Industry relocation, linkages and spillovers across the Baltic Sea: extending the footloose capital model

Ole Christiansen, Dirk H. Ehnts, Hans-Michael Trautwein

Abstract

Studying the recent relocation of manufacturing industries from the Nordic countries to the Baltic countries, this paper provides an empirical application of the footloose capital model, a framework for spatial analysis. The model is extended to include input-output linkages and FDI spillovers. It is calibrated and applied, industry by industry, to a 3x3 matrix of Baltic countries and Nordic countries and to the pairing of these blocs. Simulation results are compared with ‘real world’ data and discussed in regard to testability restrictions of the footloose capital model. Incorporation of vertical linkages and spillovers can improve the goodness of fit, but while the predicted direction of industry relocation is often correct, predicted levels are not.

Keywords: new economic geography, footloose capital model, linkages, spillovers
JEL classification: F120, F140, R120

1. Introduction

In the context of integration of the Central and Eastern European accession countries into the European Union, expectations are high that these countries will achieve faster economic development through inward foreign direct investment (FDI). It is generally argued that the relocation of productive activities from Western economies would create a more vertically differentiated structure of production in Eastern economies, with upstream and downstream linkages between the sectors. This process could generate economies of scale and scope that help to increase aggregate employment, income, and demand. It is also argued that productivity of local firms would be enhanced by FDI through technology spillovers that come with cooperation and imitation.

In general, the ‘footloose capital’ (FC) model of location theory, developed by Martin and Rogers (1995) and extended by Ottaviano et al. (2002) and Baldwin et al. (2003, chs 3 and 5), is a suitable framework for studying the causes and effects of cross-border flows of direct investment. Unlike many other models in the domain of the ‘New Economic Geography’ (NEG) it is analytically tractable and amenable to empirical studies. However, the stan-
Standard formulations of the FC model do not capture the linkages and spillover effects of FDI operationally. Following Venables (1996), intermediate goods are typically defined as CES aggregates of all varieties of the industrial good (see also Brakman et al. 2009, p. 151). For reasons of technical tractability, it may be practical to let all varieties of the final product be inputs in each others’ production. However, this procedure implies that imperfect substitutes are simultaneously treated as complementary goods, both upstream and downstream. This blurs the perspective on changes in output and productivity in a vertical production structure and is not compatible with input-output data. The first objective of this paper is therefore to extend the FC framework by modelling the structure of vertical linkages less restrictively and empirically more operationally.

The second objective is to integrate FDI spillovers. In the NEG literature, spillovers have been modelled in the static terms of Marshallian externalities of regional specialization (Fujita and Thisse 2002). Here we set the focus on dynamic spillovers generated by cross-border movements of firms. While such effects have been examined in empirical literature outside the NEG domain (see, e.g., Kugler 2006, Javorcik and Spatareanu 2009), they have not - to our knowledge - been explicitly integrated in the FC framework before.

The third objective of our paper is to study industry relocation in the Baltic region of the EU in terms of cross-border movements from the EU-Nordic countries (Finland, Sweden and Denmark) to the Baltic States (Estonia, Latvia and Lithuania). We have chosen these two blocs of countries because we think that empirical application of the FC model extended to include linkages and spillovers generates insights into the dynamics of economic development in the Baltic region. At the same time, the characteristic mix of similarities and differences within and between these blocs is particularly suitable for bringing out the dynamics at the core of an extended FC model that includes linkages and spillovers.

Why is the Baltic region a suitable test case for application of the extended FC model? The six countries form two distinct groups of three in neighbouring regions around the Baltic Sea. They all have relatively small populations, compared to Russia, Poland, and Germany, the other neighbours on the Baltic shore. Until 1991, the two groups were quite strictly separated in political and economic terms. The Baltic States were part of the Soviet Union, and trade and investment flows between the Baltic States and the Nordic countries were small (Laaser and Schrader 2004). This changed during the 1990s, when the Baltic States (henceforth: the Baltics) regained their independence and started their transformation into Western-style market economies. At least two out of the three EU Nordic countries (henceforth: the Nordics) are now among the largest trade partners for each of the Baltics. And the picture is even more impressive in terms of FDI. The Nordics are the biggest investors in the Baltics. As of 2009, they together account for about 65 per cent of inward FDI stock in Estonia, nearly 27 per cent in Lithuania, and nearly 25 per cent in Latvia; outward FDI from the Baltics to the Nordics is negligible.

All six countries are members of the European Union. At the beginning of the observation period (in the mid-1990s) all of them had at least an accession perspective. Despite some convergence in the integration process, both groups remain distinct subregions of the EU, especially with regard to their income levels. In 2007, the end of our observation period and the beginning of the great financial crisis, Sweden’s GDP alone was more than five times
larger than the aggregate Baltic GDP. In the same year, the Nordic per capita income (PPP-adjusted average) was roughly twice the Baltic per capita income. While the Nordics form the richest subregion in the EU, the Baltics are among the poorest subregions. However, between 1995 and 2007 per capita incomes rose by factor 4 in the Baltics, as compared to factor 1.8 in the Nordics. Finally it should be noted that, even though the outside world tends to regard the Nordics and the Baltics as homogeneous groups of countries, the industry structures and other characteristics (cultural and historical backgrounds) of the six economies are quite heterogeneous.

What do these facts imply for analysis of industry relocation in NEG terms? Trade costs arise for exports of goods from one region to the other, but they are not likely to be prohibitive, as distances across and around the Baltic Sea are comparatively short. Nor are trade costs likely to make a strong difference between the countries. EU integration forced countries to bring their economies under the rule of the *acquis communautaire*. Political barriers to trade and investment - another component of trade costs that would complicate the picture - were thus relatively low and decreasing. Moreover, EU membership (or the prospects of it) should imply some coherence in the data sets.

That the Baltic and Nordic countries have relatively small populations means that they are relatively similar in potential market size - at least in comparison with the other neighbours (Russia, Poland, Germany). This symmetry makes complete agglomeration of industries in one region or country less likely to occur. In terms of actual market size, on the other hand, the Baltics and the Nordics are quite different, as GDP and other income figures show - and the differences were even greater back in the 1990s. This indicates a high potential for capital flows from the Nordics to the Baltics. The dominant role that the Nordics play in the inward FDI stocks of the Baltics shows that such capital flows actually take place. Last but not least, the transition process of the Baltics can be considered as a policy experiment of opening markets. This beds for dynamics in location choices that one would not normally see in more tranquil times. All facts taken together suggest that the two regions should trade with each other to a degree that makes changes in trade composition and the spatial distribution of industrial activities observable. The Baltics and the Nordics appear to be an almost ideal case for testing the predictive powers of the FC model.

The structure of the paper is as follows. In the second section we describe a linear version of the FC model, adapted from the earlier literature. Due to its highly stylized character and to limitations in the data bases, we cannot test the FC model with conventional econometric methods. Yet we use real data for the relevant variables to run simulations of relocation in the manufacturing industries, both in the Nordic-Baltic aggregate and in a 3x3 matrix for the Nordic-Baltic country pairs. In the next section we describe the simulations and present the results for relevant industries. In the fourth section we check on the predictions of the FC model by confronting simulation results with statistical indicators of industry relocation in terms of exports and FDI stock. In the next section we extend the basic setup of the FC model and simulation to include spillovers, and in the following section we do the same for linkages,

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2 As explained in the next section, the footloose capital model is an appropriate framework for analysis of this constellation, since the exclusion of various non-linearities makes it less prone to extreme solutions than core-periphery models. Yet even in the FC model, strong differences in market size tend to generate extreme solutions.
in order to see whether these extensions increase the predictive quality of the simulations. In the last section we conclude that positive FDI spillovers could not be detected, whereas the linkage effects appear to be significant.

2. A Linear Footloose Capital Model

NEG has developed a variety of models to simulate location of industries. The choice is between models, where workers, capital owners, or just capital units are on the move. For our purposes, a model with capital flows appears to be the best choice, since factor movements in terms of capital appear to be much stronger than labour migration across the Baltic Sea (Kielyte and Kancs 2000).

Two alternative frameworks with capital flows are the ‘footloose entrepreneur’ and the ‘footloose capital’ models. In the former setup, owners of firms move along with capital, i.e. they consume their income in the region where their firms are (re-)located. We rule this out on the basis of realism. Under present conditions, not many shareholders of multinational enterprises that invest in the Baltics move there. Hence we choose the FC model, in which only capital moves, but not its owners. Moreover, we use the linear setup of the FC model in order to avoid the problems that would come with bifurcations, hysteresis, and other complications of non-linearity. The framework permits us to deal with non-symmetric regions, such as the Nordics and the Baltics. Two opposite forces create incentives for profit-maximizing firms to move to or leave a region, with the additional influence of efficiency: the positive profit effect of market access and the negative profit effect of market crowding. That way firms will not (except under extreme conditions) agglomerate completely in one region. The smaller region might have a smaller market, but it offers a less competitive environment. Therefore, some firms find it more profitable to locate in a small region. Efficiency also influences firm location in so far as lower costs translate into higher profits.

The FC model is a 2x2x2 model with two regions, two factors of production and two sectors - and hence two goods (Baldwin et al. 2003, ch. 5). In our case, the regions are called the Nordics and the Baltics. The two sectors are agriculture $A$ and manufacturing $M$. Factors of production are labour $L$ and capital $K$; their owners are in both cases assumed to be geographically immobile. Physical capital can be moved costlessly from one region to the other. So $s_N$, the share of ‘world’ capital employed in the Baltics, is allowed to differ from $s_K$, the share of world capital owned by residents in the Baltics. $s_L$ is the share of the world endowment of $L$ that is employed in the Baltics. Capital movements across the regions are generated by capital owners’ search for the highest nominal profit $r$. Since the owners spend their capital income in the region where they live, price index changes in the region where the capital is employed are of no direct concern. This means that even if more capital becomes available in one region through faster growth or a rise in saving, the decision where to put that capital to work is made by the workings of the FC model. Remember that the resulting $s_n$ gives us the relative and not the absolute share of industry. Capital flows are modelled through the standard ad hoc ‘migration’ equation (see Baldwin et al. 2003, ch. 2). This yields a change in the Baltic share of employed capital, $\dot{s}_n$. In the following, Nordic variables are denoted by asterisks.

$$\dot{s}_n = (r - r^*)(1 - s_n)s_n$$ (1)
The structure of the agricultural sector is kept as simple as possible. The sector supplies a homogeneous good, the A-good, under constant returns to scale, using labour as the only input. The sector is perfectly competitive, and unit costs are $e_A w$, where $e_A$ is the technology parameter and $w$ the wage rate. Agricultural wages in the Baltics $w$ and Nordic $w^*$ are not equalized, but agricultural goods can nevertheless be traded. The agricultural good $A$ serves as numeraire and it is assumed that $e_A = 1$. In the original linear footloose model, workers can switch between industries, which equalises wages. Here, we allow wages to differ between regions.

The manufacturing sector is monopolistically competitive. A range of $n$ firms produces a differentiated M-good of $n$ varieties, such that the total number of varieties (across the two regions) can be written as $n^\Omega = n + n^\star$. The firms use $K$ exclusively as a fixed-cost input $F$ (e.g. for setting up a factory), while $L$ is the sole variable input. The total cost of producing $x$ units of a variety of the M-good can thus be expressed in terms of a linear function with fixed and variable costs, $F + (w / e_M) x$, which captures increasing returns to scale. Exports of the M-good to the other region are costly. It is assumed that the costs of shipping one unit of the M-good between the Baltics and the Nordics are $\tau$ units of the A-good, and that they are paid by the exporting region.

Preferences are described by the quasi-linear quadratic utility function:

$$U = \alpha \int_0^{n^\Omega} x_i^2 di - \frac{\beta - \delta}{2} \int_0^{n^\Omega} x_i^2 di - \frac{\delta}{2} \left( \int_0^{n^\Omega} x_i^2 di \right)^2 + C_A,$$

where $\alpha > 0, \beta > \delta > 0$, $x_i$ is consumption of variety $i$ of a manufactured good, and $C_A$ is consumption of the agricultural good. Preferences in the two regions are identical. Utility optimization produces linear demand for the typical variety $j$ of the manufactured good:

$$x_j = a - (b + cn^\Omega) p_j + cP,$$

with

$$p \equiv \int_0^{n^\Omega} p_i di, \quad a \equiv \frac{\alpha}{\beta + \delta(n^\Omega - 1)}, \quad b \equiv \frac{a}{\alpha}, \quad c \equiv \frac{\delta b}{\beta - \gamma}.$$

Demand depends on the own price, $p_j$, and on the average price $P$ of other firms. Income does not influence demand due to the special form of the utility function.\(^3\) Demand for the agricultural good is determined as a residual. Total demand is (3) multiplied by the number of consumers.

The typical firm in the Baltics thus maximises total profits as follows:

$$\pi = ( p - (w / e_M)) [a - (b + cn^\Omega) p + cP] M + (p - (w / e_M) - \tau) [a - (b + cn^\Omega) p + cP^*] M^*,$$

\(^3\) Baldwin et al. (2003, ch. 5) argue that neglect of income effects has little impact on the logic of agglomeration, and that this form of utility function helps to avoid the exaggeration of market size differences that tends to occur in models with CES utility functions.
with
\[ H \equiv s_L L^\Omega + s_K K^\Omega, \quad H^* \equiv (1 - s_L)L^\Omega + (1 - s_K)K^\Omega \] (6)

\( H \) and \( H^* \) are the numbers of consumers in each region and \( p \) and \( \bar{p} \) are the prices that Baltic firms charge in their home markets and in their Nordic export markets respectively. As firms are assumed to compete in prices, consumer prices of domestic and foreign varieties in the Baltics are:
\[ p = \frac{1}{2} \frac{2[a + (w/e_M)(b + cn^\Omega) + \tau cn^*]}{2b + cn^\Omega}, \quad \bar{p}^* = p + \frac{\tau}{2} \] (7)

Equilibrium prices are not simply mark-up prices as in other NEG models, but depend on spatial distribution of firms. The reason is that trade costs protect local firms from foreign competitors. It is assumed that trade costs fulfil the condition \( \tau < \frac{2(a - b a_M)}{2b + cn^w} \), such that there can be two-way trade. Dividing firms’ operating profits by the invested \( F \) units of capital yields the rate of profit:
\[ r = (b + cn^\Omega) \left[ (p - (w/e_M))^2 + (\bar{p} - (w/e_M) - \tau)^2 H^* \right] / F \] (8)

The equilibrium number of firms is determined by:
\[ n = s_n K^\Omega / F \] (9)

In the long run, capital is mobile between regions. As firms are defined by capital input, the distribution of capital and firms is identical. Long-run equilibrium is characterized by a no-arbitrage condition, stating that there are no more profit incentives to move:
\[ r = r^*; \quad 0 < n < 1 \]
\[ r > r^*; \quad n = 1 \]
\[ r < r^*; \quad n^* = 1 \] (10)

The first expression holds for interior equilibria where manufacturing firms are located in both regions, whereas in the other cases all industry would agglomerate either in the Baltics (\( n=1 \)) or in the Nordics \( n^*=1 \). Substituting (8) into (10), using (7), yields the profit differential:
\[ r - r^* = \tau \left\{ 2(2a - 2b(w/e_M) - b\tau) \left[ (s_L - \frac{1}{2})L^\Omega + (s_K - \frac{1}{2})K^\Omega \right] \right. \\
- c\tau (L^\Omega + K^\Omega)(n - \frac{1}{2}) \right\} \] (11)

Equation (11) closes the model. The profit differential determines the change in the Baltics’ share of employed capital as described by equation (1).

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4 Admittedly this setting of prices implies the possibility of dumping; for a discussion see Ottaviano et al. (2002), p. 417.
3. Simulation

The FC model is a highly stylized story in which the world is represented by two regions (or countries), two types of goods, and two production factors. It may be doubted whether it makes sense to run ex-post simulations with this model using data from a sample of 22 out of 99 NACE sectors (group D - manufacturing), of 6 out of 27 EU countries (not to speak of the rest of the world), and with capital flows confined to FDI. There are at least two possible mechanisms of industry relocation. The first works via FDI from one region to the other (though not all statistically observed FDI implies relocation). The second works via ‘independent’ exits of firms in one region and entries of firms in the other; for example, firms in the Nordics would close down, because they cannot compete with firms in the Baltics. If the Baltic newcomers are financed with loans or portfolio investment from Nordic capital owners, we have a second variety of FC. This is considerably more difficult to identify in the data. Yet we think that our simulation exercises yield some valuable insights into the potential as well as the difficulties of carrying out empirical studies based on the FC model.

We have run our simulations industry by industry, bloc-wise for the regions (Nordics - Baltics in the aggregate), but also for all Nordic - Baltic pairs of countries (which gives us nine cases). The partial-analysis character of the FC model, which derives from the suppression of income effects through the choice of a quasi-linear quadratic utility function, may be considered as a general drawback of the model. Yet here it is an advantage, because it permits us to look at changes in the Baltic shares of employed capital in each industry in isolation. The simulations are based on annual data, as no higher frequency was consistently available. The simulation results are driven by the parameters, some of which are permanent while others are time-specific.

Table 1 lists the parameters of the FC model. The list is not complete, as some parameters are eliminated by way of normalization, while others are only of technical importance. Parameters $a$, $b$, and $c$, which are not listed above, determine the love for variety. The endogenous variable in the simulation is the relative share of capital employed in the Baltics, $s_n$.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>$\tau$</td>
<td>trade costs between regions</td>
</tr>
<tr>
<td>$s_K$</td>
<td>Baltic share of owned capital, $K$</td>
</tr>
<tr>
<td>$s_L$</td>
<td>Baltic share of employed labour, $L$</td>
</tr>
<tr>
<td>$e_M$</td>
<td>productivity of Baltic manufacturing production (by year)</td>
</tr>
<tr>
<td>$w$</td>
<td>wage in Baltic region (by year)</td>
</tr>
<tr>
<td>$K^\Omega$</td>
<td>absolute value of total capital</td>
</tr>
<tr>
<td>$L^\Omega$</td>
<td>absolute value of total labour</td>
</tr>
</tbody>
</table>

Source: own table

We do not change trade costs from year to year in our model in order to avoid results being driven by their changes. For the endowment parameters $s_K$, $s_L$, $s_n$, $K^\Omega$, and $L^\Omega$, we have used data for capital formation and labour force that are available from national statistical offices. Table 2 shows Baltic shares of the combined labour force in 1995, pairwise, related to Nordic
countries. Hence, the share of Estonia in the combined labour force of Estonia and Denmark is 18.4 per cent. Due to asymmetries in the size of populations in the two blocs, the calculated shares do not vary much from year to year; therefore, we take 1995 labour shares as the basis for all calculations, given that our simulations start with the following year.

Table 2. Actual labour shares of the Baltics in the total of Nordics and Baltics, 1995

<table>
<thead>
<tr>
<th>Country</th>
<th>Denmark (DK)</th>
<th>Finland (FI)</th>
<th>Sweden (SE)</th>
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<tbody>
<tr>
<td>Estonia (EE)</td>
<td>0.184</td>
<td>0.204</td>
<td>0.127</td>
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<tr>
<td>Latvia (LV)</td>
<td>0.273</td>
<td>0.300</td>
<td>0.195</td>
</tr>
<tr>
<td>Lithuania (LT)</td>
<td>0.365</td>
<td>0.396</td>
<td>0.271</td>
</tr>
</tbody>
</table>

Source: Eurostat, own calculations

For analytical convenience we assume that the distribution of owned physical capital is equivalent to that of labour, \( s_K = s_L \). There are, of course, large differences in owned capital stock between the Nordics and the Baltics, due to differences in both the sizes of their economies and their histories. Yet the purchasing-power adjusted incomes from capital, which matter here, may not be all that different. It might also be objected that differences in capital endowment actually induced the capital flows (FDI and others) that could be observed during the transition process. However, in the context of the FC model, spatial distributions of capital ownership and capital usage are detached from each other, and shares in capital ownership affect market size only weakly through consumer demand.

The global endowment-value parameters, \( K^Ω \) and \( L^Ω \), have also been simplified. \( K^Ω \) was normalized to 1. In this way, \( s_n \) becomes an expression for both the share and the absolute number of firms. \( L^Ω \) is set to 15, so that the share of the manufacturing sector in total GDP amounts to about 20 per cent. Even though this setting is unrealistically low, it is required in order to keep the model open for the possibility of full agglomeration, so that the A-sector is big enough to pay for transport costs.

Note that while endowments matter for the demand side, wages do not. Discussing the location of single industries in a partial-analysis perspective, it is assumed that wages matter only as a cost factor, and hence exclusively on the supply side. The last parameter is the industry-specific technology parameter \( e_{m} \). Together with wage \( w \) it determines comparative advantage in the model through Ricardian differences in technology. In the real world, wage differences between the Baltics and other EU regions have played a major role in explaining relocation of industries to the accession countries (EU Commission 2003). Data for wages and productivity are taken from Eurostat as available for the period 1997-2007. Industries are represented by NACE groups. Data gaps in some Baltic cases before 2000 were filled using estimates. Whenever plausible, we used average annual growth rates calculated from available values. In all other cases, gaps were filled by the productivity figures of the following year.

Based on these parameter definitions, the simulation yields the Baltic share of employed capital, \( s_n \). Its changes over time indicate industry relocation. The variable \( s_n \) can be calculated for every NACE group. We think it insightful to select one industry for evaluation of the model.
We have chosen NACE 20, the wood industry,\(^5\) because it is the only sector that shows significant output in all six countries and significant FDI stock in all three Baltic States. This choice might seem odd, since endowments play a role in this industry. However, Moroney (1975) shows that labour costs and resource endowments are complementary explanations for trade. Endowments of wood are not exhausted but managed, since it is a renewable resource. Also, the wood industry comprises more than wood cutting (but stops short of furniture).

Table 3. Equilibrium values of \(S_n\) in industry NACE 20 in per cent, projected and real (wood and wood products), Baltic aggregate

<table>
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<tbody>
<tr>
<td>projected</td>
<td>20.6</td>
<td>20.8</td>
<td>20.8</td>
<td>19.9</td>
<td>21.5</td>
<td>21.5</td>
<td>21.2</td>
<td>21.2</td>
<td>21.2</td>
<td>20.8</td>
<td>20.6</td>
</tr>
<tr>
<td>real</td>
<td>5.4</td>
<td>6.2</td>
<td>7.2</td>
<td>8.9</td>
<td>10.0</td>
<td>11.6</td>
<td>15.5</td>
<td>13.9</td>
<td>15.1</td>
<td>15.0</td>
<td>15.6</td>
</tr>
</tbody>
</table>

Source: own calculations

Table 3 shows the results for the bloc simulation, where the Baltics are aggregated as one region and the Nordics as the other. Here \(s_n\) denotes the aggregate Baltic share of total industry. Between 1997 and 2002, the equilibrium share of the wood industry in the Baltics rose from around 20.6 to 21.5 per cent. Given that the adjusted share of labour, \(s_{Ln}\), in the Baltics amounts to 26 per cent, the result does not seem to indicate the expected catching-up. The result does not compare too well with reality, which is shown in the second row. From 1997-2002 we see some catching-up, while from 2003-2007 the Baltic share of industry stagnates.

Table 4 reports the results for the 3x3 country-wise simulations. These are shown in the upper half of the table. For example, the equilibrium industry share of Estonia in relation to Denmark is 9.4 per cent in 1997, rises slightly to 10.9 in 2002, and falls to 9.2 in 2007. The real share of industry is calculated by dividing the Baltic country’s production by the combined production of the two countries and is given in the lower half of the table. We see an increase in the share of the Baltic country \textit{vis-à-vis} the Nordic country in all rows. This increase is much more pronounced in the real world data than in the simulated data. It should be kept in mind, though, that the simulations pertain to long-run equilibrium values, whereas the real data also reflect short-run fluctuations.

A major cause for discrepancies between the simulated and real data is certainly to be found in the foreign borrowing that took place in the Baltics prior to the great financial crisis, which started in 2007. Foreign borrowing increased local demand and corresponding wage rises, almost a doubling of wage levels between 2002 and 2007, entered the simulations with the effect of pushing industry away from the Baltics, when in reality it tended to pull industry towards these countries due to a relative increase in demand. It should be noted that there is a certain trade-off between applicability of the FC model to real world data, as compared to NEG models that include demand effects in terms of circular causation, and the neglect of demand effects in the FC model. On the other hand, the statistical demand effect of 2003-2007 should not be overrated, since a large fraction may be of a transitory nature. The partly drastic adjustments in the external accounts (in particular of Latvia) that took place in the wake of the global credit crisis, may - once the post-2007 data become available - change the picture towards stronger parallelity in the real data and the simulation results.

\(^5\) NACE 20 includes manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.
With respect to the question of bloc versus country simulations, we find that results vary. If countries are grouped in a bloc, much valuable information is lost due to aggregation. The correlation coefficient is just 0.34 for the bloc-wise simulation, lower than any of the country-wise simulation coefficients. The country-wise simulations yield results that in most cases fit reasonably well.

4. Foreign Direct Investment and Exports

To check the predictions of the FC model, we confront them with statistical indicators of industry relocation. As discussed in earlier sections, we assume that a positive change in $s_n$ corresponds with a significant inflow of FDI⁶ in the respective industry, and that a high value of $s_n$ correspondingly implies a relatively large stock of Nordic FDI in the Baltics. Moreover, an increase in $s_n$ should normally go along with a rise in exports of the same industry. Finally, comparing the changes in sectoral output in both regions should also give a clue about the validity of the model. Here we set the focus on the wood industry in Latvia, as sectoral FDI data were available only for this country, in time series that are consistent only until 2004.

As Table 4 has shown, the model predicts industry relocation from all three Nordic countries to Latvia in the years 1997-2003. The extent of industry relocation seems to be the biggest in the case of Sweden. Firms from both Finland and Denmark are predicted to relocate at a lower rate. In absolute terms, industry relocation from Denmark to Latvia is most significant.

Table 4. Simulated equilibrium and real values of $s_n$ in the industry NACE 20 (wood and wood products) in per cent

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<tbody>
<tr>
<td>EE-DK</td>
<td>9.4</td>
<td>9.3</td>
<td>9.5</td>
<td>9.4</td>
<td>10.0</td>
<td>10.9</td>
<td>10.6</td>
<td>9.8</td>
<td>8.5</td>
<td>9.3</td>
<td>9.2</td>
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<td>EE-FI</td>
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<td>7.9</td>
<td>8.0</td>
<td>8.3</td>
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</table>

Source: own calculations

⁶There are different types of FDI, such as greenfield FDI, M&A, and joint venture; not all of them are connected with industry relocation. However, disaggregated data were not available.
If we compare this with the data displayed in Figure 1 we see that the model does not fare too badly, at least in regard to signs of change. Exports and FDI increased in relation to all the Nordic countries.

**Figure 1.** Exports (continuous line, left scale) and FDI stock (dotted line, right scale) in the Latvian wood industry, in million euros

![Graph showing exports and FDI stock over time](image)

Source: Central Statistical Bureau of Latvia

Rates of change, on the other hand, differ significantly. Danish FDI has increased more strongly than predicted, in line with exports to Denmark. Exports to Sweden rose much more (in absolute terms) than FDI from Sweden. Exports to and, in particular, FDI stock from Finland are much smaller than one would assume from the simulation. These differences are certainly explained by market structures not captured by the model, and probably also to some extent by calibration of various parameters. It is also quite plausible that Finnish FDI and trade have been concentrated in Estonia, due to proximity - not only in distance, but also in language and other cultural aspects. Accounting for these links by a reduction of relative trade costs between Finland and Estonia would improve the result of the prediction.

Looking at the growth of simulated equilibrium values of $s_n$ between 1997 and 2003 in Latvian industry NACE 20, it is interesting that the value is highest in relation to Sweden (21.2 per cent, compared to 4.1 for Denmark, and 13.1 for Finland). This is reflected in the data. Swedish imports and FDI are rising faster than those of the other Nordics. The data also support the more general predictions about industry relocation from the Nordics to the Baltics. In table 5 we find that output growth in the Baltics outperforms that of the Nordics. Hence, we can conclude that there is a relative increase in production in the Baltics. Summing up, the example of the wood industry appears roughly to confirm the predictions of the FC model. It would be interesting to add spillovers and linkages to the model to see if interactions between multinationals and local firms have any effect on industry location.

---

7 Annual mean values for 1996-98 in terms of DM/LVL, recalculated by 1 EUR = 1.95583 DM.
Table 5. Output in million euros, NACE 20

<table>
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<td>1,745</td>
<td>1,744</td>
<td>1,864</td>
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<td>505</td>
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<td>986</td>
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<td>697</td>
<td>805</td>
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<td>296</td>
<td>355</td>
<td>435</td>
<td>510</td>
<td>582</td>
<td>694</td>
<td>782</td>
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<td>4,603</td>
<td>4,820</td>
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<td>5,186</td>
<td>5,303</td>
<td>5,608</td>
<td>5,679</td>
<td>5,728</td>
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<td>7,688</td>
<td>7,883</td>
<td>8,091</td>
<td>8,981</td>
<td>10,350</td>
<td>1.51</td>
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</table>

Sources: Eurostat, Central Statistical Bureau of Latvia, own calculations

5. Spillovers

The occurrence of technology spillovers is a possible side effect of cross-border flows of capital. In such cases, technology is transmitted from newly arriving multinational enterprises to domestic firms. There is a large literature about spillovers from FDI, mostly based on standard neoclassical and endogenous growth theories (Javorcik 2004 provides an overview). The Baltics are quite small, so we treat them as regions. We limit the model to intra-regional spillovers and linkages since there are no data on inter-regional trade and input/output relations for the Baltics. The simplest and most direct case is a pure technological spillover from an arriving firm that affects the productivity of local firms. Productivity of local and newly arriving (foreign) firms should converge as more firms move from one region to the other. Inclusion of technology spillovers changes the dynamics of the model (of section 3) as circular causation becomes possible. A simple modification of the productivity measure that keeps the FC model tractable is necessary:

\[ e_M^{\text{new}} = (1 + s_{n,t-1} - s_{n,t})e_M + (s_{n,t} - s_{n,t-1})e_M^* \] (12)

The change in \( e_M^{\text{new}} \) hence depends on the change in \( s_n \), i.e. productivity reacts, with a lag, to relocation. Positive technological spillovers can be expected if \( s_n \) has risen and foreign productivity \( e_M^* \) is higher than domestic productivity \( e_M \). This is of course only a first approximation, since the lag structure may differ in reality and other determinants may play a role. Moreover, we have assumed that wages do not immediately adjust.

We tested for spillovers, starting from the case of Latvia again. In addition to NACE 20 (wood industry) we selected NACE 31 (electrical machinery and apparatus), since horizontal spillovers should be stronger in high-tech industries, as compared to low-tech sectors.

Table 6 describes the changes in the location of industry in NACE 20 and 31 for the case of Latvia and Finland. There should be a feedback in the sense that simulation of the FC model including \( e_M^{\text{new}} \) yields a different configuration of industry location \( s_n \). Nevertheless, if technology spillovers are included in the FC model (FCTS), location of firms in both NACE 31 and NACE 20 does not change significantly. Possibly our extended model underestimates the effects of spillovers, as the latter might not be linear functions of the presence of multinational firms. In NACE 31 the actual size of the industry in Latvia is so small that spillovers might be hard to detect, if they occur at all. Our time series may also be too short to account for the lags that typically exist between the arrival of FDI and their effects. Barrios et al. (2005) found that the net effect from the entry of multinational enterprises (MNEs) is negative at first.
and then turns positive as more and more foreign firms arrive; in addition to time, the number and share of MNE in the industry may thus play a role. In contrast to other studies, wages adjust to changes in productivity with a lag of one year and erase competitive advantages. In the end, we find no proof of horizontal technological spillovers from FDI. This is in line with the results of other studies, but it could also be due to limitations in the data.

6. Linkages

Industries are not autonomous, but trade goods with each other. The output of one industry might be the input of another. Following Hirschman (1958), this constitutes a vertical linkage. The input-output flows through such vertical linkages might change when foreign MNEs arrive (see figure 2).

Assuming that FDI takes place in industry B, there might be a rise in domestic demand in a sector that provides inputs to the MNE (backward linkage to industry A). On the other hand, the MNE might provide a cheaper input or new variety to a downstream sector (forward linkage to industry C). Since firms making investments abroad are on average more productive than domestic firms (cf. Melitz 2003), we expect inward FDI to have positive linkage effects. As pointed out in the introduction, existing versions of the FC model use CES aggregates of all varieties of the manufactured good as intermediate goods. In our view, this procedure does not (appropriately) take account of vertical linkages, as they can be identified from input-output tables and other relevant data, so we develop two different approaches to incorporate linkages into the FC framework.

The first approach takes account of backward linkages, as described in figure 2 by the supplies of inputs for industry B by industry A. We assume that a rise in the Baltic share of firms in industry B, $s_n^{\text{back}}$, feeds back to industry A. Increased local production in industry B raises demand for inputs from industry A, affecting the prices in that industry. For the sake of simplicity, we assume that the maximum rate of price change corresponds to the share of the deliveries of A to B in the total production of A. A higher price leads to higher profits in the region, which attracts firms.

---

A feedback to the demand side would result, which is not modelled here. It would be interesting to pursue this road in future research.

---

### Table 6. Simulated equilibrium and real values of $S_n$ in industry NACE 20 (wood) and NACE 31 (electrical machinery and apparatus)

<table>
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<th>2001</th>
<th>2002</th>
<th>2003</th>
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<th>2007</th>
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<td>0.26</td>
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<td>0.28</td>
<td>0.29</td>
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Source: own calculations
The new price of a variety is described by

\[
p = \frac{1}{2} \left[ a + \left( \frac{w}{e_M} \right) (b + cn^F) + \tau cn^* \right] \times \left( 1 + 2 \varepsilon_n^{back} - \varepsilon \right)
\]  

(13)

The right-hand part in brackets represents the rise in price caused by changes on the demand side. \( \varepsilon \), the price elasticity of demand for a specific input, affects pricing of the final good. We demonstrate this with an example. In Estonia, the wood industry (NACE 20) gets inputs from NACE 26 (manufacture of other non-metallic mineral products) that amount to about two percent of the latter sector’s total output. Now we need to make some assumption about how changes in demand translate into prices. Therefore, we posit that changes in NACE 20’s demand for a NACE 26 product can change the price of that product in the range of -2 to +2 per cent, so that \( \varepsilon = 0.02 \). If all the wood industry is located in the Nordic country \( S_n^{back} = 0 \), equation (13) yields the original price multiplied by 0.98. For the Nordic country, the multiplier would be 1.02 (see equation (7) for the original version). The bracket on the right of equation 13 is only there to get a multiplier of \( S_n^{back} = 0 \). If the wood industry is distributed symmetrically (\( S_n^{back} = 0.5 \)), the multiplier takes on unit value. A higher price is positive for the firms in the region, since its costs do not change. This means that profits rise.

Table 7. Simulated equilibrium values of \( S_n \), in per cent, industry NACE 26
(Manufacture of other non-metallic mineral products)

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<td>9.8</td>
<td>10.8</td>
<td>14.5</td>
<td>13.7</td>
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Source: own calculations

Table 7 shows the results for the case of Estonia and Finland. The extended model (FCBL) features backward linkages. It predicts an Estonian share in NACE 26 that is lower than that of the basic FC model. In 1997, the share of firms of NACE 26 locating in Estonia is predicted to be 7.8 per cent (FCBL) against 11.0 (FC) and 5.7 (reality). The reason for this discrepancy is the backward linkage: As firms in NACE 20 are predicted to be mostly located in Finland (and the other Nordics), that region enjoys the advantage of higher local demand

Figure 2. Linkages and spillovers resulting from foreign direct investment

Source: own graph
The share of firms of NACE 20 in the Baltic region that we used is an average of the three individual shares of the Nordic countries.
of wearing apparel (NACE 18). This is a classic vertical linkage where one would expect an influence of the prices of one industry on the other.

We have calibrated the FCFL model for Latvia in the period 2000-07 based on a 1998 input/output table from Latvia’s CSB 2003. Earlier data on productivity in the Baltics is not available. The results are given in table 8, where they can be compared to the original results of our simulation. Note that equilibrium values of $s_n$ in the FCFL model are lower than in the benchmark FC model. This is because the intermediate industry is located mostly in the Nordics, which lowers the input costs of that region’s intermediate products there. Only if the relatively small Baltic economies were to succeed in attracting a share of the textile industry that exceeds their share in total labour would they gain competitiveness in the wearing apparel industry.

Table 8. Simulated equilibrium values of $S_n$ in industry NACE 18 (wearing apparel)

<table>
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<tr>
<th>Countries</th>
<th>model</th>
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Source: own calculations

Inclusion of forward linkages tends to produce a less positive result for the Baltics because the home-market effect, which normally plays against them, gains in strength. This downward correction seems realistic from 2000-2003, at least in the case of Latvia versus Denmark and Finland. In 2004-2007 the FC model is the better fit. The case of Latvia versus Sweden fails spectacularly.

We have discussed two extensions of the FC model. The first features backward linkages, the second forward linkages. Both work to the effect that the region with a higher share of industry in the upstream/downstream sector gains more industry than in the benchmark FC model. The transmission channel is prices, for inputs in the case of forward linkages, for final products in the case of backward linkages. Inclusion of vertical linkages creates an additional agglomeration force, as suggested by Venables (1996). In our case this new force works against the Baltics and lowers their share of industry compared to the basic FC model. Our empirical findings support some of the predictions from the model.

The implication of the FCVL models is that the arrival of an MNE in the Baltics should have positive effects on upstream and downstream sectors through price effects. Most FDI would thus induce more firms to enter up- or downstream sectors. This follow-up movement would in turn generate another round of feedbacks. The effects are cumulative, as they are all advantageous to the receiving region’s industries. In the end, the arrival of a MNE could trigger a ‘FDI wave’ or a ‘relocation wave’. If threshold values can be identified, the model might
be able to explain the volatility of FDI. Our time series are too short to provide any evidence in that respect.

7. Conclusion

Some interesting results emerge from our attempt to apply the FC model to an empirical study. In general, the model is suitable for describing important aspects of the economic integration of the Baltics and the Nordics. There is continuous change in the distribution of firms between the two groups of countries. Some of it may be due to faster growth of new firms and/or output per firm in the Baltic country, but much of it can be explained by the activities of MNEs in terms of FDI flows from the Nordics to the Baltics. We have applied the FC model in two ways: bloc-wise and pair-wise simulations. The country-by-country results were more pronounced and corresponded better to the real data. The bloc simulations delivered a ‘one size fits all’ result, suggesting that the Baltics were not treated very differently by firms. This does not accord with real data. Even though the Baltics are small, it seems important to treat them as separate entities when calculating the distribution of industry locations. We encountered various problems in the empirical application of the FC model. Due to data restrictions, relevant parameters were hard to come by.

Empirical research on technology spillovers and so-called vertical spillovers is normally conducted by using a growth theory framework. We have come up with a new approach by using a NEG model which we amended to feature spillovers and linkages. The two categories of secondary effects of FDI can be separated analytically, and the simulations that have been redefined accordingly yield the expected results. As in most of the empirical literature on FDI spillovers, we have not detected any significant positive spillovers from FDI in the Baltics. This may also be due to limitations in our data, given that we have only short time series for the economies in question. The quality of our simulations can be improved by incorporating vertical linkages. The Baltic share was predicted to be lower in all industries due to the fact that the relevant downstream or upstream firms were mostly located in the Nordics. In industries where I/O linkages are significant, the arrival of MNEs is generally expected to create benefits for down- and upstream firms. However, our results lead to the tentative conclusion that the speed of such processes is slowed down by the relatively large weight of the linkages that MNEs have in their home countries.

The supply-side effects of inward FDI flows and productivity growth in the Baltics are possibly limited by the size of their home markets. Our model indicates that, due to this limitation, expectations of faster economic development through FDI inflows to the Baltics might have to be modified. In the period 2002-07, the markets in the Baltics apparently grew at much higher rates than predicted by our long-run oriented model. Yet much of the market growth in the real data was fuelled by foreign borrowing exposed as unsustainable after the outbreak of the great credit crisis in 2007. It remains to be seen in the real-world data of the subsequent five years whether actual adjustments in the external relations of the Baltics (in particular Latvia) lead to a greater convergence with the model predictions in the long run.
References


**Book Review**

*Economic prosperity recaptured: the Finnish path from crisis to rapid growth.*


Finland’s economic performance from the mid-1990s has been remarkable in spite of its having suffered a severe financial crisis at the beginning of the 1990s leading to the economy’s worst recession. How can we explain Finland’s success in negotiating the perils of financial turmoil and concomitantly transforming itself into a high technology economy?

Economic prosperity recaptured: The Finnish path from crisis to rapid growth tackles the topic head-on. Seppo Honkapohja, Erkki A. Koskela, Willi Leibfritz, and Roope Uusitalo write a concise volume building on the authors’ previous work (e.g. Honkapohja and Koskela, 1999) and also advancing fresh insights. The authors tell stories short and tall, meeting with considerable success in throwing light on Finland’s experience.

The book contains seven chapters. Following the introduction in Chapter 1, Chapters 2 and 3 deal with the crisis and related policy mistakes. The country escaped the 1970s oil crisis relatively unharmed mainly due to agreements with the Soviet Union, and following a period of disinflation pursued liberalisation and deregulation policies during the 1980s. But reforming and liberalising led to an overheating economy – inflation doubled between the mid-1980s and 1990 - which subsequently collapsed at the beginning of the 1990s. The downturn was worsened by the parallel disintegration of the Soviet Union; the authors estimate that the Soviet demise accounts for roughly 3% of the 7% GDP decline in 1991. Finland’s collapse was followed by recovery and a successful transition to a high-tech, thriving economy from the mid-1990s.

The Finnish crisis of the 1990s is rather similar to events in Mexico during the 1994-1995 ‘Tequila crisis’, Asia during 1997-1998 (beginning with the Thai baht’s devaluation in 1997), Russia in 1998, Brazil in 1999, Turkey in 2000, and Argentina in 2002. Finland’s crisis evolved from various factors, including an increasing private sector debt alongside capital flows encouraged by a higher domestic interest rate in relation to foreign rates.

Finland also had debt and illiquidity problems. Furthermore, the country’s monetary policy stance gave the impression that the exchange rate could be kept stable, which was a further factor encouraging bubbles in real estate and other asset prices. But these monetary and exchange rate policies were unsustainable: Finland devalued the markka in November 1991 and floated the currency in September 1992, adopting an inflation targeting regime. In explaining
historic monetary policy setting in Finland, the study could have benefited from running a formal econometric exercise. Empirically estimated reaction functions can provide valuable information for discussing monetary policy.

The book does explain other important mechanisms operating during the crisis. Increasing bank lending tends to precede crises, as was also the case in Finland. The conclusion arises from empirically estimating a consumption function revealing that credit growth contributed to private consumption growth and collapse before and after the crisis. Econometric modelling indicates the likely existence of threshold effects in the impact from finance to consumption, but the analysis does not attempt to explore that feature of the data.

The 1991 banking crisis ended up costing around 7.5% of GDP in 1992. Growing bank lending was not the problem itself, but regulation and supervision did not advance at the same pace, and banking surveillance only improved after 1991. As a result of the crisis, the banking system was reformed and wide-ranging restructuring took place. The stabilisation attempt also benefited from Finland’s centralised wage bargaining. The book also draws attention to the positive role of labour market training programmes in setting the stage for the economy’s recovery and subsequent take-off.

Chapter 4 focuses on the growth and structural changes following the crisis. Globalisation is a theme in the chapter and Finland has benefited from opportunities arising from the increasing volume of global trade. The study explains productivity growth as resulting mainly from changing total factor productivity (TFP). TFP growth contributed to rapidly closing the output gap arising from the financial crisis.

But not all recoveries from crises rest on higher productivity growth and economic transformation. For instance, the Dominican Republic, a small emerging market economy, suffered a banking crisis with events similar to those occurring in Finland (Sánchez-Fung, 2005). As is often the case, the subsequent recovery was mainly consumption-based and fuelled by an appreciating currency after initial overshooting in the 2003-2004 crisis.

So what was behind Finland’s ability to recover from the crisis while concomitantly becoming more competitive on the basis of technological advance? Chapter 5 explains the importance of human capital in the Finnish recovery. The investigation explicates that Finland was prepared to benefit from the turning tide as it had a qualified labour force. In fact, educational attainment measured using average years of formal schooling has been increasing during the last three decades. Engineering education is of good quality and appears to be a factor in explaining the economy’s transformation. But, unlike countries such as India that also have a strong technology-focused tertiary education system, Finland has been preparing from more basic levels and the country performs very well in standardised tests. Results for 15-year old Finnish children in the Program for International Student Assessment (PISA) examinations consistently top the rankings in sciences and math.

Chapter 6 focuses on the leap towards a technology-driven economy. Information and communication technology spearhead Finland’s growing prominence in the international economy and comprise a large amount of the country’s exports. Government-supported and private investment in research and development has been critical for the success of Finland’s techno-
logy ventures -the National Technology Agency (TEKES) has been an important institution in allocating funding.

The case of Nokia is revealing: the company was successful in transforming from its origins manufacturing cables, metals, and rubber products to being a powerhouse with the largest share in the global cellular phones market. It is worth noting the extent to which the company has benefited from government financial backing. The book reports that TEKES contributed about 10% of Nokia’s research and development expenditure in 1991, even though the support has been declining over time – it was only 0.4% in 2004. The strategy of using government money to finance the private sector is paying off: Nokia contributes to the rest of the economy not only directly but also via its suppliers and the positive spillover from its research and development activities to other technology industries and to academia. Other sectors are actively endorsed, such as biosciences, but the results from that course of action are still to be seen.

Chapter 7 concludes by highlighting the challenges that Finland faces going forward. Unemployment is relatively high for an otherwise fairly successful economy, remaining above pre-crisis levels. The authors also underline issues common to other rich economies: population aging and the implications of facing an increasingly more open and competitive global economy. The book should prove illuminating for anyone interested in economic growth and development. But potential readers should be warned that there is no recipe in the book as to how other countries could follow Finland’s path to consolidating a technology-driven economy.

References


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