Convergence through spillovers and linkages: The role of multinational enterprises

Ole Christiansen and Dirk H. Ehnts*
Department of Economics
Universität Oldenburg, Germany

September 2005

Abstract

The recent EU accession process with some central and eastern european countries (CEEC) becoming members of the European Union has led to a surge in interest in the economics of transition. One of the important questions is that of the location of industries. Will the new members attract so many multinational enterprises (MNEs) that a deindustrialization process will occur in the rest of Europe? Or are the agglomeration forces of the European core so strong that only low-skilled intensive industries move East?

We use the footloose capital (FC) model from Ottaviano et al. (2002) to predict industry location for Scandinavian and Baltic countries. We use different levels to apply the FC model, going from a region vs region setup to a 3x3 country matrix. A special setup exists for linkages and spillovers. Results then are compared to data (production, exports and FDI) on a two-digit level of the NACE classification.

We find that the FC model works better with countries than with multicountry blocs. The predictions of the model were mainly confirmed for the wood industry. We find that MNEs do move from Scandinavian to Baltic countries while there is also growing firm entry in Estonia, Latvia, and Lithuania. The role of linkages was relatively unimportant. Finally, convergence in technology through spillovers from MNEs might lead to divergence in industry location.

JEL classification: F150

Keywords: spillovers, linkages, multinational enterprises, foreign direct investment, Baltic States

Preliminary draft. Do not cite. Do not distribute. Thank you.

*Fak.II-VWL, Carl von Ossietzky Universität Oldenburg, 26111 Oldenburg, Germany. Contact: ole.christiansen@mail.uni-oldenburg.de, dirk@ehnts.de, http://www.globalization-and-employment.de

1 Introduction

The location of industry as a topic of economic integration has recently gained massive interest anywhere in the world. Outsourcing of services to India has triggered a political debate in the U.S.A., while the relocation of manufacturing to the CEECs started a pan-European debate on deindustrialization. The main point of the debates was the fear of the economically advanced nations that they would loose their main industries while it is not clear where new jobs would be created. The dynamics of comparative advantage at work now threatens the ongoing process of trade liberalization[1].

The main question in these discussions would be that of the location of industry. Where does industry locate? This question is getting interesting as regions integrate themselves into regional blocs (EU, WTO, etc) and abandon tariffs, quotas and other trade restrictions. In an autarkic world where economies have the characteristics of islands industry location would be dependent on regional factors. With international integration, the question is more complicated. Is the national level important for location of industry, or the regional level? Or are countries perceived as larger regions in which firms choose their location?

We will try to endeavor in this direction. Interesting recent theories like the New Economic Geography (NEG) have tried to shed light on related questions[2]. The trade-off between market-access and level of competition is one of the main findings of the subject, although one must admit that the idea is quite old. It was illustrated neatly by Lerner and Singer (1937) who wonder where two sellers of ice-cream would locate at a beach. It turns out that they chose to locate side by side in the middle of the beach.

Today, with the recent improvement in NEG models, new tools are available. The FC model of Ottaviano et al. (2002) seems to us as a good approach to industry location. We use this model to predict the location of industries in Scandinavian and Baltic countries. There is quite a menu to choose from when it comes to NEG models. We will explain later why we chose that specific model and discarded the others.

The model is calibrated to fit the Scandinavian countries of Denmark, Finland, and Sweden, which are then set up against the Baltic countries of Estonia, Latvia, and Lithuania. We chose industries of the manufacturing sector, services were omitted. The main share of FDI goes to the service sector, and trade in services has been increasing rapidly (OECD, 2004). However, services lack transport/transaction costs which are a main feature in the model. Also, they are mainly localized and harder to measure. The model predicts mostly the movement of firms from Scandinavia to the Baltic States. Hopefully, this is reflected in our data. We reckon that are there are

[1]The EU recently re-introduced quotas on Chinese textiles, see The Economist (2005)
[2]Fujita et al. (1999) give a very good overview on the applications of the NEG.

two possibilities for reflecting the movements of an industry's firms in the model:

1. Firms move from one country to the other. In the data this might be reflected by FDI flows and surging production and/or employment in one country while the other experiences at least stagnation.

2. Firms in one country go bankrupt while in the other country existing firms expand and/or new firms are created. This might be more difficult to detect in the data.

We expect to find this kind of behaviour in the empirical part of our paper. The simulations will be run for every industry, and for 9 country pairs - a 3x3 matrix of Scandinavian and Baltic countries. The model will be adjusted to account for linkages and spillovers.

In the center of the spillover argument is the positive spillover effect. The introduction of MNEs in a local economy is supposed to increase their neighbours productivity. This prediction mainly stems from the Endogenous Growth Theory[3]. Knowledge is supposed to be disseminated between economies which are integrating their markets. As a transmission mechanism there are trade and (inward) foreign direct investment. The latter is the only way to directly transfer technology, though. Spillovers cannot be internalized by their emitters. They are non-rival in consumption and non-excludable. This means that all firms can in theory benefit from spillovers, and the benefits are not dependent on the number of firms enjoyed the spillover.

Actual spillover channels are identified by the literature as the (negative) competition effect, the learning effect, the demonstration effect, and the worker movement effect. These are the main effects. Competition damages local firms, while the other effects are positive. Local firms might learn from MNEs, and they also might imitate processes or products. Spillovers are not dependent on market transactions and cannot be forestalled once the MNE has established its facility in the host economy.

Linkages are of a different nature. The name associated with them is Albert Hirschman, who wrote a book on development[4] in which he described his idea of growth via linkages. Hirschman recognized that industries have different levels of interaction with other industries of the economy. While some industries do not need many inputs, there are some who source a lot of products locally. This is equivalent to backward linkages. Also, some industries' output is vitally important for other industries. For instance, a country without a steel industry was at disadvantage during Hirschman's time when trying to develop a car industry. That would be a forward linkage.

[3]see Romer (1986)

[4]see Hirschman (1958)

Originally, linkages were applied to a whole industry. Hirschman's conclusion was that there exist industries which are very important to the economy as a whole because of its relations with other industries. Therefore these sectors should be subsidized in order to create enough linkages to other parts of the economy as to create enough growth to reimburse the original investment via taxes.

1.1 Related literature

Recent papers on the location of industry include Pusterla and Resmini (2005) and Midelfart-Knarvik et al. (2000). Both papers develop models which are econometrically estimated. Therefore, the approach is different. Midelfart-Knarvik et al. find that 'endowments of skilled and scientific labour are important determinants of industrial structure'. Also, forward and backward linkages matter. The authors pool the data for all countries, so they do not predict industry locations (or reasons for them) for explicit countries. Pusterla and Resmini look at the choice of locations of foreign firms in transition countries. They find that low-tech firms do not care so much about national borders as long as the country is likely to become a member of the EU. However, this approach is marginal as it only looks at the moving firms while the extent of movement is determined exogenously.

The empirical literature for linkages and the role of MNEs is relatively small. Aside from the old literature of input/output analysis it was preceded by the discussion of spillovers. Blomström (1983) started the literature by looking for spillovers of MNEs in developing countries. The setup of the research design was quite simple: Spillovers are present if industries with an above average share of MNEs exhibit higher than average productivity. An equation from growth theory was used to validate this point.

The developing literature was huge and its findings unsatisfactory. Results were varying from positive to negative spillovers while some authors found no spillovers at all. In a survey, Görg and Strobl (2001) speak of a publication bias: extreme results would be published while everything in between was likely to be suppressed. Recently, Martin and Bell (2004) in their study for Argentina used very specific survey data and were still not able to find spillovers.

New studies incorporate linkages as well as spillovers, Smarzynska Javorcik (2004) for instance looks for spillovers through linkages. Her results are mixed. What is clear, however, is that most empirical researchers are not bothered by economic theory. So far, none of the authors could explain the difference between linkages and spillovers. Concerning the results, it is also unclear what a positive relation between the presence of MNEs and above average productivity (or productivity growth) would prove. Do MNEs bring with them new technology that spreads over? Or are they attracted by high productivity (growth) in the first place so that they just react to economic processes?

The role of MNEs in the growth process is unclear, and maybe the questions asked will not lead to insightful answers. That is why we will take another route from here in this paper. We are not so much interested in how MNEs influence the local industry but rather in how shifts in the location of production are realized. If the path leads to convergence, then what kind of convergence will it be? There might be specialization between regions, with some industries fully agglomerated in one country, and there might be dispersion, where industries are located close to the consumers and the same technology is available almost everywhere.

The outline of the paper is as follows. Some short facts about Scandinavian and Baltic countries are given next. In a theoretical part 3 the linear footloose capital model (Baldwin et al. 2003) is introduced. Then the model will be calibrated for use with real word data and simulations will be run for different setups[5]. These results will be given in section 3.3, followed by an empirical test, where the predictions of the model will be evaluated. Section 4 concludes the paper.

2 Scandinavian and Baltic economies

The countries we then selected for the simulation were chosen mainly because of two considerations: Countries should not be too different in both groups so that results could be compared more easily. Also, the regions should trade between themselves enough to make changes in trade composition observable. All countries should also belong to the European Union[6]. We chose the Baltic countries of Estonia, Lithuania and Latvia and the Scandinavian countries of Denmark, Finland and Sweden[7].

While we know that the Baltic countries are not very similar in history, culture and economic aspects, they are quite similar in the aspects of our model: Distances to the Scandinavian countries are significantly but not extremely different, and the size of the countries is not too different neither. As of 2003 total populations for the countries are (in millions) 5.4 (DK), 5.2 (FI), 9.0 (SE), 1.4 (EE), 2.3 (LV), and 3.5 (LT). GDP in the Baltic States is from around (in billions of EUR) 8.0 (EE) to 9.9 (LV) and 16.3 (LT), while in Scandinavia GDP reaches 187.1 (DK), 143.3 (FI) and 267.3 (SE)[8].

[5]They include an alternative extension of the model. Simulations will include one industry and multiple countries.

[6]The accession of countries to the EU and their economic relations with existing members seem very promising as a story of integration, like that told by the FC model. Furthermore membership of the EU is important to get coherent data.

[7]Iceland and Norway also belong to Scandinavia. Neither of them is a member of the EU and they are both relatively far away from the Baltic States.

[8]All data is taken from the website of Eurostat.

Table 1: Lithuanian FDI stock by origin, in thousand LTL and shares

country	2001	2002	2003	2004
Total	9,337.3	10,661.9	13,183.8	13,699.4
Denmark	0.18	0.18	0.17	0.17
Sweden	0.17	0.16	0.15	0.15
Germany	0.07	0.09	0.10	0.10
Finland	0.06	0.06	0.06	0.09
USA	0.09	0.08	0.08	0.08

Source: Statistical Department of Lithuania (2004)

The spatial distribution of industry does not only depend on Denmark, Finland and Sweden. Nevertheless their influence is relatively high. Combined, the three Scandinavian countries account for around 40% of inward FDI stock in Lithuania (see table 1). The situation is not very different in Latvia. Here, the share of the three Scandinavian countries accounts for around 30% of inward FDI stock (see table 2). These numbers show the relative importance of Denmark, Finland and Sweden for the Baltic States.

Table 2: Latvian FDI stock by origin, in thousand LVL and shares

country	2001	2002	2003	2004
Total	1,067,248	1,168,155	1,273,048	1,291,028
Sweden	0.13	0.13	0.13	0.13
Germany	0.13	0.11	0.10	0.10
Denmark	0.12	0.11	0.09	0.09
Estonia	0.06	0.06	0.06	0.09
Norway	0.05	0.07	0,07	0.07
Finland	0.05	0.05	0.06	0.07

Source: Central Statistical Bureau of Latvia (various issues)

If one is to conclude that FDI inflows and FDI stock are a sign of firms moving from one country to another, then the net effect matters. If Baltic firms move to Scandinavia in the same proportion, then the overall effect is nil. Table 3 shows that FDI flows from Lithuania to Scandinavia are negligible. Overall Lithuanian FDI outward stock in 2001 amounts to 117.3 million LTL, which is around 32.8 million EUR. In that year, Lithuanian firms held only 20,000 EUR worth of investments in Finland, 240,000 EUR in Denmark, and 170,000 EUR in Sweden. This is not different in the other countries.

Table 3: Lithuanian direct investment abroad by country, in million LTL

country	2001	2002	2003	2004
total	117.28	191.42	197.05	330.5
Russia	12.99	38.54	29.99	98.31
Latvia	32.59	36.49	45.12	42.98
Finland	0.02	0.39	0.54	0.50
Denmark	0.24	0.24	0.19	0.22
Sweden	0.17	0.63	0.96	0.20

Source: Statistical Department of Lithuania (2004)

3 Simulations with the footloose capital model

If one is looking for a model to simulate the location of industry there is a lot of variety. The now established New Economic Geography has developed a lot of different models, where labourers, entrepreneurs or capital are on the move. For our reasons a model with the movement of capital seems to be a good choice. Why? First of all, labour mobility in the countries which we will run the simulations for is low. Also, foreign direct investment is a capital movement and therefore fits into the model. If there is a relocation of firms in the model, we should be able to observe FDI flows in the data.

This narrows the choice of models down to those with capital flows. The two setups left were the footloose entrepreneur and the footloose capital model. In the former the owners of firms consume their income in the firm's region. We ruled this out on basis of realism. The shareholders of MNEs investing in Eastern Europe are not likely to consume their income there. In the end, we choose a linear setup of the footloose capital model (henceforth FC model). The linearity allows us to forego all the problems that come with bifurcations, hysteresis and other non-linear problems. The model also allows for non-symmetric regions which is absolutely necessary.

Two forces in the model create incentives for profit-maximizing firms to move or leave a region: there is the positive force of market access, which is opposed by the effect of market-crowding. That way firms never agglomerate completely in one region. The smaller region might have a smaller market, but less competition. Therefore, a firm might find it more profitable to locate in the small region.

3.1 The structure of the FC model

The FC model is a 2x2x2 model: two regions, two factors of production and two industries (and hence goods). We will name the regions west and east, where we think of the Baltic States as an example for the east and of the Scandinavian countries for the west. The two sectors are agriculture A, a technical necessity to equal wages in both regions, and manufacturing sector M. Factors of production are labour L and capital K, with both types of factor owners geographically immobile. However, capital can be moved costlessly from one region to the other. s_L is the share of the world endowment of L that is employed in the east, s_K is the share of capital owned by eastern residents and s_n the share of world capital employed in the east.

Capital is seeking its highest (nominal) reward π[9]. Capital flows are modeled through the ad hoc equation:

$$s_n = (\pi - \pi^*)(1 - s_n)s_n \tag{1}$$

The agricultural sector is kept as simple as possible. It supplies a homogeneous good under constant returns to scale while using only labour. The sector is perfectly competitive, unit costs is $e_A\ w_L$. This means that wages in east w_L and west w_L^* are equalized in the agricultural sector. Because L is the only input in manufacturing, too, wages are equalized over both industries. This means that, choosing good A as the numeraire, $p_A = p_A^* = w_L = w_L^* = 1$.

Production in the manufacturing sector is carried out by monopolistically competitive firms. They produce a differentiated good and use K to cover for fixed cost while L covers marginal cost under increasing returns to scale. Total costs for producing a variety amount to $\pi F + w_L e_M x$. Trade in M is costly. Transport costs of τ are paid with agricultural goods by the sending region.

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

$$U = \alpha \int_{i=0}^{n+n^*} x_i di - \frac{\beta - \delta}{2} \int_{i=0}^{n+n^*} x_i^2 di - \frac{\delta}{2} (\int_{i=0}^{n+n^*} x_i di)^2 + C_A, \tag{2}$$

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

$$x_j = a - (b + cn^w)p_j + cP, P \equiv \int_{i=0}^{n+n^*} p_i di, \tag{3}$$

$$a \equiv \frac{\alpha}{\beta + \delta(n^w - 1)}, b \equiv \frac{a}{\alpha}, c \equiv \frac{\delta b}{\beta - \gamma} \tag{4}$$

Demand depends on the own price, p_j, and on the average price P of the other firms. Income does not influence demand due to the special utility

[9]Western variables are indicated by a star.

function. The demand for the agricultural good is determined as a residual. Total demand is (3) multiplied by the number of consumers.

Profit maximization looks like this:

$$\pi = (p - e_M)[a - (b + cn^w)p + cP]M + (\bar{p} - e_M - \tau)[a - (b + cn^w)p + cP^*]M^* \quad (5)$$

$$M \equiv s_L L^w + s_K K^w, M^* \equiv (1 - s_L)L^w + (1 - s_K)K^w, \quad (6)$$

where M and M^* are the number of consumers in each region and p and $\bar{p}$ are the prices of eastern firms charged in the home and foreign market respectively. Resulting consumer prices in the east are:

$$p = \frac{1}{2}\frac{2[a + e_M(b + cn^w) + \tau cn^*}{2b + cn^w}, \bar{p^*} = p + \frac{\tau}{2} \quad (7)$$

Equilibrium prices depend on the spatial distribution of firms and are not mark-up prices like in many NEG models. The reason behind this is that trade barriers protect local firms from competition[10]. The reward to a firm's F units of capital is the firms operating profit if $F = K_w = 1$, which also means that $n^w = 1$:

$$\pi = (b + cn^w)\Big[(p - e_M)^2 M + (\bar{p} - e_M - \tau)^2 M^*\Big]/F \quad (8)$$

As any firms that is active requires F unit of capital the equilibrium number of firms is determined by:

$$n = s_n K^w/F \quad (9)$$

In the long run, capital is mobile between regions. As capital determines firms, the distribution of capital and that of firms is identical. Capital moves wherever its reward is highest. In equilibrium, there are no more incentives to move, alas moving capital from one region to the other will not raise its profit. This occurs when:

$$\pi = \pi^*; \qquad 0 < n < 1; \quad (10)$$

$$\pi > \pi^*; \qquad n = 1; \quad (11)$$

The first expression holds for interior equilibria where industry is agglomerated in both regions, while in the second case all industry has agglomerated in a core region. Putting (8) into (10) or (11) using (7) results in the rental rate differential (rrd):

[10]There exists a no-black-hole condition which must hold to have positive levels of trade: $\tau < \tau_{trade} \equiv \frac{2(a - ba_M)}{2b + cn^w}$.

$$rrd = \tau\Big(2(2a-2be_m-b\tau)\Big[(s_L-\frac{1}{2})L^w+(s_K-\frac{1}{2})K^w\Big]-c\tau(L^w+K^w)(n-\frac{1}{2})\Big) \quad (12)$$

In the case of $\tau = 0$ the rental rate is always zero. Rental rates do not depend on the spatial distribution of firms then. If trade costs arise $\tau > 0$, the location firms is driven by two forces. The first is the advantage of access to the bigger market. In the equation it corresponds to the first part in the curly brackets. The second part, to the right of the angular brackets, describes the market-crowding disadvantage of being in the region which hosts more firms. The interplay of these two forces determines the outcome of the model.

3.2 Estimation of parameters

To gain insights, we want to fit real world data into the model. Thus a calibration of the model is needed. The task of finding the right parameters is very tricky in general. Sometimes one can estimate, sometimes one needs to take a parameter as a metaphor to find a satisfying result. We would have preferred a model with easy possibilities of adjusting the data, but it was not to be.

We think that the model makes sense from a theoretical point of view. We have the right mechanism (market-access versus market-crowding), we have capital flows (which we interpret as FDI), we have intra-industry trade (in manufacturing), differences in endowment (labour and capital) and in technology (e_M). The empirical data is hard to get, but it is more or less available. That is why we decided to give it a try.

Table 4: list of parameters

parameter	explanation
τ	transport costs between regions
s_K	capital K owners' share (east)
s_L	labour L share (east)
K^w	absolute value of capital K
L^w	absolute value of labour L
e_M	technology parameter of production in M (east)
s_n	employed capital K share (east) [variable]

Source: own table

In table 4 we list the parameters of the model. This list is not complete. Other parameters are already eliminated through normalization or are only of technical importance[11]. On the other hand, s_n is not a parameter but the variable that shows us the outcome of the model. Therefore, we need to determine what it means in the context of the model and how we can compare it to the data in the econometrical part of this paper.

Finding values for the endowment parameters s_K, s_L, s_n, K^w, and L^w seems easy at first sight. Data for capital formation and labour force are available from most national statistical offices. The ratios s_K and so on can be calculated from that data. The problem with this method is that the home market effect in the model is too strong to allow significant differences in endowments. Therefore, differences in endowments have to be scaled down[12].

Table 5: original s_L

	Denmark	Finland	Sweden
Estonia	0.184	0.204	0.127
Latvia	0.273	0.300	0.195
Lithuania	0.365	0.396	0.271

Source: AMECO, own calculations

Table 5 shows us a country's share of the combined labour force. As the model would collapse into a core-periphery equilibrium in all these cases, labour force has to be rescaled. We define the biggest difference of labour forces[13] as being equivalent to $s_L = 0.42$. For every percentage point of difference we change the parameter by only .3 percentage points. This is expressed in Table 6.

What is important here is that no value lies above .5, because that would not reflect the relative size between the two regions anymore. In all cases of the table the smaller Baltic region has a value of below .5. For reasons of convenience we assume that the distribution of capital is equivalent to that of labour. This means that s_K equals s_L. This should be a good enough approximation[14].

Next are absolute endowments with parameters K^w and L^w. K^w is normalized to 1[15] because then s_n expresses the share and also the absolute number of firms. L^w is set to 2. That means that the location of labour is more significant than the location of capital owners when it comes to the distribution of industries. While capital owners might have more money

[11] Parameters a, b, and c determine the love for variety.

[12] We are aware of the fact that a two country model cannot explain the whole distribution of industry. That is also why we limit the home market effect here.

[13] That would be Estonia versus Sweden, with Estonia having a share of only .127.

[14] Differences in capital formation exist, but they are not easily comparable. Purchasing power parities would play a role, as does the exchange rate.

[15] This is done by setting $F = 1$.

they tend to consume less. Therefore, we made mass demand by labourers more significant by choosing $L^w > K^w$.

The last parameter to be determined is the technology parameter at producing the manufacturing good e_M. The parameter determines competitive advantage in the model through Ricardian differences in technology. However, since in the model wages are equalized but nominal wages matter in international decisions on location we want to include a measure for wage adjusted labour productivity. It is a ratio of 'apparent labour productivity' and 'average personnel costs'. Data is available for 1996-2002 (Eurostat, 2002 and website).

Table 6: adjusted s_L

	Denmark	Finland	Sweden
Estonia	0.417	0.423	0.400
Latvia	0.444	0.452	0.421
Lithuania	0.471	0.481	0.443

Source: own calculations

Industries are represented by NACE groups. It is assumed that industries are different in their values of e_M only. Note that capital is only needed to determine the location of firms and labour is important for the demand effect. This is contrary to most other international trade models.

3.3 Simulation results

The result of the simulation is the variable s_n which can be calculated for every NACE group[16]. To evaluate the model we pick one specific industry. We chose the wood industry (NACE 20[17]) because production was strong in all countries and also FDI stock was existent. There might be a slight bias in our selection process, but on the other hand there is no point in picking an industry that is not important in any of the countries we look at. We acknowledge that this is a low-tech industry according to the OECD classification (2003).

Table 7 shows the results for the bloc simulation[18]. Scandinavia and the Baltic States each form one region. The equilibrium share of wood industry in the Baltic States lies at around 30 per cent, with the one exception of the year 2000 (15%). Given that the (adjusted) share of labour, s_n, in the Baltic region equals 42% the model predicts a relative decrease in the share

[16] We have data for most manufacturing industries. Fitting the model for each industry is time-consuming. We plan to publish results for all industries in a second paper

[17] Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.

[18] s_n this time equals the share of the three Baltic countries in total industry.

of firms in the Baltic countries. However, this result heavily depends on finding the right value for the adjusted labour share. Unless one compares the result between the blocs of Scandinavia and the Baltic States to that of other blocs its meaning is clouded. In the case of a 3x3 setup it would be easier to find a good approximation for s_n. Nevertheless, in terms of convergence the result seems to indicate that there is no catch-up progress. The higher demand in Scandinavia together with the home market effect keeps the industry locked in.

Table 7: Simulation results, equilibrium value of s_n in the wood industry (NACE 20), Baltic States

countries	1996	1997	1998	1999	2000	2001	2002
SCA	0.27	0.23	0.25	0.25	0.15	0.33	0.33

Source: own calculations

The first column of table 8 (countries) gives us the combination of countries. Estonia (EE), Lithuania (LT), and Latvia (LV) are the Baltic countries on the one side, while on the other we have the Scandinavian nations of Denmark (DK), Finland (FI), and Sweden (SE). The following columns gives us the results of the simulation for the division of industries, s_n. The second column gives us the share of the Baltic country of the respective industry in the year 1996. So between Estonia and Denmark, 24.1% of wood industry will locate in Estonia according to our calibrated FC model.

Table 8: Simulation results, equilibrium value of s_n in the wood industry (NACE 20), Latvia

countries	1996	1997	1998	1999	2000	2001	2002
EE-DK	0.241	0.239	0.236	0.239	0.239	0.246	0.258
EE-FI	0.392	0.279	0.328	0.338	0.328	0.402	0.412
EE-SE	0.127	0.083	0.116	0.119	0.123	0.138	0.141
LV-DK	0.503	0.500	0.498	0.492	0.481	0.546	0.546
LV-FI	0.684	0.621	0.650	0.639	0.617	0.744	0.736
LV-SE	0.375	0.347	0.368	0.358	0.351	0.434	0.424
LT-DK	0.556	0.554	0.549	0.563	0.570	0.629	0.631
LT-FI	0.677	0.579	0.623	0.646	0.649	0.767	0.753
LT-SE	0.341	0.294	0.330	0.343	0.354	0.426	0.412

Source: own calculations

Results should not be taken too literal, because we calibrated the parameters. Therefore, high values of s_n are a sign for relative attractiveness of the Baltic countries, nothing more. Predictions of $s_n > .5$ do not point to an industry configuration where more companies exist in the respective Baltic State than in the Scandinavian. However, the results can be used to forecast the adjustment in the number of firms in the Baltic States. These adjustments can happen domestically by rising average output or by an increase in the number of firms. The third possibility would be the arrival of MNEs. This is what we will examine in the empirical part of this paper.

In calibrating the technological differences we made a compromise that lets us calculate the model without reaching extreme results, but there are setbacks. By normalizing the biggest difference in wage adjusted labour productivity between the countries (over all industries) to .8 we erase the level of these differences. The biggest difference in wage adjusted labour productivity often exists between Latvia and Sweden, and if that is not the case, between Latvia and Denmark or Finland.

3.3.1 Linkages

When thinking about industry location one has to bear in mind that industries are not autonomous, but are exchanging inputs and outputs with each other. The output of one industry will be the input of another. This is called a linkage. The FC model does not incorporate linkages, which seem to be an important factor in international industry location nevertheless. To compensate for this, we recalculated e_M to account for linkages.

We use input/output tables for Latvia[19] to identify the inputs of the wood industry (see table A.3). The inputs from manufacturing sectors[20] combine for a share of 25 per cent of total output. We now weigh the input by its share in total output and determine a new e_M for the wood industry by adding up the weighted e_M from input industries[21]. NACE 15, for instance, delivers inputs worth 1,708,000 LVL to the wood industry. This accounts for a share of 0.00589 per cent in total output, therefore the efficiency parameter e_M of that industry[22] (298.72) enters into the calculation with a weight of 0.589 per cent. The weighted inputs are the summed up to form the e_M of inputs, which are a share of the new e_M of NACE 20. Inputs account for 25 per cent of the new e_M, so the e_M of NACE 20 enters with a weight of 75 per cent. Now e_M equals 221.64, which is only slightly higher than the original value of 220.00.

[19]We also included linkages for an input/output table of Finland, see table A.4

[20]NACE divisions 15-37.

[21]Of course the industries that deliver the inputs source inputs from other industries themselves. This multiplicator effect is diminishing and is not likely to significantly change the results.

[22]As inputs might be sourced from foreign countries as well, we should calculate another weighted e_M, this time based on origin of inputs. There is no sufficient data to do this, however. Transport costs would diminish advantages of imported inputs anyway.

The incorporation of linkages does not seem to change the results of our model. The change of e_M is very small, in this case only 0.75 per cent. A recalculation of our simulation would deliver the same results again, more or less. In the case of the wood industry, which is a low tech industry where the extent of linkages is assumed to be limited, our result might have been expected. It would be more interesting to look at a high-tech industry with a bigger share of (imported) inputs.

3.3.2 Spillovers

The occurance of spillovers is always a possibility when firms move from one country to another. There is a large literature about spillovers from FDI, which assumes that technology is transmitted from newly arriving multinational enterprises to domestic firms. This effect is absent in the basic FC model.

We try to simulate spillovers by redefining the efficiency parameter e_M. It now equals $e_M * (1 + s_n - s_L)$. It follows that the arrival of firms helps to determine e_M. If the share of firms in one region, say Latvia, is larger than that of its labourers [23], than firms in this region become more similar to that of the other, which might be Denmark. As the efficiency parameter of Denmark is normalized to 1, e_M of Latvia increases from its original value of .809.

What does that mean in the context of the FC model? The first thing to note is that the competitive situation for Latvia worsens as e_M gets lower. Therefore, we have a negative spillover here. e_M as a parameter includes both wages and productivity, so there are two explanations for what has happened. Wages have increased faster than productivity, or else productivity has fallen faster than wages. Both scenarios are worth considering.

If technology spillovers are positive, local firms reacted to the arrival of MNEs by increasing productivity, but they were unable to stop wages from rising more than proportionally. Overall, wage adjusted productivity falls. In the other case MNEs might have driven average output of local firms down. Productivity would have fallen, and probably faster than wages. Wages tend to be sticky when it comes to falling productivity.

The result including spillovers for the case of Latvia and Denmark in the location of wood industry is .48 (down from .54 in the basic FC model). Spillovers here decreased the efficiency advantages of Latvia, and, what is more, the convergence in efficiency led to more divergence in industry. This is an interesting result. If Baltic firms loose their advantage of low wages through higher productivity, then the home market effect might pull industries away. It would thus be interesting to do more research on the role of wages and productivity in determining the efficiency parameter e_M.

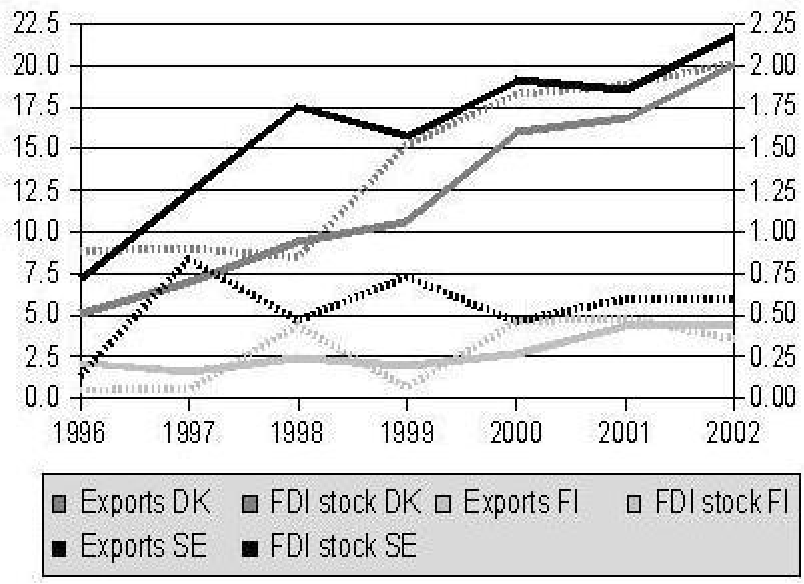
[23] which we assume as an equilibrium situation here

3.4 Empirical results

As we have different setups of the basic FC model, we will proceed in stages. First we will discuss the case of two blocs, where each Scandinavia and the Baltic States are aggregated to form a bloc. Industry can move between these blocs. Then we proceed to the national view, where we put country against country in a 3x3 matrix. Afterwards we discuss modifications of the model, allowing for linkages and then spillovers.

The main question now is how to verify the predictions of the model. There are many possibilities - if the data is available. Coming back to the introduction, there are two ways of relocating industry. Firstly, firms can move from one region to the other. The other possibility is that firms in one region diminish in number and/or output while the other region prospers (firms increase output and/or the number of firms increases). We will consider both these cases in the following.

Fig. 1: Exports (continuous line, left scale) and FDI stock (dotted line, right scale) over production in the wood industry, Latvia, in million Euros[24]



Source: Central Statistical Bureau of Latvia, Investment in Latvia, various issues and online database at www.csb.lv

We assume that a high value for s_n should correspond with a significant flow of inward FDI in the same industry. Firms are supposed to react to market size and technology which are determinants of the choice of location in the model. Like gravitation equations our model predicts a rise in the

[24]mean values for the respective whole year, 1996-98 taken from DM/LVL and recalculated by 1 EUR = 1.95583 DM

number of firms in the Baltic States in most industries. In our example we took the wood industry and predicted the location of industry for Latvia and the Scandinavian countries.

From table 8 it becomes clear that industry relocation from Finland to Latvia is predicted to be very strong, Latvia's predicted equilibrium share in the wood industry goes up from 68.4% in 1996 to 73.6% in 2002. Against Denmark the equilibrium share increases from 50.3% to 54.6% in the same period, that against Sweden from 37.5% to 42.4%. This means that Latvia would gain a lot of industry share against Finland, gain modestly against Denmark and not at all against Sweden.

In the first scenario, growing exports and FDI inflows in Latvia would suggest big gains of firms in the industry. To show the relative importance of FDI and exports we divided both by production. Our data which we present in Figure 1 shows that exports to Denmark and Sweden increase threefold at least while FDI stock increases only in the case of Denmark. Swedish FDI inward stock in Latvia remains relatively stable. Exports to Finland remain on a low level during the whole period, the FDI inward stock increases only slightly.

Compared with our predictions, the data seems to fit relatively well. Our prediction of firms moving from Denmark to Latvia is reflected in the data. The case of Sweden also looks good, only that exports rise more than expected. The case of Finland is different. Finnish firms do not seem to move to Latvia on a big scale. Why is that? Finnish FDI inward stock in Latvia is very low compared to that of Estonia. We reckon that cultural ties, like a quite similar language, drove Finnish FDI towards Estonia while leaving Latvia and Lithuania alone.

Table 9: Number of enterprises, NACE 20

countries	1996	1997	1998	1999	2000	2001	2002	total growth
Denmark	1026	992	926	790	787	763	689	0.67
Estonia	607	639	698	810	735	833	964	1.59
Latvia	-	887	960	1058	1186	1136	1154	1.30
Lithuania	1310	1606	1419	1599	1663	1743	1759	1.34
Finland	3410	2957	3089	2974	2981	2892	2839	0.83
Sweden	4284	5344	5508	5677	6059	6284	6440	1.50

Source: Eurostat website, Central Statistical Bureau of Latvia, and own calculations

In the second scenario firms are not moving between the regions, but there is firm entry in one region and firm exit in the other. Table 9 presents the number of firms in the regions for different years. The last column reports the total growth in number of enterprises from 1996-2002[25]. A positive growth trend is observable for the Baltic States and Sweden. The other two Scandinavian countries saw their number of firms decline during this period. It seems that firms in Scandinavia did exit the market while firms entered the market in the Baltic States, with the exception of Sweden[26].

4 Conclusion

We must admit that this paper is only a first try to verify the footloose capital model empirically. We can say that a rejection of the model would be preliminary on grounds of our data. The case for using the Baltic States and the Scandinavian countries of Denmark, Finland, and Sweden is strong. The model predicts increasing trade and firms moving from Scandinavia to the Baltic States in most industries. Our data has shown that the regions are integrated and among each others most important trading partners.

The calibration of the model was not flawless. When wage adjusted labour productivity data is adjusted, differences in technology might be blurred. To standardize the technology parameter e_M to 0.8 might result in a well-behaved model, but on the other hand it becomes very unlikely to get extreme results. It is not clear, however, if this really becomes a concern.

The case of the wood industry is a good example to show that the FC model can predict at least some short term trends. We have shown in a 3x3 setup that firms are moving from Scandinavia to Latvia. Also, firms enter the market there while they seem to exit in Denmark and Finland. In this framework the point for convergence is strong. Baltic States on average seem to be growing stronger than Scandinavian firms in categories like output, employment, exports, and FDI inflows. In total, we find our predictions confirmed. However, this is not the case when we build two blocs (Scandinavia versus Baltic States). The result of an equilibrium industry division with two thirds of industry locating in Denmark, Finland, and Sweden and the remaining third in Estonia, Latvia, and Lithuania might have more of a long-run character. This could be examined in future research.

Incorporating linkages and spillovers into the FC model did not yield any new results. Both changed results only slightly. The wood industry might not be the industry to go to when looking for linkages and spillovers, however. It would be interesting to build a case around a high tech industry with a lot of exports. Still, there would be difficulties with the concept and the data which remain to be solved.

[25] Foreign firms are included in the data. At this moment, there is no disaggregated data on ownership of firms available.

[26] Production increased more strongly in Latvia, as seen in table A.1. Concerning growth in employment, the Baltic States dominate the Scandinavian countries. This is shown in table A.2. All this points to industry relocation by firm entry/exit in the respective markets.

A lot more remains to be done. A closer look into the determinants of transaction costs could improve our estimations of transport/transaction costs. Then, the role of endowments in the model could be strengthened by incorporating more details. Finally, it would be interesting to look into more industries and try to establish a better connection between the industry characteristics and their supposed dynamic of relocation. Industries might be divided according to technology (OECD, 2003). In the case of a low-tech industry like the wood industry a relocation to the Baltic States is plausible. It would be interesting to look at high-tech industries and their predicted spatial patterns. The role of linkages in the process of international industry location could gain more importance. If that is the case, the question of convergence can probably be tackled more efficiently.

We hope that our paper helped a little bit to close the gap between theory and empirics in the New Economic Geography. We calibrated the FC model to predict locations of industry on a two-digit NACE level which we then confronted with FDI, production and export data on that level. To our knowledge this is the first time that somebody uses such specific data on the question of location of industry. We are not sure yet if the FC model is a good tool to predict short-run changes in industry location, if it should be used to calculate industry locations some years away from today or if it is not useful at all. The partial equilibrium character of the model together with the relatively good fit of the data might be a first clue.

Bibliography

Baldwin, Richard, Rikard Forslid, Philippe Martin, Gianmarco Ottaviano, and Frédéric Robert-Nicoud (2003), '*Economic geography and public policy*', Princeton

Bell, Martin, and Anabel Marin (2004), 'Where Do Foreign Direct Investment-Related Technology Spillovers Come From in Emerging Economies? An Exploration in Argentina in the 1990s', *European Journal of Development Research*, 16, 3: p.653-686

Blomström, Magnus, and Håkan Persson (1983), 'Foreign investment and spillover efficiency in an underdeveloped economy: evidence from the Mexican manufacturing industry', *World Development*, 11, 6: p.493-501

Central Statistical Bureau of Latvia (various), '*Investment*', Riga

Central Statistical Bureau of Latvia (2003), '*Input/output tables for Latvia 1998*', Riga

Economist, The (2005), '*Knickers in a twist*', 35: p.48

EUROSTAT (2002), '*Business in candidate countries - facts and figures*', Luxembourg

Fujita, Masahisa, Paul R. Krugman, and Anthony J. Venables (1999), '*The spatial economy: Cities, regions and international trade'*, Cambridge (MA)

Görg, Holger, and Eric Strobl (2001), 'Multinational companies and productivity spillovers: A meta-analysis', *Economic Journal*, 111, 475: p.723-739

Hirschman, Albert O. (1958), '*The strategy of economic development*', New Haven

Hunya, Gabor (2004), 'FDI in Small Accession Countries: the Baltic States' *EIB Papers*, 9, 2: p.92-113

Lerner, Abba Ptachya, and Hans Werner Singer (1937), 'Some Notes on Duopoly and Spatial Competition', *The Journal of Political Economy*, 45, 2: p.145-186

Midelfart Knarvik, Karen-Helene, Henry Overman, and Anthony J. Venables (2000): 'Comparative Advantage and Economic Geography: Estimating the Location of Production in the EU', *CEPR Discussion Paper No.*

2618

OECD (2003), *ANBERD and STAN databases*

OECD (2004), '*Promoting Trade in Services - Experience of the Baltic States*', Paris

Ottaviano, Gianmarco I.P., Takatoshi Tabuchi, and Jacques-François Thisse (2002), 'Agglomeration and Trade revisited', *International Economic Review*, 43: p.409-436

Pusterla,Fazia, and Laura Resmini (2005), 'Where do firms locate in transition countries? An empirical investigation', draft

Romer, Paul (1986), 'Endogenous technological change', *Journal of Political Economy*, 98, 5: p.71-102

Smarzynska Javorcik, Beata (2004), ' Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages', *American Economic Review*, 94, 3: p.605-627

Statistical Department of Lithuania (various), '*Foreign direct investment*', Vilnius

UNCTAD (2001), '*World Investment Report: Promoting linkages''*, New York and Geneva

Annex 1 - Data

Table A.1: Production, NACE 20, in million EUR

production	1996	1997	1998	1999	2000	2001	2002	total growth
DK	1.542	1.644	1.745	1.744	1.864	1.807	1.748	1,13
FI	3.373	4.410	4.603	4.820	5.387	5.186	5.303	1,57
SE	5.962	6.873	6.946	7.143	7.686	7.062	7.338	1,23
LV	187	338	410	468	591	657	742	3,96

Source: Eurostat website, Central Statistical Bureau of Latvia, and own calculations

Table A.2: Number of employees, NACE 20, in thds.

employees	1996	1997	1998	1999	2000	2001	2002	total growth
Denmark	16,912	16,972	17,247	16,168	16,601	15,705	14,745	0,87
Estonia	-	-	-	-	14,380	15,156	17,435	1,21
Latvia	-	-	23,409	29,368	32,021	30,265	-	1,29
Lithuania	20,137	22,133	20,338	20,511	23,056	25,644	27,913	1,39
Finland	25,552	27,378	28,132	28,547	29,560	29,029	28,219	1,10
Sweden	35,346	41,158	42,881	42,446	42,499	42,689	42,100	1,19

Source: Eurostat website and own calculations

Table A.3: FC model with linkages, wood industry, Latvia 1998

NACE	Input in thds. of LVL	Share in total output	e_M	Weighted e_M
NACE 15	1708	0.00589	298.72	1.76
NACE 16	0	0.00000	n/a	0.00
NACE 17	268	0.00092	112.80	0.10
NACE 18	55	0.00019	133.80	0.03
NACE 19	58	0.00020	n/a	0.00
NACE 20	36224	0.12487	220.00	27.47
NACE 21	2930	0.01010	281.00	2.84
NACE 22	146	0.00050	207.60	0.10
NACE 23	15295	0.05272	n/a	0.00
NACE 24	13601	0.04688	188.30	8.83
NACE 25	2637	0.00909	234.60	2.13
NACE 26	1839	0.00634	262.20	1.66
NACE 27	981	0.00338	288.20	0.97
NACE 28	4852	0.01673	179.60	3.00
NACE 29	9015	0.03108	143.30	4.45
NACE 30	24	0.00008	334.30	0.03
NACE 31	718	0.00247	176.60	0.44
NACE 32	23	0.00008	169.20	0.01
NACE 33	221	0.00076	166.20	0.13
NACE 34	2747	0.00947	283.80	2.69
NACE 35	32	0.00011	141.80	0.02
NACE 36	1115	0.00384	150.10	0.58
NACE 37	3	0.00001	123.20	0.00
Inputs	Share / e_M	0,25272	226.50	57.24
NACE 20	Share / e_M	0,74728	220.00	164.40
e_M linkages	new e_M			221.64

Source: Central Statistical Bureau of Latvia (2003)

Table A.4: FC model with linkages, wood industry, Finland 1995

ISIC rev.3	Input in mill. FIM	Share in total output	e_M	Weighted e_M
15-16	61	0.00282	137.3	0.38755
17-19	26	0.00122	131.1	0.15945
20	2271	0.10493	136.1	14.28132
21-22	495	0.02288	202.0	4.62253
23	70	0.00323	126.8	0.40980
24ex2423	496	0.02291	210.8	4.82993
2423	0	0.00000	210.8	0.00000
25	57	0.00263	157.3	0.41360
26	181	0.00837	143.6	1.20229
271,2731	40	0.00183	216.8	0.39663
272,2732	50	0.00233	216.8	0.50424
28	244	0.01127	134.3	1.51415
29	158	0.00728	139.7	1.01729
30	8	0.00037	122.0	0.04458
31	10	0.00048	148.6	0.07190
32	32	0.00149	215.5	0.32195
33	2	0.00010	147.2	0.01488
34	12	0.00054	132.2	0.07169
351	4	0.00018	126.4	0.02234
353	0	0.00000	109.4	0.00000
352, 359	1	0.00005	145.1	0.00753
36-37	13	0.00062	142.7	0.08780
Inputs	Share / e_M	0,19231	157.98	30.38
NACE 20	Share / e_M	0,80769	136.10	109.93
e_M linkages	new e_M			140.31

Source: OECD Input-Output Database, edition 2002