Heckscher–Ohlin and agglomeration

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Abstract

We argue that embedding endowment-based comparative advantage within a standard NEG framework helps solve the indeterminacy due to multiple equilibria and the ambiguity concerning the relation between integration and specialisation (monotonicity versus non-monotonicity) typical of the NEG literature. In particular, we show that if endowments are in the FPE set, the process of trade integration involves an overshooting of international specialisation and relative factor prices with respect to the free trade level determined by factor abundance. In contrast, if endowments are outside the FPE set, then, even in the presence of agglomeration forces, specialisation and factor prices are monotonically related to trade costs, as implied by the standard trade theory. We argue that the model can shed light on some puzzling stylised facts.

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1. Introduction

The New Economic Geography (NEG) has devoted little attention to the analysis of the interplay between factor abundance and agglomeration forces. One possible rationalisation for this neglect is that allowing for endowment-based comparative advantage could have obscured the most striking feature of NEG models, i.e., that even in the absence of any intrinsic and exogenous differences among countries, agglomeration forces are entirely...
sufficient to explain country specialisation. However, lacking a sounder understanding of the interplay between agglomeration forces and the traditional determinants of comparative advantage, the growing efforts to discriminate empirically between the traditional and the new location theories may turn out to be somewhat premature. For instance, as noted by Brüllhart (1998a), one problem with the empirical test of NEG models is that “on the one hand, they generally emphasise the unleashing of agglomeration forces after trade liberalisation, but on the other hand, they also accommodate multiple equilibria and non-monotonicity.”

In this paper, we argue that embedding endowment-based comparative advantage within a standard NEG framework helps solve the indeterminacy due to multiple equilibria and the ambiguity concerning the relation between integration and specialisation (i.e., monotonicity versus non-monotonicity) typical of the NEG literature. Moreover, this extension provides new insights and testable predictions concerning the co-evolution of international specialisation and relative factor prices after trade liberalisation.

Our paper is closely related to Fujita et al. (1999, henceforth FKV). In Section 16.5, entitled “Multiple Factors: Industrial Clustering in a Heckscher–Ohlin World” (pp. 293–298), they build a model which, like ours, embeds Heckscher–Ohlin features within a NEG framework by allowing for two immobile factors and for inter-industry differences in factor intensities. However, the model provides only a partial integration of the two approaches, since FKV assume that the two countries have identical factor ratios and hence abstract from endowment-based comparative advantage, which is a crucial ingredient in a “truly” Heckscher–Ohlin world. In fact, since in the absence of international differences in the factor ratios there is no trade in a Heckscher–Ohlin world, it follows that the Heckscher–Ohlin determinants of specialisation can play no role in FKV, where specialisation and factor prices are instead uniquely determined by agglomeration forces. As a consequence, and as in most NEG models, in FKV both the trade pattern and factor prices are indeterminate. Moreover, the model in FKV exhibits a “bang-bang” behaviour, which means that the effects of trade liberalisation on country specialisation and factor prices are either nil or catastrophic. These features make the model hard to confront with data. Therefore, in this paper we move a step further by allowing for endowment-based comparative advantage within the framework explored by FKV. This extension helps solve the indeterminacy due to multiple equilibria and exhibits a non-catastrophic behaviour. Further, it provides a clear picture of how factor abundance and agglomeration forces jointly determine international specialisation and relative factor prices in the process of trade integration.

In particular, we show that if endowments are in the factor price equalisation (FPE) set (i.e., if the two countries’ factor ratios are not too dissimilar), then agglomeration forces induce an over-specialisation with respect to the free trade level in the process of economic integration. Hence international specialisation, which follows comparative advantage, is non-monotonically related to trade costs. This pattern of specialisation has striking implications for the mechanics of the Stolper–Samuelson effect. In particular, agglomeration forces induce an overshooting of relative factor prices with respect to their free trade level in the process of economic integration. This implies a reversion of

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1 See Baldwin et al. (2003) and Fujita et al. (1999) for extensive analysis of the New Economic Geography.
the relation between factor prices and factor abundance: when two countries with similar factor ratios become sufficiently integrated, in each the abundant factor becomes relatively expensive. In contrast, we find that if endowments are outside the FPE set (i.e., if trading partners are very dissimilar in terms of factor ratios), then, even in the presence of agglomeration forces, specialisation and factor prices are monotonically related to trade costs, as implied by the traditional trade theory. Finally, we show that the interplay between factor proportions and agglomeration forces may help explain a stylised (and apparently puzzling) fact, i.e., the simultaneous rise in production specialisation and fall in trade specialisation experienced by most European countries in the last decades.

Next section reviews the related theoretical literature. Section 3 illustrates the model, whose main implications are discussed in Sections 4 and 5. Section 6 briefly concludes.

2. Related literature

The standard Heckscher–Ohlin model implies that trade liberalisation unambiguously increases specialisation. By the mechanics of the Stolper–Samuelson effect, this induces a monotonic convergence of relative factor prices across countries. The implications of NEG models are instead less clear-cut. In Krugman and Venables (1996), agglomeration forces induce industrial clustering after trade liberalisation. In contrast, in FKV (Section 16.5), the relation between specialisation and trade costs is non-monotonic. A non-monotonic relation between integration and agglomeration, which was first derived by Venables (1996), is also a feature of Krugman and Venables (1995), and Puga (1999). In all these models, however, countries are assumed initially identical (i.e., there is no comparative advantage) and hence the trade pattern is indeterminate.2

Although most NEG models abstract from factor endowment differences, there are a few exceptions.3 Krugman and Venables (1990) consider two countries that differ both in terms of factor endowments and market size to show that agglomeration forces may run against comparative advantage, and that such a phenomenon is however temporary, since countries increasingly specialise in their comparative advantage industry in the final stages of trade liberalisation.4 We will argue, instead, that neither result is a robust implication of NEG models, since their internal logic suggests that the converse is true, i.e., that agglomeration economies strengthen comparative advantage and that the final stages of trade integration involve a falling specialisation in the comparative advantage sector. In Markusen and Venables (2000), which builds on Helpman and Krugman (1985), country size and factor proportions jointly determine comparative advantage and country

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2 See Ottaviano and Puga (1999) for an analysis of the main features of these and other related NEG models.
3 Venables and Limao (2002) analyse how factor proportions and transport costs jointly determine international specialisation in a model with a continuum of locations. The model assumes, however, perfect competition, constant returns to scale and the absence of market imperfections. Hence, it abstracts from the interactions between factor proportions and agglomeration forces.
4 In this model, market size is exogenous, however, and is captured by a parameter in a linear demand function for differentiated manufacturing products.
specialisation.\textsuperscript{5} However, in this model, as well as in Krugman and Venables (1990), the effect of country size on the trade pattern disappears once the assumption of sectoral asymmetries in transport costs is removed.\textsuperscript{6} A recent paper by Amiti (2001) embeds Heckscher–Ohlin features within a NEG model to show that trade integration may lead to the agglomeration of a labour-intensive downstream industry into the capital abundant country. In this model, as in the above-mentioned works, agriculture is constant returns to scale and freely traded, whereas manufacturing is subject to trade costs and agglomeration economies. Finally, Forslid et al. (2002) use European data to simulate the effects of trade integration on industrial location in a setting with four regions, 14 industries and three mobile factors. Our model gives a clear theoretical explanation for the simulation results in this study.

Our paper is also related to recent work analysing the tension between agglomeration forces and Ricardo-type comparative advantage. For instance, Venables (1999), Ricci (1999) and Forslid and Wooton (2003) embed technological differences within a NEG model. These models cannot address, however, the effects of agglomeration forces on income distribution.

As mentioned earlier, in order to study how factor proportions and agglomeration forces co-determine the evolution of international specialisation and income distribution after trade liberalisation, we augment the model in Chapter 16 of FKV by allowing for international factor endowment differences.\textsuperscript{7} We use this model as a benchmark for our analysis for the following reasons. First, it does not rely on an ad hoc assumption of sectoral asymmetries in transport costs. Second, it is quite general in that both sectors exhibit increasing returns to scale and imperfect competition. Finally, since in this model agglomeration economies do not rely on factor mobility, it is well suited for an analysis of international specialisation.

3. The model

Consider a world in which there are two countries, Home and Foreign,\textsuperscript{8} two industries (indexed by $i=1, 2$), and two internationally immobile production factors, which we call

\textsuperscript{5} See also Puga and Venables (1999) on this point. They extend Krugman and Venables (1995) to a multi-industry/multi-factor context in order to analyse the effects of trade liberalisation on the specialisation pattern of a small country. This model too abstracts from factor endowment differences. It is shown that the final stages of trade liberalisation are associated with a rising specialisation of the small country in the labour-intensive industries.

\textsuperscript{6} This result has been formally demonstrated by Davis (1998), in his critique of the literature based on the home market effect. He further shows that the assumption that differentiated goods incur higher transport costs than homogeneous goods is counterfactual.

\textsuperscript{7} Peri (2002) uses a dynamic version of a similar model with forward-looking agents to explore the implications of frictions in the cross-sectors labor mobility on the persistence of specialisation. He finds that the greater the frictions, the greater the persistence, and that the result is strengthened in the presence of comparative advantage. His paper does not address, however, the implications of NEG models embedding endowment-based comparative advantage on the co-evolution of trade and production specialisation and income distribution after trade liberalisation.

\textsuperscript{8} Variables related to the foreign country are denoted by an asterisk. We will only illustrate the equations relative to the domestic country, since those for the foreign country are analogous.
capital ($K$) and labour ($L$). The two countries have identical preferences and technology, but are differently endowed with capital and labour. Assume, in particular, $K/L > K^*/L^*$, i.e., that the domestic country is capital abundant.

The two industries are monopolistically competitive à la Dixit and Stiglitz (1977), and produce differentiated goods under increasing returns to scale. Both industries incur identical iceberg transport costs: $\tau > 1$ units must be shipped from one country in order that one unit arrives in the other country. The price indices ($q_i$) for the two industries are defined by

$$ q_i = \left[ n_i p_i^{1-\sigma} + n_i^* (p_i^* \tau)^{1-\sigma} \right]^{1/\sigma} \quad i = 1, 2 \quad (1) $$

where $n_i$ and $n_i^*$ are the varieties of industry $i$ produced in the domestic and foreign country, respectively, and $p_i$ and $p_i^*$ are the prices charged for each variety.

Production of each variety requires a fixed amount $a$ and a variable amount $b$ of an input whose unit cost is denoted by $C_i$. The total cost function of a firm in industry $i$ is then given by: $TC_i = (a + b x_i) C_i$, where $x_i$ denotes output.

Firms in each industry are symmetric; $\sigma > 1$ is the (constant) perceived demand elasticity for their products. The price that maximises their profits is then

$$ p_i = \frac{\beta \sigma}{\sigma - 1} C_i = C_i \quad i = 1, 2 \quad (2) $$

where the latter equality follows from the choice of units such that $\beta \sigma = \sigma - 1$.

The zero profit condition implies

$$ x = \frac{(\sigma - 1) a}{\beta} = 1 \quad (3) $$

where the latter equality follows from the choice of units such that $a = 1/\sigma$. Note that equilibrium output is the same across firms and sectors.

The input used by industry $i$ is a Cobb–Douglas composite of capital, labour and a CES aggregate of industry $i$’s differentiated goods. The unit cost functions for these inputs are

$$ C_1 = w^{(1-\gamma)} r^{(1-\gamma)} (1-\gamma) q_1^\delta; \quad C_2 = w^{(1-\gamma)} r^{(1-\gamma)} (1-\gamma) q_2^\delta \quad (4) $$

where all parameters are in the interval $(0, 1)$. $\delta$ is the share of own industry output in total cost in the two industries.\(^9\)

Full employment of labour and capital implies $L = L_1 + L_2$ and $K = K_1 + K_2$. From Eq. (4), the shares of labour and capital in total revenue (cost) are

$$ wL_1 = (1-\delta)\gamma n_1 p_1; \quad w(L-L_1) = (1-\delta)(1-\gamma) n_2 p_2 \quad (5) $$

$$ rK_1 = (1-\delta)(1-\gamma) n_1 p_1; \quad r(K-K_1) = 1(1-\delta)\gamma n_2 p_2 \quad (6) $$

\(^9\) Unlike FVK, we do not consider inter-industry cost linkages. The reason is that, as long as inter-industry linkages are lower than intra-industry linkages, they are essentially irrelevant for our analysis.
Rearranging Eqs. (5) and (6), we obtain
\[
\frac{K_1}{L_1} = \frac{1 - \gamma w}{\gamma r}, \quad \frac{K_2}{L_2} = \frac{K - K_1}{L - L_1} = \frac{\gamma w}{1 - \gamma r}
\]

In the following, we assume \( \gamma > 1/2 \), i.e., that industry 1 is labour-intensive.

Consumers have Cobb–Douglas preferences over the CES aggregates of the two industries. They spend an equal share of their income \( Y = rK + wL \) on each industry’s varieties. Further, since a share \( \delta \) of revenue is devoted to purchases of own industry intermediate goods, it follows that total expenditure \( e_i, i = 1, 2 \) for the two industries’ varieties is
\[
e_i = (1/2)(wL + rK) + \delta n_i p_i
\]

It can be shown that total demand for each of the two industries’ varieties is
\[
x_i = \frac{1}{p_i^{1-\sigma}} \left[ e_i q_i^{\sigma-1} + e_i* \tau^{1-\sigma}(q_i*)^{\sigma-1} \right]
\]

From Eq. (3) note that, if industry \( i \)’s firms are active in equilibrium, then \( x_i = 1 \).

Equilibria are given by the solutions of the system of Eqs. (1)–(8) and the analogous equations for the foreign country. Multiple equilibria may arise for special configurations of parameters. In a longer version of this paper, we show, however, that even when multiple equilibria arise and a perverse trade pattern is also sustainable (i.e., the one in which each country specialises in the industry which uses intensively its scarce factor), that pattern is not likely to be observed.\(^\text{10}\) The reason is that, since NEG-type agglomeration forces set in motion when countries are already specialised according to their comparative advantage (which dictates specialisation in the former stages of trade integration), it is highly unlikely that they can reverse a pattern of specialisation based on factor abundance. Hence, since the potential indeterminacy arising from multiple equilibria is not severe in this model, in the following, in order to illustrate some interesting implications of the model, we will stick with parameter configurations for which multiple equilibria do not arise.

### 4. Integration, specialisation and relative factor prices

Consider first a parameter configuration that yields a diversified free trade equilibrium, i.e., an equilibrium in which both industries are active in both countries in the absence of trade costs. This condition holds when endowments are in the factor price equalisation set, i.e., when the two countries’ factor ratios are not too dissimilar.

Fig. 1 plots the share \( s_2 = \frac{p_1 p_2}{p_1^2 + p_2^2} \) of the capital-intensive industry’s output in the capital abundant domestic country as a function of trade costs. Two cases are illustrated in

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\(^\text{10}\) The interested reader is referred to Epifani (2001). Multiple equilibria are more likely in the presence of small inter-sectoral factor-intensity differences, high equilibrium scale economies, or a high share of intermediates in total costs.
the figure. The dashed curve is drawn for $\delta = 0$, i.e., in the absence of forward and backward linkages among producers. The solid curve is drawn for $\delta = 0.5$. Both curves are drawn for $K^* = L$ and $L^* = K$.\footnote{Unless otherwise stated in the text, all the figures set: $L = K^* = 0.7, \ K = L^* = 1, \ \sigma = 5, \ \delta = 0.5$ and $\gamma = 0.8.$} Hence, given the symmetry of this example, these curves also represent the share $s_1^*=\frac{p_1^*n_1^*}{\rho_1^*n_1^*+\rho_2^*n_2^*}$ of the labour-intensive industry’s output in the labour abundant foreign country.

Note that, in the absence of agglomeration economies generated by the linkages among producers, trade liberalisation monotonically increases specialisation according to comparative advantage. This is the standard implication of the traditional approach.

In the presence of linkages among producers, i.e., for $\delta > 0$, trade liberalisation also fosters, initially, international specialisation according to comparative advantage. The crucial difference is that, for trade costs lower than $\zeta$, the degree of international specialisation exceeds the one attained in free trade (i.e., for $\tau = 1$, in correspondence to which we have drawn a straight line). Hence, agglomeration economies exert a sort of magnification effect on the specialisation based on comparative advantage. The reason for this result is that a country specialised in its comparative advantage industry has a double advantage with respect to its partner country. First, it exploits the advantage of using intensively its abundant factor. Second, it exploits the positive externalities generated by the forward and backward linkages among producers in this industry. Using the terminology adopted by Paul Krugman, we can say that second nature advantage strengthens first nature advantage. Note, however, that this self-reinforcing mechanism is not endless and does not lead to a monotonic increase in specialisation after trade liberalisation. The figure in fact shows that international specialisation reaches a peak for intermediate trade costs, and then starts to decline for further reductions of
The intuition is that agglomeration forces weaken for low trade costs, and hence specialisation decreases back to the level determined by first nature advantage (i.e., factor abundance) in the latter stages of integration.

The above pattern of specialisation has interesting implications for the behaviour of factor prices, to which we now turn. Fig. 2 plots the rental/wage ratio in the two countries as a function of trade costs for the same parameter values as in Fig. 1. The solid and dashed monotonic curves represent the rental/wage ratio in Home and Foreign, respectively, for $\delta = 0$. Note that, in the absence of forward and backward linkages among producers, the gradual fall of trade barriers brings about factor price convergence, as predicted by the standard trade theory. Further, since in this example endowments are in the FPE set, we also have factor price equalisation in the free trade equilibrium.

The solid and dashed non-monotonic curves reported in Fig. 2 represent the rental/wage ratio in Home and Foreign, respectively, for $\delta = 0.5$. Note that there is relative factor price convergence in the initial stages of trade integration. This is the traditional Stolper–Samuleson effect. The striking novelty is that factor price equalisation is reached for positive levels of trade costs (i.e., for $\tau = \bar{\tau}$). Afterwards, further falls of trade costs imply an overshooting of the relative price of the factor with which each country is relatively endowed. Hence, the model suggests that when two similar countries become sufficiently integrated, then in each country the abundant factor becomes relatively expensive. This result is induced by agglomeration forces, which strengthen specialisation according to comparative advantage and hence exacerbate the traditional Stolper–Samuelson effect. In other words, for positive trade costs, each

Note that the monotonic and non-monotonic curves in Fig. 1 mimic fairly closely the results by Forslid et al. (2002) relative to the effects of trade integration on the evolution of European industry in the CRS and IRS sectors, respectively.
country is so specialised in its comparative advantage industry, and hence the relative demand for the abundant factor is so high, that its relative price rises above the free trade level.

Finally note that, for sufficiently low trade barriers, the weakening of agglomeration forces, which induces a partial relocation of resources toward the sector of comparative disadvantage, also involves a reversion of the Stolper–Samuelson effect in the proximity of free trade.

To see the specific role played by factor abundance in generating the patterns illustrated in Figs. 1 and 2, note that in the absence of endowment-based comparative advantage, as is the case in FKV, trade liberalisation has no effects either on specialisation or on relative factor prices (which in this case are equal across countries) until a critical level of trade costs is reached: at this point, a catastrophic agglomeration occurs and relative factor prices change abruptly, but the direction of change is indeterminate. Afterwards, trade liberalisation has again no effects at all until a new break point is reached that restores a perfect symmetry.

4.1. Complete specialisation

Our results hinge critically on the assumption of factor price equalisation and diversification in the free trade equilibrium. The reason is that the non-monotonicity of specialisation and relative factor prices are both determined by an agglomeration-induced over-specialisation (with respect to free trade) for positive trade costs. In contrast, when at least one country specialises completely in free trade, specialisation cannot exceed its free trade level in the process of economic integration, and hence the non-monotonicity disappears. Fig. 3 illustrates the qualitative behaviour of specialisation and relative factor prices when factor endowments are outside the FPE set. Panel (a) shows that in this case the qualitative evolution of specialisation is the same, with or without linkages among producers. The only effect of agglomeration forces is to induce complete specialisation (in one or both countries) for a higher level of trade costs. Panel (b) shows that complete specialisation stops the process of factor price convergence. In this case, even in the presence of linkages among producers, there is no overshooting of relative factor prices and no reversion of the Stolper–Samuelson effect.
5. Empirical implications

Finally, we discuss some of the model’s implications in the light of the empirical evidence.

5.1. Skill premium and skill abundance

The model can shed light on an empirical puzzle noted, among others, by Acemoglu (1999). Using a sample of advanced countries, Acemoglu documents a positive association between skill abundance and the skill premium. The correlation turns instead negative and consistent with the prediction of the standard trade theory when a sample of less developed countries is considered. Acemoglu explains this paradox with reference to the effects of endogenous skill-biased technical change. Our model gives a different explanation for this evidence. We have in fact shown that, if two countries have similar factor ratios and are sufficiently integrated, then agglomeration economies may induce an excess of specialisation and a consequent reversion of the relation between relative factor prices and relative factor endowments. This explanation is consistent with the fact that, with respect to low and medium income countries, advanced countries are more similar in terms of factor endowments and more closely integrated. Hence, in this sample of countries, it is more likely to observe the reversion of the relation between factor abundance and factor prices suggested by the model.

5.2. Trade and production specialisation

Some recent empirical studies (Midelfart-Knarvik et al., 2000, Amiti, 1999, Brülhart, 1998b, Brülhart and Torstensson, 1996) document a slight tendency toward an increase in production specialisation in the EU countries in the last decades. With reference to our model, this evidence would suggest that European countries are still on the right arm of the inverted U-shaped curve. A second stylised fact of the last decades European experience is a general tendency toward an increase in intra-industry trade (Brülhart, 1998a). This evidence is somewhat puzzling, since an increase in production specialisation is at odds with a simultaneous increase in the measures of intra-industry trade, as long as we take the latter as inverse measures of inter-industry trade specialisation.

Our model is consistent with this paradoxical evidence. Fig. 4 illustrates the main implications of the model concerning the co-evolution of trade and production special-

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13 This would also suggest that overall trade costs among European countries are still quite large (larger than 40% in our specific example). Indeed, preliminary estimates of overall impediments to trade among European countries, obtained from the structural estimation of NEG models, suggest that these costs are surprisingly high. For instance, Head and Mayer (2003) find that the ad valorem equivalent of these costs is greater than 40% for the median industry in France–Germany trade and that it is much higher in France–Italy trade.

14 For an attempt to clarify this puzzle, see also Rushashyankiko (1999).
The co-evolution after trade integration. The horizontal axis reports the value of trade costs. The vertical axis reports the value of the following variables

\[
s_2 = \frac{p_2 n_2}{p_1 n_1 + p_2 n_2}
\]

\[
X_2 - M_2 = p_2^{1-\sigma} e_2^{*} \tau^{1-\sigma} (q_2^{*})^{\sigma-1} - (p_2^{*})^{1-\sigma} e_2 \tau^{1-\sigma} q_2^{\sigma-1}
\]

\[
IIT_2 = 1 - \frac{X_2 - M_2}{X_2 + M_2}
\]

\[s_2\] is the share of the capital-intensive industry 2’s output in the capital abundant domestic country. \((X_2 - M_2)\) is the value of domestic net exports in industry 2. Its expression is obtained from Eq. (8) and the analogous for the foreign country. Finally, \(IIT_2\) is the Grubel–Lloyd index of intra-industry trade in industry 2. The curves illustrated in Fig. 4 are drawn for the same parameter values as in Figs. 1 and 2. Hence, given the symmetry of the parameter configuration, these curves also illustrate the co-evolution of trade and production specialisation by the labour abundant foreign country in the labour-intensive industry 1.

Note that, on the right arm of \(s_2\), the model implies both an increase in production specialisation and in the IIT index. Note, also, that \((X_2 - M_2)\) and \(s_2\) have the same co-evolution after trade liberalisation. Hence, no puzzle arises as long as trade specialisation is measured by net sectoral exports.\(^{15}\)

\(^{15}\) Note that, since the units melt in transit do not affect the Grubel–Lloyd index, our results do not depend on whether or not these units are included in the definition of net sectoral exports.
In order to reconcile the behaviour of the IIT index with that of $s_2$ and of net exports, first note that, in the presence of growing net sectoral exports, the IIT index grows if and only if net trade grows less than gross trade. This, in turn, requires that sectoral imports grow more than exports after trade liberalisation.\(^\text{16}\) In this model, this may occur, even in the presence of a relocation of firms toward the sector of comparative advantage in both countries, because this effect can be offset by another effect which pushes in the opposite direction. In particular, the assumption of love for variety embedded both in the preferences and the technology implies that when trade barriers are reduced, in each country the import demand for each variety of the comparative advantage good may grow more than demand for each variety of the comparative disadvantage good, because of the lower initial level of the former. This drives the increase in the IIT index.

6. Conclusion

In this paper, we have argued that, once endowment-based comparative advantage is taken into account, the New Economic Geography yields rich and clear-cut predictions concerning the effects of trade liberalisation on international specialisation and income distribution. In particular, we have shown that: (1) If endowments are in the FPE set (i.e., if trading partners are not too dissimilar in terms of factor ratios), then the process of trade integration involves an overshooting of specialisation and relative factor prices with respect to the free trade level determined by comparative advantage. This also implies a reversion of the relation between factor prices and factor abundance; (2) International specialisation and relative factor prices are instead monotonically related to trade costs when integration occurs among countries with very dissimilar factor ratios (i.e., when endowments are outside the FPE set). (3) Integration may involve a simultaneous rise in production specialisation and fall in trade specialisation. These predictions, which are broadly in line with some puzzling stylised facts, can be a step toward the formulation of a rigorous test of NEG models.

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\(^{16}\) The condition for an increase in net exports after trade liberalisation is $\frac{dX_2}{dt} > \frac{dM_2}{dt}$. Conversely, the condition for an increase in the Grubel–Lloyd index is $\frac{dM_2}{dt} > \frac{M_2}{X_2} \frac{dX_2}{dt}$. Hence, for $\frac{dX_2}{dt} < \frac{M_2}{X_2} < \frac{dM_2}{dt} < \frac{dX_2}{dt}$, we have both an increase in net exports and in the index of intra-industry trade.
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