UNIVERSITEIT GENT

FACULTEIT ECONOMIE
EN BEDRIJFSKUNDE

HOVENIERSBERG 24
B-9000 GENT
Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

WORKING PAPER

Foreign direct investment spillovers within and between sectors: Evidence from Hungarian data[1].

Koen Schoors[a,2] and Bartoldus van der Tol[b]

[a] **CERISE, Ghent University, Belgium; LICOS, University of Leuven, Belgium**

[b] **Ghent University, Belgium**

October 2002

2002/157

[1] Financial support from the European Commission Research Training Network "Understanding Financial Architecture: Legal and Political Frameworks and Economic Efficiency" is gratefully acknowledged. This research project was initiated while Koen Schoors was visiting fellow at the University of Oxford (Saïd Business School) whose hospitality and financial support are gratefully acknowledged. We wish to thank Sabien Dobbelaere and discussants at the EEA conference in Venice for useful comments.
[2] Phone: +32 9 264 89 74; Fax: +32 9 264 35 99; E-mail: koen.schoors@rug.ac.be

D/2002/7012/32

Foreign direct investment spillovers within and between sectors: Evidence from Hungarian data

Koen Schoors and Bartoldus van der Tol

Abstract

This article analyses how FDI influences labour productivity of domestic firms in Hungary. We find that foreign firms perform better than local firms. The presence of foreign firms has a positive spillover effect on labour productivity of local firms in the same sector, specifically in very open manufacturing sectors. Spillover effects between sectors are found to be relatively more important than spillover effects within sectors. Foreign investment in user sectors has a positive spillover effect on local suppliers, while the opposite holds for foreign investment in supplier sectors. Absorption and openness play a significant role in these spillover effects.

JEL: F2, O3

Keywords: Foreign direct investment, sectoral spillover, intersectoral spillover

1) Introduction

Foreign direct investment (FDI) is assumed to play a crucial role in economic restructuring and enhancing growth in the Central European transition countries (see Hooley, 1998; Barrell and Holland, 2000). In this paper we will try to analyse the performance effects of FDI in Hungary, the largest recipient of FDI in Central Europe. We try to answer four questions. Do foreign firms perform better than local firms? Are there any spillover effects of FDI within sectors and if so, are they positive or negative? Are there any spillover effects of FDI between sectors and if so, are they negative or positive? Do spillover effects depend on other factors such as the degree of openness of the sector or absorption of the domestic firm?

This work relates to a large body of literature on the effect of FDI on domestic firms. FDI constitutes a direct injection of foreign capital and technology. In the context of transition economies, we expect that FDI will raise productivity. Hence foreign firms will be more productive than local ones. This is referred to as the **direct effect of FDI**. The positive direct effect of foreign ownership has been confirmed empirically in a large number of studies. Next to a direct effect, there exist a number of externality effects, by which FDI affects other firms in the same sector or even in other sectors. These indirect effects are commonly referred to **as spillover effects**. These originate from several sources. First, FDI could generate a beneficial transfer of know-how and technology. Teece (1977) describes various channels through which this technology diffusion effect may run, mainly labour turnover from foreign firms to local firms (see also Fosfuri, Motta, and Ronde, 2001) and imitation of nearby technology (the demonstration effect). Second, the injection of capital and technology certainly stimulates competition in the local market. This competition effect can work either way as suggested in theoretical work of Sanna-Randacio (1999) and Lehay and Neary (1999). Indeed, if the initial difference in technology between foreign firm and the domestic firm is large and human capital is poor (low absorption), the foreign firm is likely to suffocate local unproductive competitors (the so-called market-stealing effect). However, if the technology gap is not small and human capital is well developed, the increased competition may stimulate a productivity catch-up by local firms. The direction of the competition effect therefore depends on the absorptive capacity of the local firm, as measured by its level of technology (see also Sjöholm, 1999).

The empirical literature on spillover effects of FDI has not reached consensus. Several empirical papers assess the intrasectoral spillover effect of FDI on domestic firms. Blomström and Persson (1983) and Blomström and Sjöholm (1999) find positive spillovers for respectively Mexico and Indonesia. Kokko (1994) and Borenzstein, De gregorio and Lee (1998) found that spillovers are only positive if the technology gap is sufficiently small and the initial stock of human capital is sufficiently high. Liu et al. (2000) find for the UK that the extent to which local firms benefit from FDI in their sector depends largely on their own technological capabilities. Aitken and Harrison (1999) criticise Blomström and Persson (1983) and Blomström and Sjöholm (1999) for failing to take into account firm fixed effects. They find negative

net spillovers. As regards Central Europe, Zukowska-Gagelmann (2000) finds negative spillovers for Poland and Jarolim (2000) for the Czech Republic. Controlling for technological capability, Konings (2000) finds for Eastern European transition economies that the market stealing effect dominates at the initial stages of transition, which implies a negative spillover effect. Barrell and Holland (2000) analyse the effects of FDI in 11 manufacturing sectors within Hungary, Poland and the Czech Republic and find contrasting evidence that FDI has increased labour productivity levels in most manufacturing sectors. Yudaeva, et al (2000) criticise previous studiesfor failing to take into account time-specific effects, which may have biased results. They find for Russia that the sign of the spillover effect depends on the size of the firms and they cannot reject that spillovers depend on the level of education, which validates the absorptive capacity hypothesis. Konings (2001) finds no spillovers for Poland and negative spillovers for Romania and Bulgaria.

Our work contributes to this literature in several ways. We control for selection bias by estimating a treatment effects model. We test whether the sectoral spillover effect depends on absorption. We are the first to analyse empirically the intersectoral effects of FDI. We analyse whether the intersectoral spillover effects are dependent on the openness of the sector, verifying whether FDI are a substitute for openness of the sector with respect to the effect on productivity. This relates to Xu and Wang (2000). They find strong empirical support for capital goods trade as a channel for international technology diffusion in industrialised countries and reject the hypothesis that inward FDI is a significant channel for international technology diffusion among industrialised countries.

We arrive at a number of interesting conclusions. As expected, foreign companies are more productive than local ones. This remains true after controlling for possible selection bias, although the relation between productivity and the degree of foreign ownership dissappears. We find significant positive sectoral spillover effects in Hungary and we find support for the absorption hypothesis. More importantly, the results indicate that intersectoral spillover effects are significant both statistically and economically. Indeed the intersectoral spillover effects, which have been largely ignored, are in general more important than the sectoral spillover effect. The forward linkage effect positive as expected, but the backward linkage is clearly negative. Last, we find that spillover effects depend on the openness of the sector. Specifically, both sectoral and intersectoral spillovers of FDI are distinctively important in very open manufacturing sectors. The hypothesis that sectoral spillover effects of FDI would be a substitute for openness in closed sectors cannot be maintained.

Section 2 considers FDI in Hungary and explains why we chose this. Section 3 will describe our methodological approach and data. In section 4 we report results and comment. Section 5 summarises and concludes.

2) FDI in Hungary

Skilled labour, capital and technology are the main drivers of growth in any country. In transition countries skilled labour was abundantly present. Therefore the dismal growth record of transition countries in the last phase of communism and the first phase of transition was largely blamed on the lack of capital and technology (including management skills). This deficiency is still considered to be an important impediment to growth in transition countries. Foreign direct investment is generally considered to be a convenient way out of this catch. Transition countries and developing countries alike have therefore been encouraged to devise FDI-friendly policies in order to attract FDI.

Table 1 shows that Hungary was the first country in central Europe to attract significant FDI, with the largest influx of FDI in 1990-1995 in absolute terms, let alone in per capita terms. Later the pace of FDI stalled in absolute terms, but remained relatively strong in per capita terms. Table 2 shows that Hungary boasts the highest cumulative inflow of per capita FDI in 89-99, with the lion share arriving in 1990-1995. Therefore possible effects of FDI on local Hungarian firms have had due time to resort full effect and Hungary provides a perfect case study to assess the effect of FDI on local firms. As the largest recipient of FDI per capita in the region, Hungary's relative economic success is often attributed to its success in attracting FDI. The question whether FDI into Hungary came at the detriment or the benefit of local firms is therefore particularly important.

Insert table 1

Insert table 2

3) Intersectoral effects

FDI may carry effects across sectors. We refer to these as **intersectoral spillover effects.** We consider both forward linkages and backward linkages. These intersectoral effects have previously been analysed by Markusen and Venables (1999). They study the trade-off between increased product market competition, which in their model is always negative for local firms, and linkage effects that may have a positive effect on local firms. In our paper the product market competition effect is part of the sectoral effect and the linkage effect is the intersectoral effect. Markusen and Venables show how FDI could act as a catalyst for economic growth if the linkage effects are sufficiently strong. This effect in their model produces because multinationals that are active in consumer product increase demand for local intermediate products. This has a positive effect on the local intermediate producers productivity and exports and may ultimately induce even more efficient local producers in the consumer product industry and drive the multinationals out of the

local market. This sounds like a good strategy. Sound empirical evidence of the salutary nature of foreign direct investment though intersectoral links is still missing however. We study these intersectoral links for Hungary.

If a foreign manufacturing firm invests in Hungary, it will stimulate demand for intermediate products (parts and components) on the local market. This demand stimulus for higher quality inputs will encourage local suppliers to invest and produce inputs conform to higher quality standards (see Blomström and Kokko, 1998). Local suppliers in transition economies are eager to supply to foreign companies, if only because they have a lower probability of failure and better payments reputation. Often the foreign firm actively helps and stimulates local suppliers to deliver high quality inputs. As a result productivity and international competitiveness may be increased. Markusen and Venables predict that this forward linkage spillover effect will enhance productivity of local firms.

There exists an equivalent backward linkage effect, where better inputs due to foreign investments affect the productivity of all firms that use these inputs. The inputs will be better, which should have a positive effect on local firms' productivity. This is the effect hypothesised by Markusen and Venables. In their model it produces a virtuous cycle of foreign investment by which the ultimately multinationals are driven out of the local market by more efficient local firms. However it is not so clear which direction this effect will take. The inputs produced by multinationals in the input industry may be more expensive and not adapted to local requirements. In other words, foreign investments in input sectors may mainly be beneficial to already more productive foreign enterprises in the output sector that are more fit to handle the better but more expensive inputs. In this case the productivity difference between local and foreign enterprise in the output sector will increase and the intersectoral spillover will be negative.

We evaluate these forward and backward linkages empirically with the use of input-output data provided by Hungarian Central Statistical Office.

4) Data and Empirical Approach

4.1. Data

Company-data for Hungarian firms are provided by the AMADEUS-database of bureau van Dijck. This database contains company data for medium and large companies. We use data for 1084 firms in 1997 (545 observations) and 1998 (539 observations). This dataset contains both private and state-owned companies. These years are chosen, because they are closest to the input-output data, which are for 1998. Indeed the input-output data are based on flow data running from end 1997 to end 1998. The data panel is unbalanced.

The lack of symmetry is however incidental and is not related to the liquidation or bankruptcy of certain enterprises. We use the data not as a panel but as a cross-section of firms, because we focus on the spillover effects between sectors for which we have no time series data. Every firm is allocated to a sector using two digit NACE-codes. Some enterprises are active in more than one two-digit NACE sector. In that case the firm is allocated to the first sector mentioned. If there are three different two-digit NACE-sectors, firms are omitted[1]. We use this NACE-2 sector definition because the input-output data at our disposal are in two-digit NACE format. The data include 39 sectors. Sectors with only one observation were excluded. Table 3 gives an overview of the sectors and the numbers of observation per sector.

Insert table 3

From table 3 we see that the large majority of firms in the sample are manufacturing firms. However the primary sector and the services sector (notably the distribution sector with NACE 51 and 52 are also represented in the sample.

The input-ouput needed to calculate intersectoral effects are obtained from the Hungarian Central Statistical office (HCSO, 2001).

4.2. Empirical specification

Since input output tables are not provided annually and since the structure of industry has changed greatly in transition countries in the period under study, we are limited to two observation years (essentially before and after the date of the input – output table). Therefore we are forced to pool our data and perform a cross-sectional analysis of the level of firm productivity rather than a panel analysis of changes in firm productivity. Our empirical approach is to estimate the level of firm productivity as shown in (1). There are i firms classified in j sectors. We estimate the labour productivity of a firm i in sector j (defined as output Q divided by employment L) as a standard function of the capital-labour ratio K/L, the level of human capital per worker H/L and sector-specific scale variable S. We also include the squared scale variable S^2 to allow a productivity-optimal scale. The equation is enhanced with firm-specific characteristics Y, a dummy for foreign ownership F and sectoral variables that measure the spillover effects. More specifically these are a sectoral spillover dummy SpillS, a backward linkage spillover SpillB and a forward linkage spillover SpillF, while ε is an unobserved influence on a firm's labour productivity.

[1] We repeated all regressions with a more precise sector definition, excluding all firms with more than one two-digit sector. Results remain qualitatively the same and the more precise definition is costly in terms of lost observations.

$$\frac{Q_i}{L_i} = \alpha_0 + \alpha_1 \frac{K_i}{L_i} + \alpha_2 \frac{H_i}{L_i} + \alpha_3 S_i + \alpha_4 (S_i)^2 + \alpha_5 Y_i + \alpha_6 F_i + \alpha_7 SpillS_j + \alpha_8 SpillB_j + \alpha_9 SpillF_j + \varepsilon_i \quad (1)$$

Since the choice of foreign ownership may be related to productivity, the ownership dummy may be subject to a selection bias. Foreign firms may have decided to invest in the most productive firms and this may be driving the results.

One way to control this bias would be to look at the growth of productivity rather than the level. This requires a sufficient number of years. We could not use this methodology, because it would not allow us to estimate intersectoral effects, which are based on input-output tables for one year. Indeed, the time series aspect of our analysis is entirely suppressed by our intention to capture intersectoral effects by means of input-output data, since these are not assembled every year. The huge shifts in industrial structure during transition do not allow us to use technical coefficients constant over time. Therefore we effectively use our panel data as a cross-sectional dataset and estimate the level of productivity. An alternative way to get round this selection bias is to estimate a treatment effects model (see Maddala, 1983) for the foreign ownership dummy and using firm-specific effects as RHS variables in the treatment equation. Therefore we estimate not only a simple OLS model, but also a treatment effects model where the dummy for foreign ownership F is modelled a function of firm-specific exogenous variables Z, as shown below.

$$\frac{Q_i}{L_i} = \alpha_0 + \alpha_1 \frac{K_i}{L_i} + \alpha_2 \frac{H_i}{L_i} + \alpha_3 S_i + \alpha_4 (S_i)^2 + \alpha_5 Y_i + \alpha_6 F_i + \alpha_7 SpillS_j + \alpha_8 SpillB_j + \alpha_9 SpillF_j + \varepsilon_i$$
$$F_i = \beta_0 + \beta_1 Z_i + u_i \quad (2)$$

According to the standard production function literature, we expect $\alpha 1>0$ and $\alpha 2>0$. If there is a sector-specific labour-productivity optimal scale we expect $\alpha 3>0$ and $\alpha 4<0$. For $\alpha 5$ we expect a negative sign, as explained in section 4.3. We expect that foreign firms will be more productive ($\alpha 6>0$). There are no prior expectations about $\alpha 7$, as the net sectoral effect has been found to run either way in previous studies. The theoretical expectation of Markusen and Venables (1999) for both intersectoral spillover effects is positive ($\alpha 8>0$, $\alpha 9>0$). In all regressions we control for year effects by including a year dummy, but results remain completely unaffected. This is not unexpected since the period 1997-1998 was one of stable growth in Hungary. We also include regional dummies and, if appropriate, industry dummies.

4.3. Definition of variables

All variables in (1) and (2) are expressed in logs, except the dummies, the spillover-variables and the scale variable.

Ouput Q_{ij} is defined as annual total turnover. We are forced to use this approach because of data limitations. Data are in HUF. Since we analyse two years and since the input-output data are in prices of 1998, we inflated 1997 data by the producer price index[2].

Capital K is defined as tangible fixed assets. Human capital H is approached as the value of intangible fixed assets. This is the best proxy at our disposal for R&D expenditure and hence the level of technology. The scale S_i was calculated as the ratio of the firm's sales to average sales in its sector (see also M. Blomström, F. Sjöholm, 1998, p.4-6; F. Sjöholm, 1999, p.60).

We control for firm specific effects Y by introducing the average period of customer credit. This variable is expressed in days and measures the average period needed to convert receivables into cash[3]. This variable is forward-looking. In failure prediction models based on accounting data, it often emerges as a good predictor for future failure. It captures the bargaining position and the relative strength of a firm in its operational environment and the beliefs of its customers about the firm's viability. Indeed if customers think that a supplier faces financial distress, it is rational to postpone payment, so as to provoke bankruptcy and postpone payment even further. Hence we expect a negative coefficient for days of customer credit.

The dummy for foreign ownership can and has been expressed in different ways in the literature. One option is foreign ownership sensu stricto. The dummy Foreign equals 1 if foreign ownership exceeds the 10% threshold. %. The 10% border is chosen, because it is an internationally accepted standard (see also J. Konings, 2000, p.7; A. Kokko, R. Tansini, C. Zejan 1996, p.606; M. Blomström, F. Sjöholm, 1998, p. 7), also applied by the IMF to characterise foreign ownership. It seems meaningful to distinguish between majority ownership and minority ownership. Fmaj equals 1 if foreign ownership is higher than 50%. Fmin equals 1 if foreign ownership is between 10% and 50%. We can further refine majority ownership by defining Fmax for foreign ownership at 95% or higher and Fmed for foreign ownership higher than 50% but lower than 95%.

The sectoral spillover variable $SpillS_j$ is constructed is the ratio of turnover of foreign-owned firms (Fmaj=1) to total turnover in the sector. Total turnover of the sector also includes enterprises for which ownership data are not available[4]. The variable is a proxy that captures the presence of foreign firms in a given sector.

---

[2] We use the PPI-index of the EBRD, provided in its Annual Transition Report 2000, p. 173.

[3] One could argue that this variable is determined by sector. However the inclusion of industry dummies did not affect the coefficients nor significance found for firm-level days of customer credit. Hence the variable reflects a firm-specific effect.

[4] We repeated all regressions excluding firms for which data are not available from the calculation of the spillover effect. Results remained qualitatively unchanged.

Intersectoral spillovers were calculated for every sector j as the weighted average of the sectoral spillover effect of all the other sectors $SpillS^{-j}$, using the technical coefficients from input output tables (two-digit sector definitions) as weights. We exclude the diagonal elements of the input-output table in the calculation of the weighted average, as intrasectoral effects are accounted for by the sectoral spillover variable. We also exclude the share of export in the calculation of the forward spillover, because the degree of openness is addressed separately by splitting the sample in closed, open and very open sectors (see section 5.3).

Insert table 4

Sample characteristics are shown in table 4. The statistics in table 4 seem to suggest that foreign firms are indeed more productive. Not surprisingly they are concentrated in relatively large enterprises, as measured by total turnover, but not as measured in terms of employment. Foreign firms also have a higher relative scale, more technology and are more export-oriented. The descriptive statistics also show a clear difference between majority ownership and minority ownership. Indeed table 4 seems to indicate that labour productivity is positively related to the degree of foreign ownership. It remains to be seen whether the sectoral and intersectoral spillover effects will explain productivity differences between enterprises, once we have controlled for this direct foreign ownership effect.

5. Results and interpretation

All regressions are conducted on all sectors and all firms. Adding restrictions by excluding for example small sectors, small firms or big firms, did not alter the results. We will therefore show the results without any further sample restrictions

5.1. Direct effect of foreign ownership

In first instance we look exclusively to the direct ownership effect. Results are shown in table 5. We first estimate a simple OLS (panel A) and then a treatment effects model (panel B). In panel A, we included in all equations sector dummies, regional dummies and a year dummy, which was always insignificant. Note that the introduction of days of customer credit as an independent variable decreased the number of observations from 1084 to 1021.

Insert table 5

All coefficients show the expected sign. The ownership dummies are always positive. Equation 1 reveals that foreign firms enjoy higher labour productivity than local firms. In equation 2 we refine our ownership

variable to distinguish between minority and majority ownership. Though still non-negative, the coefficient for minority ownership is lower then the one for majority ownership and insignificant. In equation 3 we differentiate majority ownership further. The coefficient for foreign ownership higher than 95% is two times as large as the coefficient for majority ownership lower than 95%, which is in turn about double the insignificant coefficient for minority ownership. These results seem to suggest that labour productivity is related to the degree of foreign ownership. This could however be due to selection bias.

In panel B of table 5 we estimate a treatment effects model. The treatment variables were, next to the constant, the absolute scale and the profit margin, in the assumption that foreign owners prefer to invest in rather big enterprises with high profit margins. Several things are noteworthy. First the ownership variables remain significant but now have much larger coefficients. Clearly the positive direct effect of ownership on productivity is not driven by selection bias. If anything the OLS estimates underestimate the positive direct effect of foreign ownership. Secondly it is not longer the case that productivity is positively related to the degree of foreign ownership. The positive relation between productivity and degree of foreign ownership found in panel A is apparently driven by selection bias. These results are robust to the choice of appropriate treatment variables. Whatever appropriate and available treatment variables we applied, we arrived at equivalent results with respect to the direct ownership effect. We therefore conclude that the positive direct effect of foreign ownership cannot be rejected. The question then is whether this was at the benefit or detriment of local firms. This is addressed in the next section.

5.2. Sectoral and intersectoral spillover effects

In table 6 we add three variables that measure sectoral spillover, backward spillover and forward spillover to the previous estimations. Since these three variables are sector-specific, the sector dummies are dropped. Les us first consider the results for sectoral spillovers. In both panels, the first three equations show OLS estimates and equations 4 to 6 show the estimates from the treatment effects model.

Insert table 6

In equations 1 to 3 of panel A, the coefficient for sectoral spillovers is significantly positive. This seems to reject the hypothesis of net negative sectoral spillover effects and to suggest that the positive sectoral spillover effects dominate the negative ones. However after controlling for selection bias in equations 4 to 6 the significance of the sectoral spillover effects falters.

In panel B we control for absorption by interacting the sectoral spillover variable with human capital per worker. The sectoral spillover coefficient now becomes significantly positive in all equations both before and after controlling for selection bias. I cannot be rejected that the net sectoral spillover effect, when

controlled for absorption, is positive. Local firms that are sufficiently developed, benefit from foreign competition in the form of FDI. This confirms the important role of absorption, even in a country as Hungary, where human capital is on average relatively well developed.

Second, all equations in panel A of table 6 exhibit intersectoral spillover coefficients that are significant and larger than the coefficients for sectoral spillovers, while the means of the variables concerned are comparable. This means that foreign direct investment has a much larger effect on firm productivity through spillovers across sectors than through sectoral spillovers. Clearly, intersectoral spillover effects are central to understanding how FDI affect local firms.

Third, we find that forward linkage spillovers (from foreign clients to local suppliers) are positive as hypothesized by Markusen and Venables (1999). Backward linkage spillovers however are found to be negative which is contrary to what was previously assumed. This unexpected result seems to suggest that countries should try to attract FDI in sectors that operate at the end of the production chain close to the end-user, because these investments clearly enhance productivity of local firms while the opposite is the case for FDI at the start of the production process. Rodriguez-Clare (1996) gives a possible explanation for our empirical finding. She shows how the linkage effect of multinationals on the host country is more likely to be favorable when the good that multinationals produce uses intermediate goods intensively (creating a positive forward linkage effect) and when host countries are not too different in terms of the variety of intermediate goods produced. If these conditions are reversed, then multinationals could even hurt the host economy. Our finding of a negative backward spillover may point ion this direction. Apparently intermediate inputs produced in Hungary are still too different from international intermediate inputs to generate a positive backward linkage spillover.

The unexpected findings with respect to intersectoral spillovers are very robust. The signs and economic significance are confirmed in all equations and of tables 6 and 8.

5.3. Spillover effects versus degree of openness

It is possible that our estimates of sectoral spillovers are biased because we do not take into account openness. Indeed, companies that export a lot have faced foreign competition before and have had the opportunity to learn from and imitate their foreign competitors. In such sectors the positive effect of FDI may be rather limited. In closed sectors on the contrary, we could expect FDI to have more spillover effects because these sectors have not previously been exposed to foreign competition and experience. In this view, the sectoral spillover effect of FDI in very closed sectors is seen as a substitute for foreign competition. One could, however, also make a case for the opposite conjecture. It is conceivable that firms in very open

sectors that export the large majority of their produce actually benefit more from FDI in their sector, because the fierce domestic competition and example posed by foreign firms in their home market makes them more fit to face foreign competition. Firms in very closed sectors on the other hand have been shielded from foreign competition and may not be fit to face the challenge. To verify this conjecture empirically, we split are sample in three parts, namely sectors that export less than 33% (closed sectors), sectors that export between 33% and 66% (open sectors) and the sectors that produce more than 66% (very open sectors). In table 7 we show a more detailed classification of sectors according to their degree of openness. The degree of openness is measured as the share of sectoral output that is exported.

Insert table 7

Comparing table 7 to table 3 reveals that all the very open sectors are manufacturing sectors. In contrast the very closed sectors do not include a single manufacturing sector, with the exception of the refinery sector (NACE 23), which is typically oriented on local consumption. Therefore the degree of openness can also be interpreted as splitting between manufacturing and non-manufacturing.

We repeated the crucial regressions of table 6 for three subsamples. Results are shown in table 8. We only report the spillover effects in order to retain readability. Panel A reports the result for closed sectors, panel B for open sectors and panel C for very open sectors.

The earlier finding that intersectoral spillovers are more important than sectoral spillovers, is strongly supported by the continued high and in most cases significant coefficients for the intersectoral spillover effects. Also the opposite signs found for backward and forward spillover effects are supported throughout table 8.

After controlling for selection bias (equations 3 and 4) we find high and significant coefficients for the direct ownership effect in all panels of table 8. Clearly foreign firms are more productive than local firms across the board. The question then is whether this productivity difference spills over to local firms either within or between sectors.

As regards **sectoral spillovers**, we question whether FDI are a substitute or a complement for openness. In the closed sectors (panel A) the sectoral spillover variable is significant in equation 1 and 2, but becomes insignificant when we control for selection bias in equations 3 and 4. In the open sectors (panel B) there are no significant sectoral spillovers, although the sign remains positive. In the very open sectors (panel C), we find positive sectoral spillovers that are significant both economically and statistically. Clearly the sectoral spillovers are most important in the very open sectors. This suggests that FDI and openness are complements rather than substitutes, as far as their effect on labour productivity is concerned.

The **intersectoral spillovers** are affected by openness too. In closed sectors (panel A) the backward spillover is negative and very significant both economically and statistically. The forward spillover is positive but only close to significant after controlling for selection bias. In the open sectors (panel B) the intersectoral spillovers lose their significance, but retain their typical signs. In the very open sectors we again find significantly negative backward spillovers (though they are smaller than in the closed sectors) and significantly positive forward spillovers (which are a lot larger than in the closed sectors).

Clearly FDI do not have benign spillover effects in relatively closed sectors: there are no signs of strong positive spillovers while there is proof of strongly negative backward spillovers. In relatively open sectors there is not much of an effect at all. The benign effects are concentrated in the very open sectors, where the sectoral spillover and the forward intersectoral spillover are large and positive. One possible explanation is that foreign companies in relatively closed sectors have, next to a positive effect, also a market stealing effect on the unprepared local companies. This may cause the insignificance of the net sectoral effect. Another explanation may be that foreign companies in relatively closed sectors collude rather than compete with the less productive local companies and reap the excess profits that follow from their higher productivity and artificially high prices. At the same time this allows the continued low productivity of local firms. Our data do not allow us to make further judgements on this.

The concentration of benign effects in the very open sectors implies that labour productivity is strongly enhanced by local FDI competition in the very open sectors. To put it simply, we find that productivity-driven export growth is strongly supported by FDI. This is reassuring, as productivity-driven export growth to the EU is central to the current growth strategy of Central Europe. Local firms that operate in very open sectors without much FDI have a relatively low productivity. Probably they draw on low labour cost as a comparative advantage, rather than labour productivity. Openness can be restated as manufacturing for this dataset. Hence FDI have specifically benign sectoral spillover effects in the export-oriented manufacturing sectors. As regards effects between sectors, it is clear that FDI are particularly benign if they are in sectors at the end of the production chain

7. Concluding remarks

In this paper we tried to answer four questions about the effect of FDI on labour productivity in Hungary. Do foreign firms perform better than local firms? Yes they do and the effect is not driven by selection bias. The selection bias is however driving the perceived relation between degree of foreign ownership and labour productivity. Are there any spillover effects of FDI within sectors and if so, are they positive or negative? Yes there are sectoral spillovers. The hypothesis of negative sectoral spillover effects is rejected

by the data since the sectoral effect is always insignificant or significantly positive. Are there any spillover effects of FDI between sectors and if so, are they negative or positive? Yes there are spillover effects between sectors. Backward linkage spillovers are found to be negative and forward linkage spillovers are found to be positive. The intersectoral effects are economically more important than the sectoral effects, which is a surprising result. Do spillover effects depend on other factors such as the degree of openness of the sector or absorption of the domestic firm? Yes. The sectoral spillover effect is dependent on absorption: it is more important in local firms with higher human capital. All spillover effects depend on the openness of the sector. Positive sectoral effects are concentrated in the very open sectors. Hence FDI and exports seem to be complements rather than substitutes as far as their effect on labour productivity is concerned. In the open sectors, intersectoral spillover effects are not very important. Negative backward spillovers dominate in closed sectors, while forward spillover effects become strongly positive in the very open sectors.

Our results imply that net positive sectoral spillover effects are particularly pronounced in the very open manufacturing sectors, where they contribute to the productivity driven growth of the export of manufacturing products. This seems to be a reassuring result and is in our view the way forward for the rest of Central Europe. As regards intersectoral spillover effects, we found that they are very significant and economically more important than sectoral spillovers. Indeed intersectoral spillovers constitute the most important transmission mechanism of spillover effects from foreign enterprises to local firms. FDI in customer companies had a strongly positive effect on their local suppliers (forward linkage spillover). The opposite is true however for FDI in the intermediate sectors, which negatively affect the labour productivity of local firms that use their products. In balance the results suggest that countries in the region should try to attract FDI in export-oriented manufacturing sectors, that produce consumer products, since this form of FDI clearly has the most benign effect on the labour productivity of domestic firms.

There is a lot of scope for further research. Further analysis should take selection bias seriously. The analysis of intersectoral effects needs to be repeated for other countries to test the robustness of the findings. Probably other effects of FDI also run across rather than within sectors. We think here for example of exports and total factor productivity. Maybe multinationals do not only learn their local competitors but also their local suppliers to export. Maybe multinationals also influence total factor productivity of local competitors and suppliers. More importantly, we think much more theoretical work is required to understand how precisely foreign direct investment affects the performance of domestic firms in developing economies. Our findings suggest that intersectoral spillovers deserve much more attention in this research and that the mechanism by which FDI affect local firms is currently poorly understood.

List of references

Aitken, B. and A. Harrison, 1994, Spillover, Foreign Investment, and Export Behavior, NBER Working Paper 4967.

Aitken, B., A. Harrison and R. E. Lipsey, 1995, Wages and Foreign Ownership: A Comparative Study of Mexico, Venezuela and the United States, NBER Working Paper 5102.

Aitken, B., G. Hanson, and A. Harrison, 1994, Spillovers, Foreign Investment, and Export Behavior, NBER working Paper 4967, December.

Barrell, Ray, Holland, Dawn, 2000, Foreign Direct Investment and Enterprise Restructuring in Central Europe, Economics of Transition 82, 477-504.

Blomstrom, M.,1991, Host Country Benefits of Foreign Direct Investment, in : D.G. McFetridge, editor, Foreign Investment, Technology and Economic Growth. Toronto: University of Toronto Press.

Blomstrom, M,, and A.Kokko 1995, Multinational Corporations and Spillovers: A Review of the Evidence, Stockholm School of Economics Working Paper.

Blomstrom, M., A. Kokko and M. Zejan, 1994, Host Country Competition and Technology Transfer by Multinationals, Weltwirtschafliches Archiv 130, 521-533.

Blomström M. en Kokko A., 1998, Multinational Corporations and Spillovers, Journal of Economic Surveys, 12, 247-277.

Blomstrom, M., R. E. Lipsey, and M. Zejan, 1994, What Explains the Growth of Developing Countries, in: W. Baumol, R. Nelson and E. Wolff, eds., Convergence of Productivity : Cross-National Studies and Historical Evidence. Oxford: Oxford University Press, 243-259.

Blomstrom, M. and E. Wolff, 1994, Multinational Corporations and Productivity Convergence in Mexico", in: W. Baumol, R. Nelson and E. Wolff, eds., Convergence of Productivity : Cross-National Studies and Historical Evidence. Oxford: Oxford University Press, 263-284.

Blomström M. en Persson H., 1983, Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from the Mexican Manufacturing Industry, World Development 116, 493-501.

Blomström M. en Sjöholm F., 1998, “Technology transfer and spillovers: does local participation with multinationals matter?”, NBER working paper 6816, November 1998, 15 pages.

Caves, R. E. 1996), Multinational Enterprise and Economic Analysis, second edition. London: Cambridge University Press.

Chung, W., W. Mitchell and B. Yeung 1994, Foreign Direct Investment and Host country Productivity: The Case of the American Automotive Components Industry, University of Michigan Working Paper.

Fosfuri, Andrea; Motta, Massimo; Ronde, Thomas , 2001, Foreign Direct Investment and Spillovers through Workers' Mobility, Journal of International-Economics 53(1), 205-22.

Hooley, Graham, et al., 1998, The Role of Foreign Direct Investment in the Transition Process in Central and Eastern Europe, in: G. Hooley, R. Loveridge and D. Wilson, eds., Internationalization: Process, context and markets. Academy of International Business Series. New York: St. Martin's Press; London: Macmillan Press, 1998, pages 176-200.

Kokko, A. and M. Blomstrom, 1995, Policies to Encourage Inflows of Technology Through Foreign Multinationals, World Development 23, 459-468.

Konings J., 2001, The Effects of Foreign Direct Investment on Domestic Firms: Evidence from Firm-Level Panel Data in Emerging Economies, Economics of Transition 9(3), 2001, 619-33.

Liu, Xiaming, et-al., 2000, Productivity Spillovers from Foreign Direct Investment: Evidence from U.K. Industry Level Panel Data, Journal of International Business Studies 31(3), 407-25.

Lopez-de-Silanes, F., J. R. Markusen, and T. Rutherford, 1994, Complementarity and Increasing Returns in Imported Intermediate Inputs, Journal of Development Economics 45, 101-119.

Maddala, G.S., 1983, Limited-dependent and Qualitative Variables in Econometrics. Cambridge: Cambridge University Press.

Markusen, J. R., 1995, The Boundaries of Multinational Firms and the Theory of International Trade, Journal of Economic Perspectives 9, 169-189.

Markusen, J. R. and A J. Venables, 1999, Foreign Direct Investment as a Catalyst for Industrial Development, European Economic Review 43(2), 335-56.

Rodriguez-Clare, A., 1996, Multinationals, linkages, and economic development, American Economic Review 86, 852-873.

Sjöholm, F., 1999, Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Establishment Data, The Journal of Development Studies 36(1), October 1999, pp 53-73.

Teece, D. J., 1977, Technology Transfer by multinational firms: the resource cost of transferring technological know-how, Economic Journal, 87, 242-261.

Zukowska-Gagelmann Katarzyna, 2000, Productivity Spillovers From Foreign Direct Investment In Poland, Economic Systems, 24(3), 223-256.

Table 1: FDI-flow to CEEC**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000*
Poland	0	117	284	580	542	1134	2741	3041	4966	6642	10000
Czech R	n.a.	n.a.	983	563	749	2526	1276	1275	2641	4912	6000
Hungary	311	1459	**1471**	**2328**	**1097**	**4410**	1987	1653	1453	1414	1650
Slovak R	24	82	100	107	236	194	199	84	374	701	1500
Bulgaria	4	56	42	40	105	98	138	507	537	806	500
Romania	-18	37	73	87	341	417	415	1267	2079	949	500
Estonia	n.a.	n.a.	n.a.	156	212	199	111	130	574	222	250
Albania	n.a.	n.a.	20	45	65	89	97	42	45	51	92
Slovenia	-2	-14	113	111	131	183	188	340	250	144	50

Source: EBRD, 2000, p.74

* estimate

** FDI is calculated as the net flow as mentioned in the balance of payments.

Table 2: FDI* flows to CEEC in relative terms

	Cumulative flow of FDI per capita ('89-'99) (in US$)	*Flow of FDI per capita (US$)*		*Flow of FDI per capita (In % van GDP)*	
		1998	1999	1998	1999
Poland	518	128	172	3,2	4,3
Czech R	1447	256	476	4,7	9,2
Hungary	**1764**	144	140	3,1	2,9
Slovak R	391	70	130	1,8	3,6
Bulgaria	284	65	98	4,4	6,5
Romania	252	92	42	5,0	2,8
Estonia	1115	397	154	11,0	4,3
Albania	137	13	15	1,5	1,4
Slovenia	701	125	72	1,3	0,7

Source: EBRD, 2000, p.74

* estimate

** FDI is calculated as the net flow as mentioned in the balance of payments.

Table 3 Sectoral distribution of sample

Nace	*obs*	*Description*
1	83	Agriculture, hunting and related service activities
2	3	Forestry, logging and related service activities
11	2	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying
14	5	Other mining and quarrying
15	113	Manufacture of food products and beverages
16	3	Manufacture of tobacco products
17	41	Manufacture of textiles
18	30	Manufacture of wearing apparel; dressing and dyeing of fur
19	14	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	25	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	19	Manufacture of pulp, paper and paper products
22	25	Publishing, printing and reproduction of recorded media
23	5	Manufacture of coke and refined petroleum products and nuclear fuel
24	54	Manufacture of chemicals and chemical products
25	34	Manufacture of rubber and plastic products
27	36	Manufacture of basic metals
28	85	Manufacture of fabricated metal products, except machinery and equipment
29	95	Manufacture of machinery and equipment n.e.c.
30	10	Manufacture of office machinery and computers
31	30	Manufacture of electrical machinery and apparatus n.e.c.
32	19	Manufacture of radio, tv. and communication equipment and apparatus
33	18	Manufacture of medical, precision and optical instruments, watches and clocks
34	36	Manufacture of motor vehicles, trailers and semi-trailers
35	8	Manufacture of other transport equipment
36	38	Manufacture of furniture; manufacturing n.e.c.
40	10	Electricity, gas, steam and hot water supply

45	61	Construction
50	11	Sale, maintenance & repair of motor vehicles and motorcycles; retail sale of automotive fuel
51	49	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52	41	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
55	12	Hotels and restaurants
60	10	Land transport; transport via pipelines
63	13	Supporting and auxiliary transport activities; activities of travel agencies
64	8	Post and telecommunications
67	3	Activities auxiliary to financial intermediation
71	2	Renting of machinery & equipment without operator and of personal and household goods
72	10	Computer and related activities
73	5	Research and development
74	18	Other business activities
Sum	1084	All sectors

Description of the sample drawn from AMADEUS.

Table 4 Selected sample statistics

Ownership	*Foreign firms*	*Of which*			*Local Firms*
		95% ≤ Foreign	*50% < Foreign < 95%*	*10% < Foreign ≤ 50%*	
Nº of observations	473	39	395	39	611
Labour productivity	32,452	37,509	32,775	24,120	23,161
Physical Capital	5,085,615	19,575,937	3,998,360	1,607,226	5,616,172
Employment	440	522	446	290	563
Turnover	9,673,073	18,600,000	9,321,350	4,264,862	4,429,215
Scale	1.26	1.76	1.27	0.67	0.85
Technology (intangibles)	102,168	91,691	110,078	32,938	77,832
Export share	0.51	0.58	0.50	0.57	0.44
Days of customer credit	68.0	67.3	67.7	72.9	49.2

Own calculations based on the sample drawn from AMADEUS

Table 5 The direct effect of foreign ownership on productivity

The dependent variable is labour productivity. K is physical capital, L is employment. F equals 1 for foreign participation of more than 10%, Fmin equals 1 for minority foreign participation, Fmaj equals 1 for majority participation, Fmax equals 1 for foreign participation higher than 95%, Fmed equals 1 for majority participation between 50% and 95%. * is 10% significance, ** is 5% significance and * is 1% significance. In the treatment effects model we show the treated variable and the treatment variables.

Panel A OLS estimates.

Variable	*Equation 1*	*Equation 2*	*Equation 3*
K/L	0.348***	0.348***	0.349***
H/L	0.081***	0.081***	0.080***
Scale	0.332***	0.332***	0.332***
$Scale^2$	-0.015***	-0.015***	-0.015***
10% < Foreign	0.169**		
10% < Foreign ≤ 50%		0.147	0.148
50% < Foreign		0.171**	
50% < Foreign < 95%			0.165***
95% ≤ Foreign			0.240
Customer credit	-0.404***	-0.404***	-0.404***
Constant	y	y	y
Regional dummies	y	y	y
Sectoral dummies	y	y	y
Year dummy	y	y	y
Adjusted R^2	0.541	0.541	0.541
N^o observations	1021	1021	1021

Panel B Treatment effects model

Independent variable	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
K/L	0.286***	0.290***	0.360***	0.281***	0.290***	0.347***
H/L	0.065***	0.067***	0.084***	0.071***	0.073***	0.097***
Scale	0.128***	0.119***	0.305***	0.116***	0.119***	0.317***
Scale2	-0.005*	-0.004 (0.122)	-0.014***	-0.004	-0.004	-0.014***
10% < Foreign (F)	1.882***			1.776***		
50% < Foreign (Fmaj)		1.874***			1.703***	
95% ≤ Foreign (Fmax)			1.649***			1.502***
Customer credit	-0.362***	-0.359***	-0.393***	-0.339***	-0.339***	-0.368***
Regional dummies	Y	Y	Y	Y	Y	Y
Sectoral dummies	Y	Y	Y	Y	Y	Y
Year dummy	Y	Y	Y	Y	Y	Y
Treated variable	F	Fmaj	Fmax	F	Fmaj	Fmax
Treatment variables		total turnover			total turnover and profit margin	
Log Likelihood	-2015.50	-2001.33	-1532.15	-1568.71	-1559.42	-1203.93
No observations	1021	1021	1021	819	819	819

Table 6 Spillover effects of FDI in Hungary

The dependent variable is labour productivity. K is physical capital, H is human capital, L is employment. * is 10% significance, ** is 5% significance and * is 1% significance. In the treatment effects model we show the treated variable and the treatment variables.

Panel A: Sectoral and intersectoral effects

Independent variable	*Equation 1*	*Equation 2*	*Equation 3*	*Equation 4*	*Equation 5*	*Equation 6*
K/L	0.367***	0.368***	0.375***	0.267***	0.278***	0.357***
H/L	-0.079***	-0.078***	-0.082***	-0.064***	-0.064***	-0.091***
Scale	0.304***	0.303***	0.315***	0.105**	0.104**	0.295***
Scale2	-0.012***	-0.012***	-0.013***	-0.003	-0.003	-0.013***
Foreign > 10% (F)	0.155**			1.823***		
Foreign > 50% (Fmaj)		0.149**			1.771***	
Foreign ≥ 95% (Fmax)			0.198 (0.276)			1.622***
Sectoral spillover	0.330**	0.335***	0.341***	0.199	0.214	0.256
	(0.034)	(0.03)	(0.028)	(0.193)	(0.165)	(0.125)
Backward spillover	-4.257***	-4.247***	-4.230***	-3.774***	-3.671***	-4.234***
Forward spillover	3.191***	3.170***	3.120***	2.663***	2.600***	3.216***
Customer credit	-0.408***	-0.407***	-0.397***	-0.356***	-0.358***	-0.380***
Regional dummies	Y	Y	Y	Y	Y	Y
Sectoral dummies	N	N	N	N	N	N
Year dummy	Y	Y	Y	Y	Y	Y
Treated variable	N	N	N	F	Fmaj	Fmax
Treatment variables				Total turnover and profit margin		
Adjusted R^2	0.505	0.505	0.503			
Log Likelihood				-1612.13	-1598.61	-1251.85
No observations	1021	1021	1021	819	819	819

Panel B: Is the sectoral effect dependent on absorption?

Independent variable	*Equation 1*	*Equation 2*	*Equation 3*	*Equation 4*	*Equation 5*	*Equation 6*
K/L	0.366***	0.367***	0.366***	0.266***	0.276***	0.355***
H/L	-0.039	-0.038	-0.039	-0.034	-0.032	-0.061**
	(0.119)	(0.132)	(0.100)	(0.175)	(0.212)	
Scale	0.297***	0.297***	0.297***	0.101***	0.100**	0.290***
Scale2	-0.012***	-0.012***	-0.013***	-0.003	-0.003	-0.012***
Foreign > 10% (F)	0.153**			1.92***		
Foreign > 50% (Fmaj)		0.149***			1.767***	
Foreign ≥ 95% (Fmax)			0.177 (0.039)			1.603***
Sectoral spillover	0.093**	0.095**	0.096**	0.073 *	0.080 *	0.074 *
interacted with H/L	(0.018)	(0.018)	(0.017)	(0.083)	(0.058)	(0.091)
Backward spillover	-4.211***	-4.200***	-4.18***	-3.756***	-3.653***	-4.195***
Forward spillover	3.164***	3.141***	3.094***	2.652***	2.593***	3.206***
Customer credit	-0.412***	-0.411***	-0.401***	-0.360***	-0.362***	-0.384***
Regional dummies	Y	Y	Y	Y	Y	Y
Sectoral dummies	N	N	N	N	N	N
Year dummy	Y	Y	Y	Y	Y	Y
Treated variable	N	N	N	F	Fmaj	Fmax
Treatment variables				Total turnover and profit margin		
Adjusted R^2	0.506	0.505	0.504			
Log Likelihood				-1611.48	-1597.79	-1251.59
No observations	1021	1021	1021	819	819	819

Table 7 Openness of sectors according to NACE-codes

Percentage of exports in total turnover	*NACE code*
0 tot 5	11,40,50,55,71
5 tot 10	64,67,74
10 tot 20	01,14,22,52,72,73
20 tot 30	23,45,51,60,63
30 tot 40	21
40 tot 50	02,15,20,28
50 tot 60	25,27,61
60 tot 70	17,24,29,33,35
70 tot 80	36
80 tot 90	16,18,19,31
90 tot 100	30,32,34

Source: Own calculations using input-output tables (HCSO, 2001, cd-rom)

Table 8 Sectoral spillover effects and the degree of openness

We repeat the regressions of table 6, panel B. We drop foreign ownership ≥ 95% (Fmax), because it proved not very useful in the previous tables. For readability we only report the direct foreign ownership effect and the spillover effects

Panel A Closed sectors (export < 33%)

Independent variable	*Equation 1*	*Equation 2*	*Equation 3*	*Equation 4*
10% < Foreign (F)	-0.194		1.681***	
	(0.211)			
50% < Foreign (Fmaj)		-0.154		1.547***
		(0.327)		
Sectoral spillover * H/L	0.139*	0.133*	0.059	0.051
	(0.066)	(0.079)	(0.398)	(0.465)
Backward spillover	-5.335***	-5.330***	-5.646***	-6.258***
Forward spillover	1.993***	2.047*	1.558	1.800
		(0.077)	(0.177)	(0.121)
Treated variable			F	Fmaj
Adjusted R^2	0.405	0.404		
Log Likelihood			-556.21	-552.22
N° observations	346	346	285	285

Panel B Open sectors (33%<export<66%)

Independent variable	*Equation 1*	*Equation 2*	*Equation 3*	*Equation 4*
10% < Foreign (F)	0.298***		1.695***	
50% < Foreign (Fmaj)		0.227**		1.596***
Sectoral spillover * H/L	0.013	0.021	-0.021	-0.018
	(0.867)	(0.79)	(0.828)	(0.852)
Backward spillover	-3.906***	-3.865***	-1.545	-1.761
			(0.205)	(0.156)
Forward spillover	4.000***	3.849***	2.016**	1.849
			(0.142)	(0.187)
Treated variable			Foreign	Fmaj
Adjusted R2	0.553	0.548		
Log Likelihood			-598.86	-597.61
No observations	417	417	324	324

Panel C Very open Sectors (66% < export)

Independent variable	*Equation 1*	*Equation 2*	*Equation 3*	*Equation 4*
10% < Foreign (F)	0.117		1.672***	
	(0.357)			
50% < Foreign (Fmaj)		0.189		1.869***
		(0.143)		
Sectoral spillover * H/L	0.26***	0.263***	0.262***	0.225***
Backward spillover	-4.910***	-4.872***	-4.859***	-3.967***
Forward spillover	4.098***	4.112***	4.365***	4.014***
Treated variable			F	Fmaj
Adjusted R2	0.605	0.607		
Log Likelihood			-398.5	-390.52
No observations	258	258	210	210

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE
HOVENIERSBERG 24
9000 GENT

Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

97/40 **A. DEHAENE, H. OOGHE**, De disciplinering van het management : een literatuuroverzicht, oktober 1997, 28 p. (published in *Economisch en Sociaal Tijdschrift*, 2000).

97/41 **G. PEERSMAN**, The monetary transmission mechanism : empirical evidence for EU-countries, November 1997, 25 p.

97/42 **S. MANIGART, K. DE WAELE**, Choice dividends and contemporaneous earnings announcements in Belgium, November 1997, 25 p. (published in *Cahiers Economiques de Bruxelles*, 1999).

97/43 **H. OOGHE**, Financial Management Practices in China, December 1997, 24 p. (published in *European Business Review*, 1998).

98/44 **B. CLARYSSE, R. VAN DIERDONCK**, Inside the black box of innovation : strategic differences between SMEs, January 1998, 30 p.

98/45 **B. CLARYSSE, K. DEBACKERE, P. TEMIN**, Innovative productivity of US biopharmaceutical start-ups : insights from industrial organization and strategic management, January 1998, 27 p. (published in *International Journal of Biotechnology*, 2000).

98/46 **R. VANDER VENNET**, Convergence and the growth pattern of OECD bank markets, February 1998, 21 p. (published as 'The law of proportionate effect of OECD bank sectors' in *Applied Economics*, 2001).

98/47 **B. CLARYSSE, U. MULDUR**, Regional cohesion in Europe ? The role of EU RTD policy reconsidered, April 1998, 28 p. (published in *Research Policy*, 2001).

98/48 **A. DEHAENE, H. OOGHE**, Board composition, corporate performance and dividend policy, April 1998, 22 p. (published as 'Corporate performance and board structure in Belgian companies' in *Long Range Planning*, 2001).

98/49 **P. JOOS, K. VANHOOF, H. OOGHE, N. SIERENS**, Credit classification : a comparison of logit models and decision trees, May 1998, 15 p.

98/50 **J. ALBRECHT**, Environmental regulation, comparative advantage and the Porter hypothesis, May 1998, 35 p. (published in *International Journal of Development Planning Literature*, 1999)

98/51 **S. VANDORPE, I. NICAISE, E. OMEY**, 'Work Sharing Insurance' : the need for government support, June 1998, 20 p.

98/52 **G. D. BRUTON, H. J. SAPIENZA, V. FRIED, S. MANIGART**, U.S., European and Asian venture capitalists' governance : are theories employed in the examination of U.S. entrepreneurship universally applicable?, June 1998, 31 p.

98/53 **S. MANIGART, K. DE WAELE, M. WRIGHT, K. ROBBIE, P. DESBRIERES, H. SAPIENZA, A. BEEKMAN**, Determinants of required return in venture capital investments : a five country study, June 1998, 36 p. (forthcoming in *Journal of Business Venturing*, 2002)

98/54 **J. BOUCKAERT, H. DEGRYSE**, Price competition between an expert and a non-expert, June 1998, 29p. (published in *International Journal of Industrial Organisation*, 2000).

98/55 **N. SCHILLEWAERT, F. LANGERAK, T. DUHAMEL**, Non probability sampling for WWW surveys : a comparison of methods, June 1998, 12 p. (published in *Journal of the Market Research Society*, 1999).

98/56 **F. HEYLEN.** Monetaire Unie en arbeidsmarkt : reflecties over loonvorming en macro-economisch beleid, juni 1998, 15 p. (gepubliceerd in M. Eyskens e.a., *De euro en de toekomst van het Europese maatschappijmodel*, Intersentia, 1999).

98/57 **G. EVERAERT, F. HEYLEN,** Public capital and productivity growth in Belgium, July 1998, 20 p. (published in *Economic Modelling*, 2001).

98/58 **G. PEERSMAN, F. SMETS,** The Taylor rule : a useful monetary policy guide for the ECB ?, September 1998, 28 p. (published in *International Finance*, 1999).

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE
HOVENIERSBERG 24
9000 GENT

Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

98/59 **J. ALBRECHT**, Environmental consumer subsidies and potential reductions of CO_2 emissions, October 1998, 28 p.

98/60 **K. SCHOORS**, A payment system failure and its consequences for interrepublican trade in the former Soviet Union, December 1998, 31 p. (forthcoming in *Economic Systems*, 2003).

98/61 **M. DE LOOF**, Intragroup relations and the determinants of corporate liquid reserves : Belgian evidence, December 1998, 29 p. (published in *European Financial Management*, 2000).

98/62 **P. VAN KENHOVE, W. VAN WATERSCHOOT, K. DE WULF**, The impact of task definition on store choice and store-attribute saliences, December 1998, 16 p. (published in *Journal of Retailing*, 1999).

99/63 **P. GEMMEL, F. BOURGONJON**, Divergent perceptions of TQM implementation in hospitals, January 1999, 25 p. (forthcoming in *Journal of Management in Medicine*, 2000)

99/64 **K. SCHOORS**, The credit squeeze during Russia's early transition. A bank-based view, January 1999, 26 p. (published in *Economics of Transition*, 2001).

99/65 **G. EVERAERT,** Shifts in balanced growth and public capital - an empirical analysis for Belgium, March 1999, 24 p.

99/66 **M. DE LOOF, M. JEGERS**, Trade Credit, Corporate Groups, and the Financing of Belgian Firms, March 1999, 31 p. (published in *Journal of Business Finance and Accounting*, 1999).

99/67 **M. DE LOOF, I. VERSCHUEREN**, Are leases and debt substitutes ? Evidence from Belgian firms, March 1999, 11 p. (published in *Financial Management*, 1999).

99/68 **H. OOGHE, A. DEHAENE**, De sociale balans in België : voorstel van analysemethode en toepassing op het boekjaar 1996, April 1999, 28 p. (gepubliceerd in *Accountancy en Bedrijfskunde Kwartaalschrift*, 1999).

99/69 **J. BOUCKAERT**, Monopolistic competition with a mail order business, May 1999, 9 p. (published in *Economics Letters*, 2000).

99/70 **R. MOENAERT, F. CAELDRIES, A. LIEVENS, E. WOUTERS**, Communication flows in international product innovation teams, June 1999, p. (published in *Journal of Product Innovation Management*, 2000).

99/71 **G. EVERAERT**, Infrequent large shocks to unemployment. New evidence on alternative persistence perspectives, July 1999, 28 p. (published in *LABOUR: Review of Labour Economics and Industrial Relations*, 2001).

99/72 **L. POZZI**, Tax discounting and direct crowding-out in Belgium : implications for fiscal policy, August 1999, 21 p.

99/73 **I. VERSCHUEREN, M. DE LOOF,** Intragroup debt, intragroup guaranties and the capital structure of Belgian firms, August 1999, 26 p.

99/74 **A. BOSMANS, P. VAN KENHOVE, P. VLERICK, H. HENDRICKX,** Automatic Activation of the Self in a Persuasion Context , September 1999, 19 p. (published in *Advances in Consumer Research*, 2000).

99/75 **I. DE BEELDE, S. COOREMAN, H. LEYDENS,** Expectations of users of financial information with regard to the tasks carried out by auditors , October 1999, 17 p.

99/76 **J. CHRISTIAENS,** Converging new public management reforms and diverging accounting practices in Belgian local governments, October 1999, 26 p. (published in *Financial Accountability & Management*, 2001)

99/77 **V. WEETS,** Who will be the new auditor ?, October 1999, 22 p.

99/78 **M. DEBRUYNE, R. MOENAERT, A. GRIFFIN, S. HART, E.J. HULTINK, H. ROBBEN,** The impact of new product launch strategies on competitive reaction in industrial markets, November 1999, 25 p.

99/79 **H. OOGHE, H. CLAUS, N. SIERENS, J. CAMERLYNCK,** International comparison of failure prediction models from different countries: an empirical analysis, December 1999, 33 p.

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE
HOVENIERSBERG 24
9000 GENT

Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

00/80 **K. DE WULF, G. ODEKERKEN-SCHRÖDER,** The influence of seller relationship orientation and buyer relationship proneness on trust, commitment, and behavioral loyalty in a consumer environment, January 2000, 27 p. (published as 'Investments in consumer relationships: a cross-country and cross-industry exploration', *Journal of Marketing*, 2001)

00/81 **R. VANDER VENNET**, Cost and profit efficiency of financial conglomerates and universal banks in Europe., February 2000, 33 p. (published in *Journal of Money, Credit, and Banking*, 2002)

00/82 **J. BOUCKAERT**, Bargaining in markets with simultaneous and sequential suppliers, April 2000, 23 p. (published in *Journal of Economic Behavior and Organization*, 2002)

00/83 **N. HOUTHOOFD, A. HEENE**, A systems view on what matters to excel, May 2000, 22 p.

00/84 **D. VAN DE GAER, E. SCHOKKAERT, M. MARTINEZ**, Three meanings of intergenerational mobility, May 2000, 20 p. (published in *Economica*, 2001)

00/85 **G. DHAENE, E. SCHOKKAERT, C. VAN DE VOORDE**, Best affine unbiased response decomposition, May 2000, 9 p.

00/86 **D. BUYENS, A. DE VOS**, The added value of the HR-department : empirical study and development of an integrated framework, June 2000, 37 p. (published as 'Personnel and human resource managers: Power, prestige and potential - Perceptions of the value of the HR function', in *Human Resource Management Journal*, 2001).

00/87 **K. CAMPO, E. GIJSBRECHTS, P. NISOL**, The impact of stock-outs on whether, how much and what to buy, June 2000, 50 p.

00/88 **K. CAMPO, E. GIJSBRECHTS, P. NISOL**, Towards understanding consumer response to stock-outs, June 2000, 40 p. (published in *Journal of Retailing*, 2000)

00/89 **K. DE WULF, G. ODEKERKEN-SCHRÖDER, P. SCHUMACHER,** Why it takes two to build succesful buyer-seller relationships July 2000, 31 p. (published as 'Strengthening Retailer-Consumer Relationships: The Dual Impact of Relationship Marketing Tactics and Consumer Personality', in *Journal of Business Research*, 2002)

00/90 **J. CROMBEZ, R. VANDER VENNET**, Exact factor pricing in a European framework, September 2000, 38 p.

00/91 **J. CAMERLYNCK, H. OOGHE**, Pre-acquisition profile of privately held companies involved in takeovers : an empirical study, October 2000, 34 p.

00/92 **K. DENECKER, S. VAN ASSCHE, J. CROMBEZ, R. VANDER VENNET, I. LEMAHIEU**, Value-at-risk prediction using context modeling, November 2000, 24 p. (published in *European Physical Journal B*, 2001)

00/93 **P. VAN KENHOVE, I. VERMEIR, S. VERNIERS**, An empirical investigation of the relationships between ethical beliefs, ethical ideology, political preference and need for closure of Dutch-speaking consumers in Belgium, November 2000, 37 p. (published in *Journal of Business Ethics*, 2001)

00/94 **P. VAN KENHOVE, K. WIJNEN, K. DE WULF**, The influence of topic involvement on mail survey response behavior, November 2000, 40 p. (published in *Psychology & Marketing*, 2002).

00/95 **A. BOSMANS, P. VAN KENHOVE, P. VLERICK, H. HENDRICKX**, The effect of mood on self-referencing in a persuasion context, November 2000, 26p. (published in *Advances in Consumer Research*, vol.28, 2001, p.115-121)

00/96 **P. EVERAERT, G. BOËR, W. BRUGGEMAN**, The Impact of Target Costing on Cost, Quality and Development Time of New Products: Conflicting Evidence from Lab Experiments, December 2000, 47 p.

00/97 **G. EVERAERT,** Balanced growth and public capital: An empirical analysis with I(2)-trends in capital stock data, December 2000, 29 p. (forthcoming in *Economic Modelling*, 2002).

00/98 **G. EVERAERT, F. HEYLEN**, Public capital and labour market performance in Belgium, December 2000, 45 p.

00/99 **G. DHAENE, O. SCAILLET**, Reversed Score and Likelihood Ratio Tests, December 2000, 16 p.

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE
HOVENIERSBERG 24
9000 GENT

Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

01/100 **A. DE VOS, D. BUYENS**, Managing the psychological contract of graduate recruits: a challenge for human resource management, January 2001, 35 p.

01/101 **J. CHRISTIAENS,** Financial Accounting Reform in Flemish Universities: An Empirical Study of the implementation, February 2001, 22 p.

01/102 **S. VIAENE, B. BAESENS, D. VAN DEN POEL, G. DEDENE, J. VANTHIENEN,** Wrapped Input Selection using Multilayer Perceptrons for Repeat-Purchase Modeling in Direct Marketing, June 2001, 23 p. (published in *International Journal of Intelligent Systems in Accounting, Finance & Management*, 2001).

01/103 **J. ANNAERT, J. VAN DEN BROECK, R. VANDER VENNET**, Determinants of Mutual Fund Performance: A Bayesian Stochastic Frontier Approach, June 2001, 31 p.

01/104 **S. VIAENE, B. BAESENS, T. VAN GESTEL, J.A.K. SUYKENS, D. VAN DEN POEL, J. VANTHIENEN, B. DE MOOR, G. DEDENE,** Knowledge Discovery in a Direct Marketing Case using Least Square Support Vector Machines, June 2001, 27 p. (published in *International Journal of Intelligent Systems*, 2001).

01/105 **S. VIAENE, B. BAESENS, D. VAN DEN POEL, J. VANTHIENEN, G. DEDENE,** Bayesian Neural Network Learning for Repeat Purchase Modelling in Direct Marketing, June 2001, 33 p. (published in *European Journal of Operational Research*, 2002).

01/106 **H.P. HUIZINGA, J.H.M. NELISSEN, R. VANDER VENNET**, Efficiency Effects of Bank Mergers and Acquisitions in Europe, June 2001, 33 p.

01/107 **H. OOGHE, J. CAMERLYNCK, S. BALCAEN,** The Ooghe-Joos-De Vos Failure Prediction Models: a Cross-Industry Validation, July 2001, 42 p.

01/108 **D. BUYENS, K. DE WITTE, G. MARTENS,** Building a Conceptual Framework on the Exploratory Job Search, July 2001, 31 p.

01/109 **J. BOUCKAERT,** Recente inzichten in de industriële economie op de ontwikkelingen in de telecommunicatie, augustus 2001, 26 p. (published in *Economisch en Sociaal Tijdschrift*, 2001).

01/110 **A. VEREECKE, R. VAN DIERDONCK,** The Strategic Role of the Plant: Testing Ferdows' Model, August 2001, 31 p. (forthcoming in *International Journal of Operations and Production Management*, 2002)

01/111 **S. MANIGART, C. BEUSELINCK,** Supply of Venture Capital by European Governments, August 2001, 20 p.

01/112 **S. MANIGART, K. BAEYENS, W. VAN HYFTE**, The survival of venture capital backed companies, September 2001, 32 p. (forthcoming in *Venture Capital*, 2002)

01/113 **J. CHRISTIAENS, C. VANHEE**, Innovations in Governmental Accounting Systems: the Concept of a "Mega General Ledger" in Belgian Provinces, September 2001, 20 p.

01/114 **M. GEUENS, P. DE PELSMACKER**, Validity and reliability of scores on the reduced Emotional Intensity Scale, September 2001, 25 p. (published in *Educational and Psychological Measurement*, 2001)

01/115 **B. CLARYSSE, N. MORAY**, A process study of entrepreneurial team formation: the case of a research based spin off, October 2001, 29 p.

01/116 **F. HEYLEN, L. DOBBELAERE, A. SCHOLLAERT**, Inflation, human capital and long-run growth. An empirical analysis, October 2001, 17 p.

01/117 **S. DOBBELAERE,** Insider power and wage determination in Bulgaria. An econometric investigation, October 2001, 30 p.

01/118 **L. POZZI**, The coefficient of relative risk aversion: a Monte Carlo study investigating small sample estimator problems, October 2001, 21 p. (forthcoming in *Economic Modelling*, 2003).

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE
HOVENIERSBERG 24
9000 GENT

Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

WORKING PAPER SERIES

01/119 **N. GOBBIN, B. VAN AARLE**, Fiscal Adjustments and Their Effects during the Transition to the EMU, October 2001, 28 p. (published in *Public Choice*, 2001).

01/120 **A. DE VOS, D. BUYENS, R. SCHALK**, Antecedents of the Psychological Contract: The Impact of Work Values and Exchange Orientation on Organizational Newcomers' Psychological Contracts, November 2001, 41 p.

01/121 **A. VAN LANDSCHOOT**, Sovereign Credit Spreads and the Composition of the Government Budget, November 2001, 29 p.

01/122 **K. SCHOORS**, The fate of Russia's former state banks: Chronicle of a restructuring postponed and a crisis foretold**,** November 2001, 54 p**.** (forthcoming in *Europe-Asia Studies*, 2003)

01/123 **J. ALBRECHT, D. FRANÇOIS, K. SCHOORS**, A Shapley Decomposition of Carbon Emissions without Residuals, December 2001, 21 p. (published in *Energy Policy*, 2002).

01/124 **T. DE LANGHE, H. OOGHE**, Are Acquisitions Worthwhile? An Empirical Study of the Post-Acquisition Performance of Privately Held Belgian Companies Involved in Take-overs, December 2001, 29 p**.**

01/125 **L. POZZI**, Government debt, imperfect information and fiscal policy effects on private consumption. Evidence for 2 high debt countries, December 2001, 34 p**.**

02/126 **G. RAYP, W. MEEUSEN**, Social Protection Competition in the EMU, January 2002, 20 p.

02/127 **S. DE MAN, P. GEMMEL, P. VLERICK, P. VAN RIJK, R. DIERCKX**, Patients' and personnel's perceptions of service quality and patient satisfaction in nuclear medicine, January 2002, 21 p.

02/128 **T. VERBEKE, M. DE CLERCQ**, Environmental Quality and Economic Growth, January 2002, 48 p.

02/129 **T. VERBEKE, M. DE CLERCQ,** Environmental policy, policy uncertainty and relocation decisions, January 2002, 33 p.

02/130 **W. BRUGGEMAN, V. DECOENE,** An Empirical Study of the Influence of Balanced Scorecard-Based Variable Remuneration on the Performance Motivation of Operating Managers, January 2002, 19 p.

02/131 **B. CLARYSSE, N. MORAY, A. HEIRMAN,** Transferring Technology by Spinning off Ventures: Towards an empirically based understanding of the spin off process, January 2002, 32 p.

02/132 **H. OOGHE, S. BALCAEN,** Are Failure Prediction Models Transferable From One Country to Another? An Empirical Study Using Belgian Financial Statements, February 2002, 42 p.

02/133 **M. VANHOUCKE, E. DEMEULEMEESTER, W. HERROELEN,** Discrete Time/Cost Trade-offs in Project scheduling with Time-Switch Constraints? February 2002, 23 p. (published in *Journal of the Operational Research Society*, 2002)

02/134 **C. MAYER, K. SCHOORS, Y. YAFEH,** Sources of Funds and Investment Activities of Venture Capital Funds: Evidence from Germany, Israel, Japan and the UK?, February 2002, 31 p.

02/135 **K. DEWETTINCK, D. BUYENS,** Employment implications of downsizing strategies and reorientation practices: an empirical exploration, February 2002, 22 p.

02/136 **M. DELOOF, M. DE MAESENEIRE, K. INGHELBRECHT,** The Valuation of IPOs by Investment Banks and the Stock Market: Empirical Evidence, February 2002, 24 p.

02/137 **P. EVERAERT, W. BRUGGEMAN,** Cost Targets and Time Pressure during New Product Development, March 2002, 21 p.

02/138 **D. O'NEILL, O. SWEETMAN, D. VAN DE GAER,** The impact of cognitive skills on the distribution of the black-white wage gap, March 2002, 14 p.

02/139 **W. DE MAESENEIRE, S. MANIGART**, Initial returns: underpricing or overvaluation? Evidence from Easdaq and EuroNM, March 2002, 36 p.

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE
HOVENIERSBERG 24
9000 GENT

Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

02/140 **K. SCHOORS**, Should the Central and Eastern European accession countries adopt the EURO before or after accession? March 2002, 29p. (published in *Economics of Planning*, 2002).

02/141 **D. VERHAEST, E. OMEY**, Overeducation in the Flemish Youth Labour Market, March 2002, 39p.

02/142 **L. CUYVERS, M. DUMONT, G. RAYP, K. STEVENS**, Wage and Employment Effects in the EU of International Trade with the Emerging Economies, April 2002, 24 p.

02/143 **M. GEUENS, P. DE PELSMACKER,** The Role of Humor in the Persuasion of Individuals Varying in Need for Cognition, April 2002, 19 p.

02/144 **M. VANHOUCKE, E. DEMEULEMEESTER, W. HERROELEN,** Net Present Value Maximization of Projects with Progress Payments, April 2002, 23 p.

02/145 **E. SCHOKKAERT, D. VAN DE GAER, F. VANDENBROUCKE,** Responsibility-sensitive egalitarianism and optimal linear income taxation, April 2002, 37p.

02/146 **J. ANNAERT, J. CROMBEZ, B. SPINEL, F. VAN HOLLE**, Value and size effect: Now you see it, now you don't, May 2002, 31 p.

02/147 **N. HOUTHOOFD, A. HEENE,** The quest for strategic groups: Overview, and suggestions for future research, July 2002, 22 p.

02/148 **G. PEERSMAN,** The transmission of monetary policy in the Euro area: Are the effects different across countries?, July 2002, 35 p.

02/149 **G. PEERSMAN, F. SMETS,** The industry effects of monetary policy in the Euro area, July 2002, 30 p.

02/150 **J. BOUCKAERT, G. DHAENE**, Inter-Ethnic Trust and Reciprocity: Results of an Experiment with Small Business Entrepreneurs, July 2002, 27 p.

02/151 **S. GARRÉ, I. DE BEELDE, Y. LEVANT**, The impact of accounting differences between France and Belgium, August 2002, 28 p.

02/152 **R. VANDER VENNET**, Cross-border mergers in European banking and bank efficiency, September 2002, 42 p.

02/153 **K. SCHOORS,** Financial regulation in Central Europe: the role of reserve requirements and capital rules, September 2002, 22 p.

02/154 **B. BAESENS, G. VERSTRAETEN, D. VAN DEN POEL, M. EGMONT-PETERSEN, P. VAN KENHOVE, J. VANTHIENEN**, Bayesian Network Classifiers for Identifying the Slope of the Customer Lifecycle of Long-Life Customers, October 2002, 27 p.

02/155 **L. POZZI, F. HEYLEN, M. DOSSCHE,** Government debt and the excess sensitivity of private consumption to current income: an empirical analysis for OECD countries, October 2002, 19 p.

02/156 **D. O'NEILL, O. SWEETMAN, D. VAN DE GAER**, Consequences of Specification Error for Distributional Analysis With an Application to Intergenerational Mobility, November 2002, 35 p.