Convergence through spillovers and linkages: The role of multinational enterprises

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Abstract

Studying the recent relocation of manufacturing industries from Nordic to Baltic countries, this paper provides an empirical application of the footloose capital model, a framework for spatial analysis developed by Roger and Martins (1995). The model is extended to include input-output linkages and technological spillovers. It is calibrated and applied, industry by industry, to a 3x3 matrix of Baltic and Nordic countries and to the pair of these blocs. The simulation results are compared with real world data and discussed in regard to testability restrictions of the footlose capital model.

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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 choose 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 Nordic 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 Nordic 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 Nordic countries 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 Nordic 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 Nordic 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 4, followed by an empirical test, where the predictions of the model will be evaluated. Section 6 concludes the paper.

2 Nordic and Baltic Economies

For the simulations of industry relocation with the footloose capital model we selected the Baltic countries Estonia (EE), Latvia (LV) and Lithuania (LT) as well as the Nordic countries Finland (FI), Sweden (SE) and Denmark (DK). These countries were chosen, because their characteristics are a mix of similarities and differences that should be especially suitable to bring out the dynamics that are in the focus of NEG models.

The six countries form two distinct groups of three in neighbouring regions around the Baltic Sea. They have all relatively small populations, compared to the other neighbours (Russia, Poland, Germany).[6] Until 1991, the two groups were quite strictly separated in political and economic terms. The Baltic countries were part of the Soviet Union, and trade and investment flows between the Baltic and Nordic countries were small[7]. This changed in the course of the 1990s, when the Baltic countries (henceforth: Baltics) became independent and started their transformation into Western-style market economies. At least two out of three Nordic countries (Nordics) are now among the largest trade partners for each of the Baltics. And the picture is even more impressive on the side of foreign direct investment (see Tables 1-3). The Nordics are among the biggest investors in the Baltics. Together they account for about 70 per cent of inward FDI stock in Estonia, 40 per

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

[6] As of 2003, total populations for the countries are (in millions): FI 5.2, SE 9.0, DK 5.4; EE 1.4, LV 2.3, LT 3.5; compare this to Russia 143.8, Poland 38.5, Germany 82.0.

[7] See Annex Table A.5

cent in Lithuania, and about 30 per cent in Latvia. Outward FDI from the Baltics to the Nordics is negligible.[8]

Table 1: Estonian FDI stock by origin, shares

country	2001	2002	2003	2004
Sweden	0.39	0.41	0.41	0.45
Finland	0.26	0.27	0.27	0.24
USA	0.10	0.07	0.06	0.05
Germany	0.03	0.02	0.03	0.02
Denmark	0.04	0.03	0.02	0.02

Source: Bank of Estonia (website)

All six Baltic and Nordic countries are now members of the European Union. Already at the beginning of the observation period (in the mid-1990s) all of them had at least an accession perspective. Despite the integration process, both groups are distinct subregions of the EU, especially in regard to their income levels.

Table 2: Lithuanian FDI stock by origin, shares

country	2001	2002	2003	2004
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)

Swedish GDP alone is more than seven times larger than the aggregate Baltic GDP.[9] And the Nordic per capita income (PPP-adjusted average) is about 2.4 times higher than Baltic per capita income.[10] While the Nordics form the richest subregion in the EU, the Baltics are the poorest subregion. However, between 1995 and 2004 per capita incomes have risen by the factor

[8] For example, overall Lithuanian FDI outward stock in 2001 amounted to 117.3 million LTL (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.

[9] As of 2003, GDP figures are (in billions of EUR): FI 143.3, SE 267.3, DK 187.1; EE 8.0, LV 9.9, LT 16.3. All data are from Eurostat.

[10] As of 2004, GNI per capita figures are (in international dollars = purchasing power parity): FI 29,560, SE 29,770, DK 31,550; EE 13,190, LV 11,850, LT 12,610. The corresponding average for EU-15 is 27,840. All data are from the Worldbank.

3.2 in the Baltics, as compared to a factor 1.6 increase in the Nordics.[11] In this sense, some convergence is observable.

Finally it should be noted that, even though the outside world tends to regard the Nordics and the Baltics as homogenous groups of countries (largely due to common cultural and historical backgrounds), the industry structures and other characteristics of the six economies are quite heterogeneous. This will become more obvious in the empirical sections of our paper.

Table 3: Latvian FDI stock by origin, shares

country	2001	2002	2003	2004
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)

What do all these facts imply for the analysis of industry relocation in terms of the New Economic Geography? Trade costs for exports of goods from one region to the other arise, 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 (but perhaps between industries), as distances are significantly, but not too extremely different between the pairs of countries to be examined. EU integration forced the countries to bring their economies under the rule of the acquis communautaire. The 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 relative 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, suggesting that the footloose capital model is an appropriate framework for the analysis of this constellation.[12] In terms of *actual* market size, on the other hand, the Baltics and the Nordics are quite different, as the GDP and other income figures show. This indicates a high

[11]The factors were calculated by comparing the leading indicators in the Worldbank's *World Development Reports* 1997 and 2005.

[12]Due to its exclusion of various non-linearities the FC model is less prone to extreme solutions, such as complete agglomeration, than core-periphery models.

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. Again, the FC model is the most appropriate framework for modelling these regional asymmetries and their effects. 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 footloose capital model.

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 Nordic 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[13]. Capital flows are modeled through the ad hoc equation:

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

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

[13]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[14]. The reward to a firm's F units of capital is the firms operating profit if $F = K^w = 1$, which also means that $n^w = 1$:

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

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:

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

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

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[15]. 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[16].

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 4 lists the parameters of the FC model. The list is not complete, as some parameters are eliminated through normalization, while others are only of technical importance[17]. The endogeneous result of the simulation is a variable, s_n. Therefore, we need to define more precisely what it means in the context of the model and how we can compare it to the data in the empirical part of this paper.

The share of the Baltic country in the number of total firms over both regions, which is represented by s_n, is a long-run equilibrium value. The movement of capital is often assumed to be very quick or instanteneous, but here capital flows are somewhat slower. Firms need to collect information about possible returns in the other region before they make their choice. This process will take time, as the fundamental returns on capital are in reality clouded by business cycles and exogeneous shocks. Hence, we do not assume that the variable s_n gives us the industry distribution for a given year.

Table 5 shows us a country's share of the combined bilateral labour force. 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

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

[16]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.

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

be a good enough approximation[18].

Next are absolute endowments with parameters K^w and L^w. K^w is normalized to 1[19] because then s_n expresses the share and also the absolute number of firms. L^w is set to 15, so that the share of the manufacturing sector in total GDP stands at around 20%. 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 they tend to consume less.

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. We will include a measure for wage adjusted labour productivity that is built by using the ratio of 'average personnel costs' and 'apparent labour productivity'. Data is available for 1995-2003 (Eurostat, 2002 and website).

Industries are represented by NACE groups. It is assumed that industries are different in their values of technology e_M and wage w 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.

4 Simulation

The result of the simulation is the variable s_n which can be calculated for every NACE group[20]. To evaluate the model we pick one specific industry. We chose the wood industry (NACE 20[21]) 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[22]. Nordic countries and the Baltic States each form one region. The equilibrium share of wood industry in the Baltic States lies at around 20 per cent, with the one exception of the year 2000 (23%). Given that the share of labour, s_L, in the Baltic region equals around 25% the model predicts a catch-up process with Nordic countries which will nearly lead to convergence. However, unless one com-

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

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

[20]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

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

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

pares the result between the blocs of Nordic countries 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. Hence, in terms of convergence the result seems to indicate that there is a catch-up progress. The higher demand in Nordic countries paired with the home market effect makes it very difficult to reach complete convergence.

Table 6: Simulation results, equilibrium value of s_n in the wood industry (NACE 20), Baltic States

countries	1995	1996	1997	1998	1999	2000	2001	2002	2003
BALT	0.17	0.19	0.18	0.19	0.18	0.18	0.23	0.19	0.20

Source: own calculations

The first column of table 7 (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 Nordic 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, 9% of wood industry will locate in Estonia according to our calibrated FC model.

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

countries	1995	1996	1997	1998	1999	2000	2001	2002	2003
EE-DK	0.09	0.08	0.09	0.09	0.09	0.09	0.10	0.11	0.11
EE-FI	0.10	0.11	0.08	0.09	0.10	0.10	0.13	0.13	0.12
EE-SE	0.00	0.01	0.00	0.01	0.01	0.02	0.03	0.03	0.02
LV-DK	0.29	0.29	0.30	0.29	0.30	0.31	0.34	0.33	0.34
LV-FI	0.32	0.33	0.30	0.32	0.33	0.33	0.39	0.36	0.37
LV-SE	0.12	0.16	0.14	0.17	0.17	0.18	0.22	0.20	0.20
LT-DK	0.23	0.22	0.23	0.23	0.24	0.24	0.28	0.25	0.25
LT-FI	0.25	0.26	0.23	0.25	0.26	0.25	0.31	0.28	0.28
LT-SE	0.08	0.12	0.11	0.13	0.13	0.13	0.18	0.14	0.14

Source: own calculations

Results should not be taken too literal. For instance, high values of s_n are a sign for relative attractiveness of the Baltic countries. 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. For now it suffices to note that the Baltic shares of industry are rising. Now we do the same for industry NACE 31 (Manufacture of electrical machinery and apparatus), which is a high-tech industry:

Table 8: Simulated equilibrium values of s_n in industry NACE 31, country by country

countries	1995	1996	1997	1998	1999	2000	2001	2002	2003
EE-DK	0.06	0.06	0.07	0.06	0.08	0.07	0.06	0.08	0.09
EE-FI	0.06	0.05	0.06	0.06	0.08	0.08	0.08	0.11	0.10
EE-SE	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.03	0.04
LT-DK	0.25	0.24	0.24	0.23	0.25	0.23	0.34	0.31	0.36
LT-FI	0.26	0.25	0.25	0.25	0.26	0.26	0.38	0.36	0.39
LT-SE	0.10	0.11	0.11	0.11	0.11	0.13	0.28	0.21	0.26
LV-DK	0.13	0.16	0.19	0.19	0.23	0.22	0.22	0.22	0.25
LV-FI	0.14	0.16	0.19	0.21	0.24	0.23	0.26	0.26	0.27
LV-SE	0.00	0.04	0.07	0.09	0.12	0.13	0.19	0.14	0.17

Here we can see that Estonia's share of industry against the Nordic countries is relatively low, why Lithuania's seems quite high. Latvia is somewhere in the middle. However, there is a lot of volatility in the location of industry. The share of Latvia in NACE 31 is supposed to rise from 0 to 19 per cent during the period 1995-2001. This seems quite unrealistic. We will compare these predictions with data from exports and FDI in a later section.

4.1 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[23] to identify the inputs of the wood industry (see table A.3). The inputs from manufacturing sectors[24] 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[25]. NACE 15, for instance,

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

[24]NACE divisions 15-37.

[25]Of course the industries that deliver the inputs source inputs from other industries

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[26] (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.

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.

4.2 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 [27], 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

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themselves. This multiplicator effect is diminishing and is not likely to significantly change the results.

[26] 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.

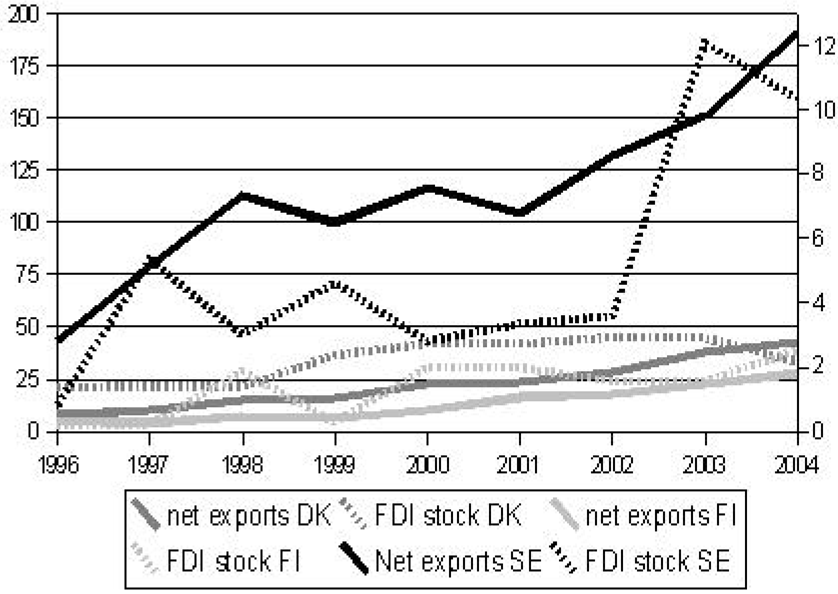
[27] which we assume as an equilibrium situation here

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 unsignificantly lower than in the basic FC model. Spillovers here decreased the efficiency advantages of Latvia, and, what is more, the convergence in efficiency and wages 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.

5 Foreign direct investment and exports

Fig. 1: Exports (continuous line, left scale) and FDI stock (dotted line, right scale) over production in the wood industry, Latvia, in million Euros[28]



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

To check the predictions of the FC model, we now confront the simulation results with statistical indicators of industry relocation. As discussed in earlier sections, we assume that a positive change in s_n corresponds with a

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

significant inflow of FDI in the respective industry, and that a high value of s_n correspondingly implies a relatively large stock of inward FDI in the Baltics. Moreover, an increase in s_n should normally go along with a rise in exports (and decrease in imports) of the same industry. Finally, comparing the changes in the number of enterprises as well as the sectoral output in both regions should also give a clue about the validity of the model.

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 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 Nordic countries.

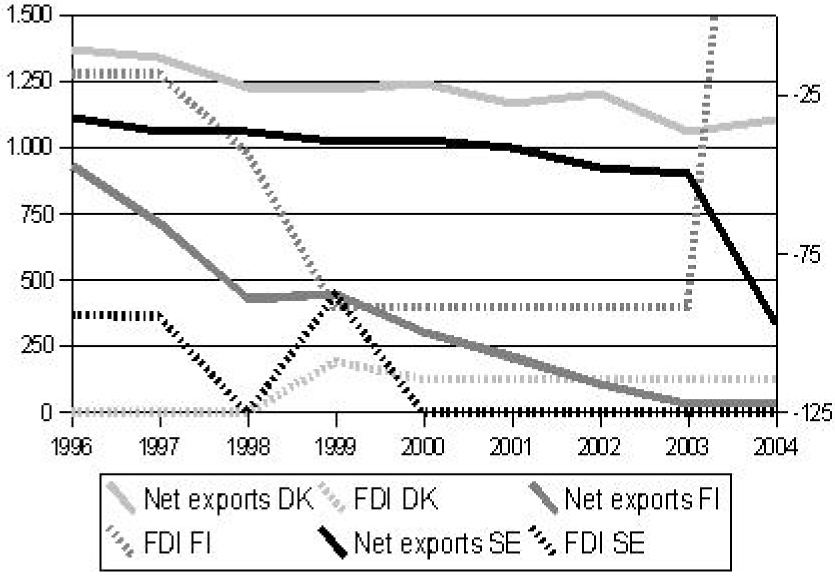
From table 7 it becomes clear that industry relocation from Finland to Latvia is predicted to be very strong, Latvia's predicted equilibrium share in the wood industry goes up from 23% in 1997 to 31% in 2001. Against Denmark, the equilibrium share increases from 23% to 28% in the same period, that against Sweden from 11% to 18%.

The data which we present in Figure 1 shows that exports to Sweden increase manyfold while those to Denmark and Finland also rise significantly, but slower. FDI stocks of all Nordic countries increase over the period of 1996 to 2004 in all cases, with a significant rise in Swedish FDI in 2003. Overall, integration of Latvia with Sweden seems to move faster than integration with the other two Nordic countries.

Compared with our predictions, the data seems to fit relatively well. Our simulations pointed to a relatively quickly increasing integration with Sweden, with the Latvian share of industry nearly doubling from 12% to 20%. Latvia's share of industry against Denmark and Finland was also found to rise, in both cases by 5 percentage points in the period from 1995 to 2003. This is more or less confirmed by our data. We can see that integration with Sweden moves on faster than integration with Denmark and Finland. However, it is a bit surprising that the level of FDI and exports are not as predicted by our model. Absolute Swedish exports and FDI are high, while those of Finland and Denmark are relatively low. The explanation might be the existence of a well-known Swedish furniture firm that happens to be active in the wood industry.

The relatively low level of Finland might be explained away by pointing to the special relationship of Finland and Estonia. They share historic cultural roots (like a very similar language), which furthers FDI flows between those two countries at the expense of the other two countries. Overall, we are satisfied with the predictions of our simulation as one could not expect that they are very precise. Also, industries can be very narrow in small countries like the Baltic states.

Fig. 2: Exports (continuous line, left scale) and FDI stock (dotted line, right scale) over production in industry NACE 31, Latvia, in million Euros[29]



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

The picture for NACE 31 looks quite complicated. Here, net exports are negative and the level of FDI stock is relatively low. Hence, it doesn't fit to our predictions of rising Baltic shares in this industry. This result was replicated for more high-tech industries. There seems to be a factor - or some more factors - that spoil our results and which are not included in our model.

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

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

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[30]. A positive growth trend is observable for the Baltic States and Sweden. The other two Nordic countries saw their number of firms decline during this period. It seems that firms in Nordic countries did exit the market while firms entered the market in the Baltic States, with the exception of Sweden[31].

6 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 Nordic countries of Denmark, Finland, and Sweden is strong. The model predicts increasing trade and firms moving from Nordic countries to the Baltic States in most industries. Our data has shown that the regions are integrated and among each other most important trading partners.

The calibration of the model was not flawless. When wage adjusted labour productivity data is being used, differences in efficiency might be blurred. The Baltic countries' workforce in some industries consists only of some thousand workers. Any arriving Nordic firm would find it very difficult to recruit talent for a competitive wage.

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 Nordic countries 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 Nordic firms in categories like output, employment, exports, and FDI inflows. In total, we find our predictions confirmed. This is not the case for a high tech industry like NACE 31. Here, factors like endowment of high-skilled labour and the investment into R&D might play a bigger role than local demand, productivity or wages.

When we build two blocs (Nordic countries versus Baltic States), the result of an equilibrium industry division with eighty per cent of industry locating in Denmark, Finland, and Sweden and the remaining 20 per cent in Estonia, Latvia, and Lithuania might have more of a long-run character. This could be examined in future research.

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

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

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.

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). 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