and the Theory of International Trade*. The MIT Press, Cambridge, Massachusetts.

Markusen, J., and A. Venables (1988): "Trade Policy with Increasing Returns and Imperfect Competition: Contradictory Results from Competing Assumptions," *Journal of International Economics*, 24(3-4), 299–316.

Neary, P. (2001): "Of Hype and Hyperbolas: Introducing the New Economic Geography," *Journal of Economic Literature*, 39(2), 536–561.

Trionfetti, F. (1999): "On the Home Market Effect: Theory and Empirical Evidence," *Centre for Economic Performance Working Paper No. 987*.

——— (2001): "Using Home-Biased Demand to Test Trade Theories," *Weltwirtschaftliches Archiv*, 137(3), 404–426.

Weder, R. (1995): "Linking Absolute and Comparative Advantage to Intra-Industry Trade Theory," *Review of International Economics*, 3(3), 342–354.

——— (2003): "Comparative Home-Market Advantage: An Empirical Analysis of British and American Exports," *Weltwirtschaftliches Archiv*, 139(2), 220–247.

Yu, Z. (2000): "Market Integration and Industrial Structure: The Home Market Effects Revisited," *mimeo*.

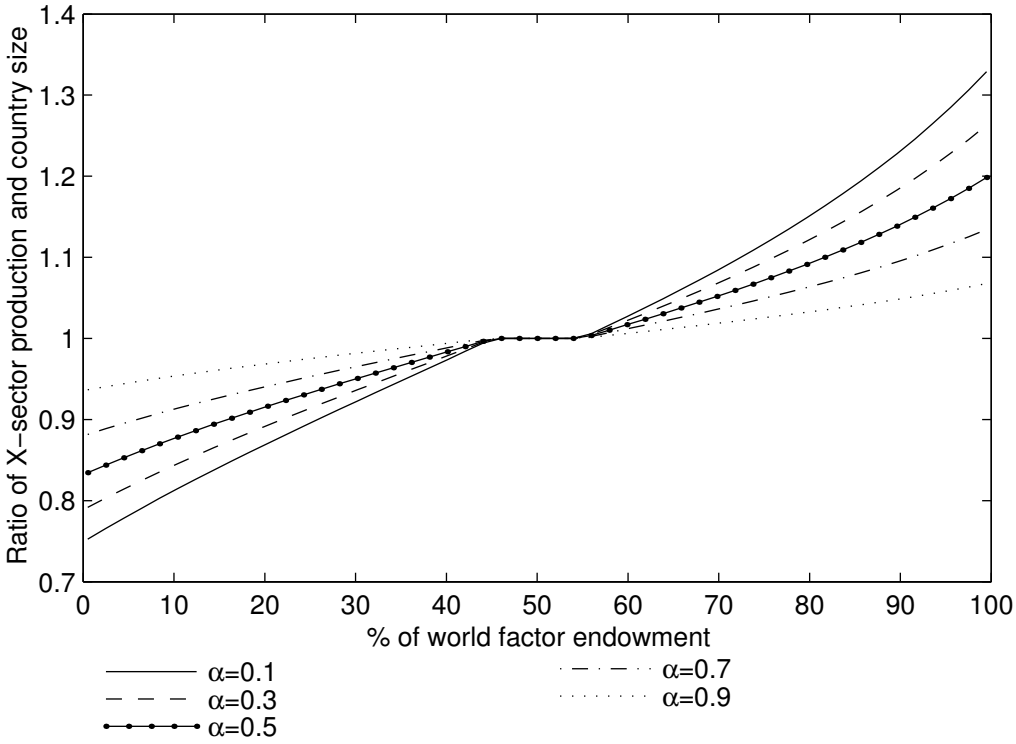

Figure 1: Only national firms allowed, $\sigma = 3$, $t_z = 0.01$, $t_x = 0.2$.

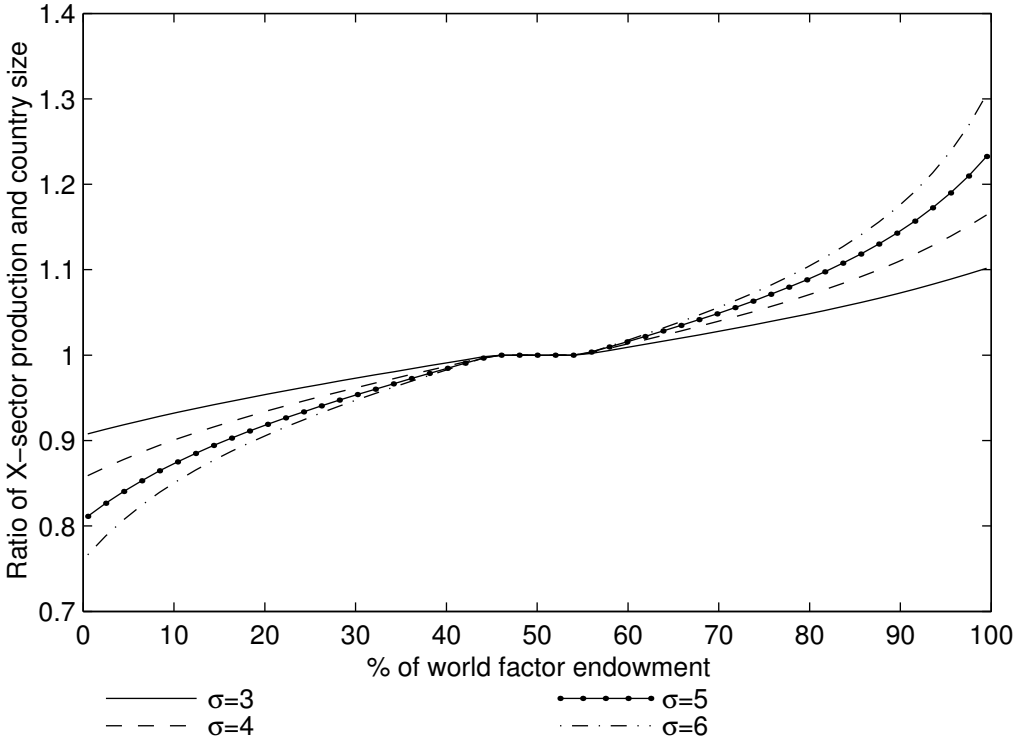

Figure 2: Only national firms allowed, $\alpha = 0.8$,$t_z = 0.01$, $t_x = 0.2$.

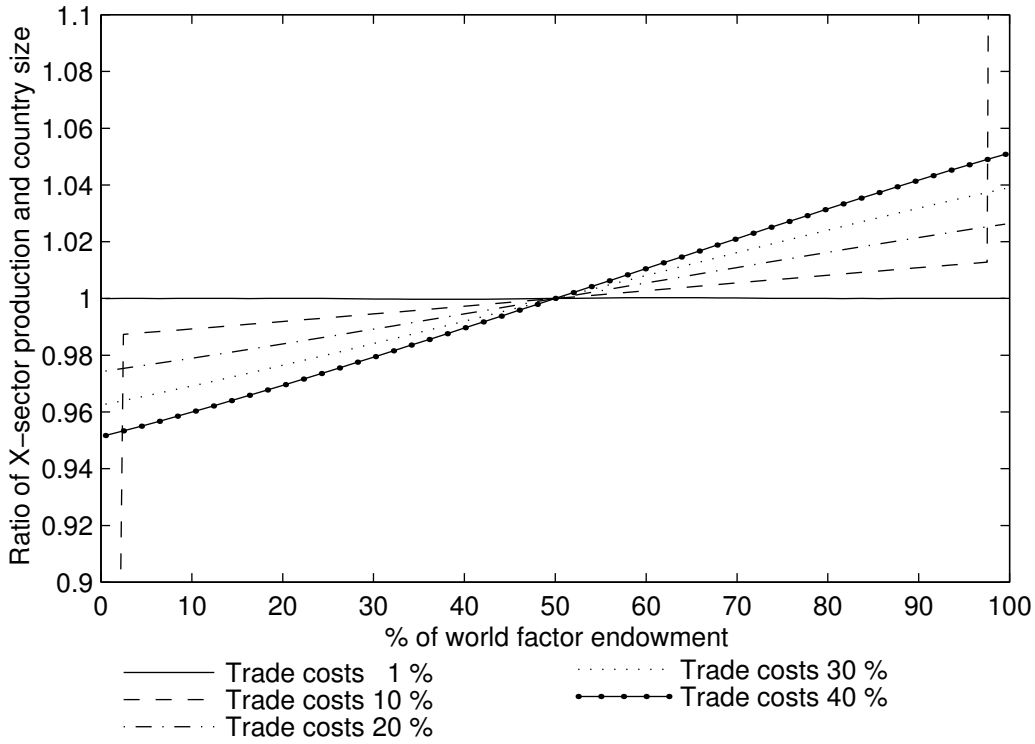

Figure 3: Multinational and national firms, $\alpha = 0.8$, $\sigma = 3$, $L = 100$, $K = 60$, $S = 30$.

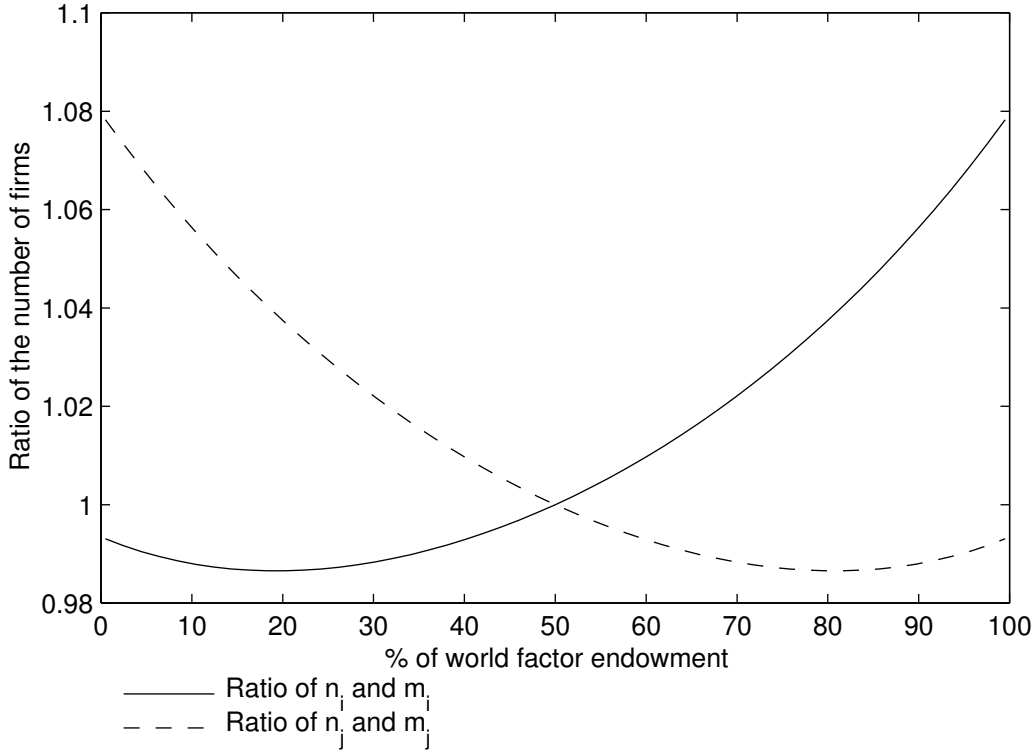

Figure 4: Ratio of the number of multinational and national firms compared to the symmetric case, $t_x = t_z = 0.2$, $\alpha = 0.8$, $\sigma = 3$.

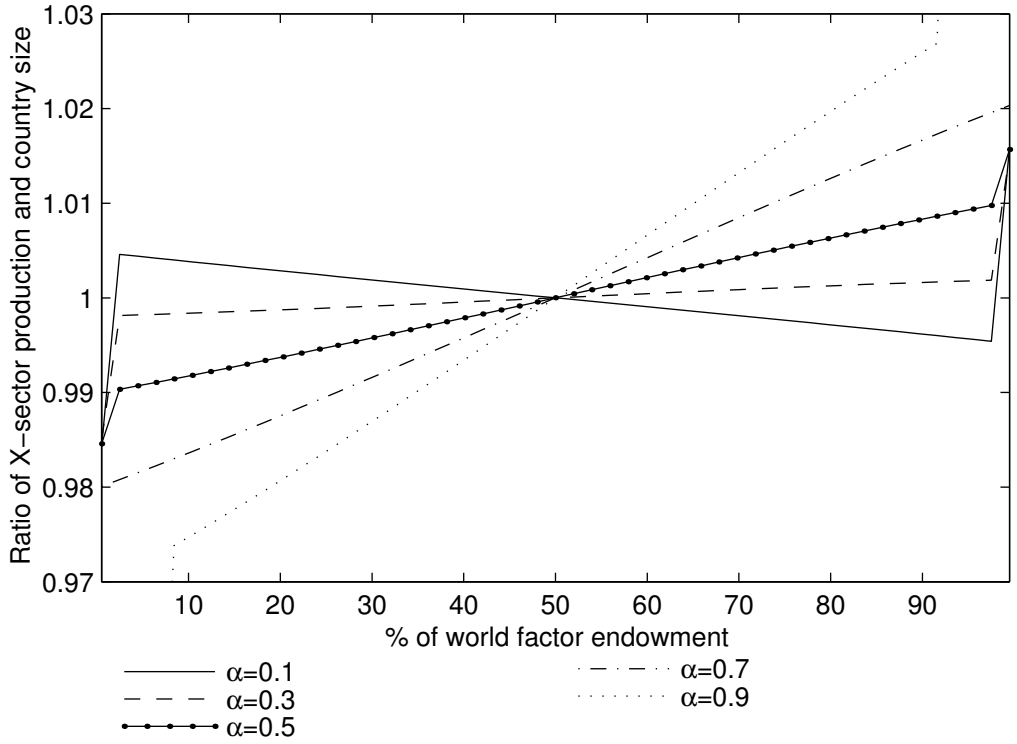

Figure 5: Multinational firms and national firms allowed, $\sigma = 3$, $t_x = t_z = 0.2$.

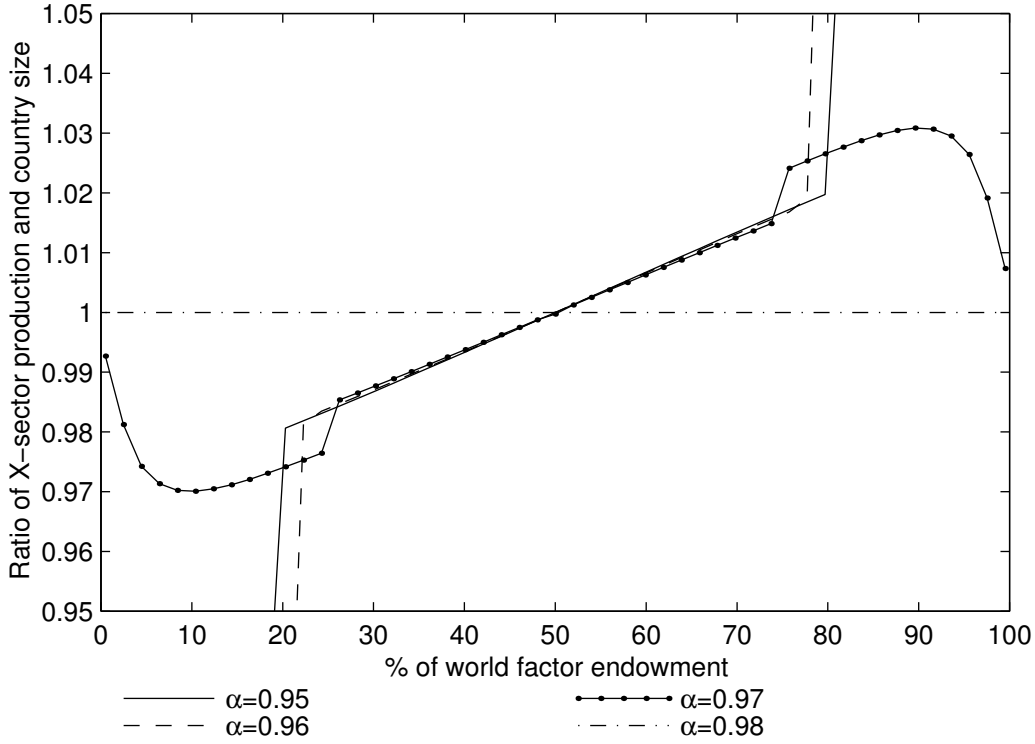

Figure 6: Multinational firms and national firms allowed, $\sigma = 3$, $t_x = t_z = 0.2$.

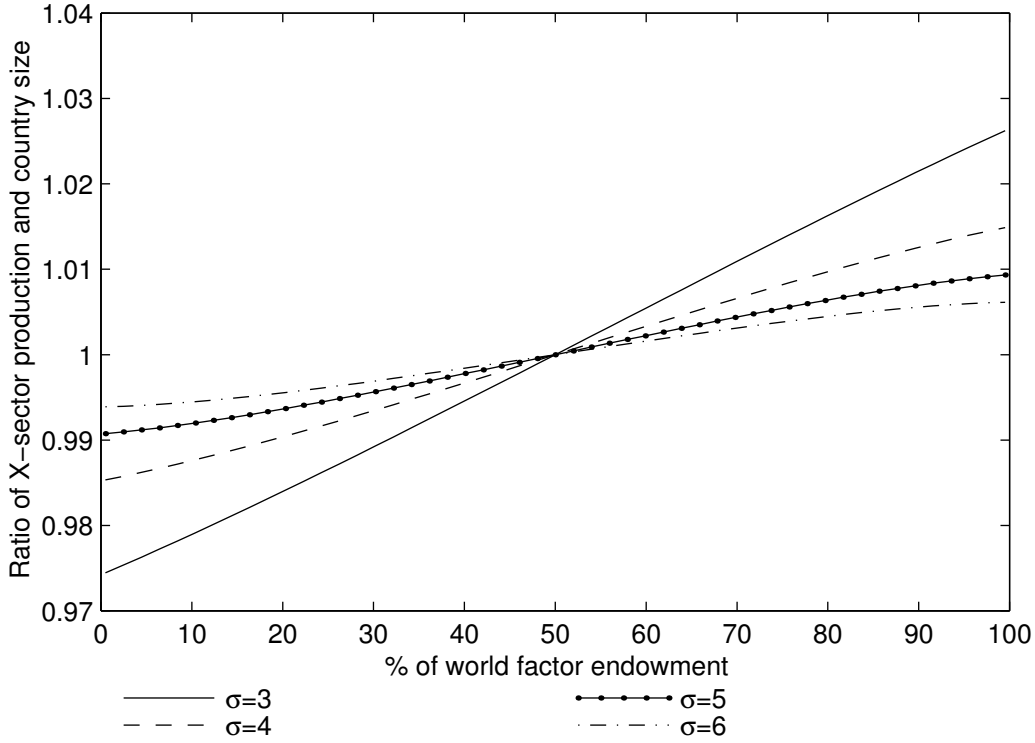

Figure 7: Multinational firms and national firms allowed, $\alpha = 0.8$, $t_x = t_z = 0.2$.

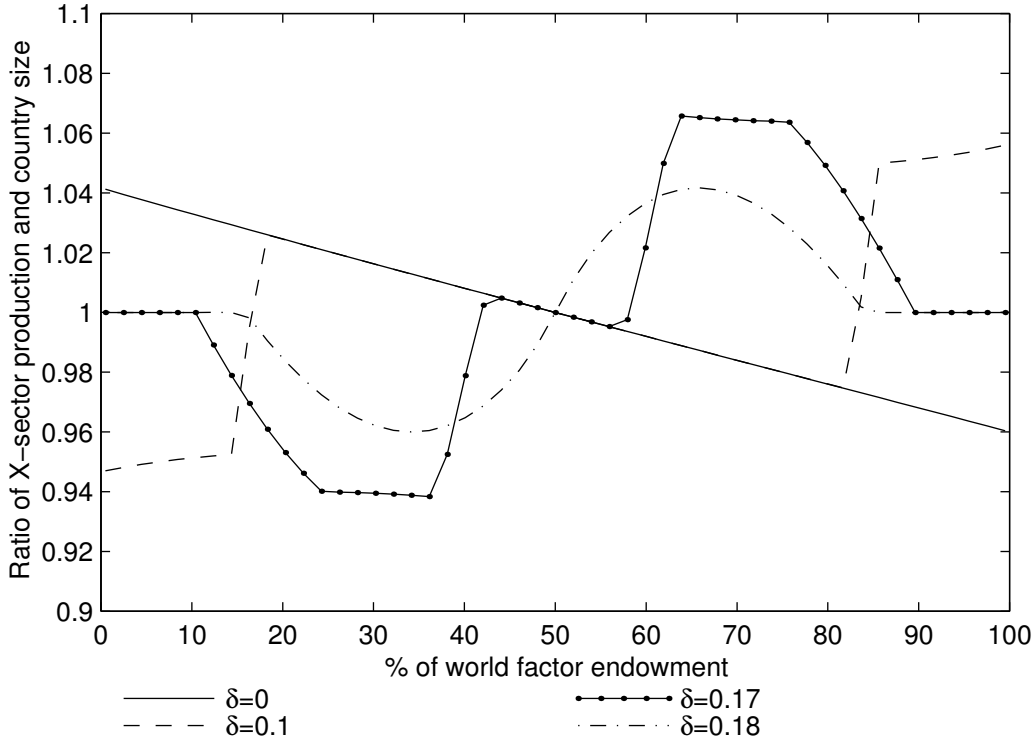

Figure 8: Multinational and national firms allowed $t_x = t_z = 0.2$, $\alpha = 0.8$, $\sigma = 3$.