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HOW DOES FDI INTERACT WITH DOMESTIC INNOVATION SYSTEMS – EVIDENCE FROM EAST GERMANY¹

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Abstract

The objective of this paper is to assess whether there is a systematic relationship between technological activities of foreign investors, their interaction with actors of the East German innovation system, and the extent of technological externalities from FDI. We use cross sectional data from a recently completed representative survey to test this relationships. We find that the technological activity of foreign subsidiaries positively correlates with the importance of selected external network partners from the East German innovation system. However, the potential for spillovers increases with technological activity of foreign subsidiaries only for East German suppliers. We draw several policy conclusions with regard to the alignment of international investment to technological processes within East Germany.

JEL-Classification: O30, O38, F20

Keywords: East Germany, National Innovation System, Foreign Direct Investment

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Introduction

In East Germany foreign direct investment inflows are linked with hopes for the generation of new employment, follow-up investment as well as a technological development. On the basis of these assumptions German economic policy makers provided considerable direct investment subsidies also to foreign investors. In addition, East Germany benefited from massive public investment into science and technology as well as infrastructure. This has been by and large financed via fiscal transfers from West Germany. For example, the annual fiscal transfers only to promote industrial investment and to build up infrastructure are about 14 billion Euro (Ludwig et al. 2005). Has this massive investment paid off with regard to foreign direct investment (FDI)? Do foreign investors locate any technological activities in East Germany? Is the East German innovation system attractive enough? Do East German firms benefit from a technological point of view?

So far, it has been argued the East German innovation system is rarely able to satisfy foreign investors' requirements for the location of technological activities in the context of global competition (Koschatzky et al. 2006). However, previous evidence from East German manufacturing showed that foreign investors have a higher degree of R&D and innovation activities compared to West German investors and East German owned enterprises, however, this is partially explained by sectoral specialisation of foreign investors (Günther and Gebhardt 2005, Belitz et al. 2007). If sector and selected firm specific effects are taken into account foreign ownership even has a negative effect on firms' innovation activity (Günther and Peglow 2007). Furthermore, evidence on technological spillover effects from foreign investment for East German firms is contradictory (Günther and Lehman 2004, Peri and Urban 2006).

From our point of view, the existing evidence could suggest that there is a relationship between technological activities of foreign investors, their interaction with the East German innovation system, and the extent of technological externalities from FDI. This paper argues that the extent of technological spillovers from foreign investment is conditional on the extent of foreign subsidiaries' locally conducted technological activities as well as the embeddedness of these activities into the East German innovation system. In order to provide adequate evidence on this issue the authors conducted a representative survey of foreign investors in East German manufacturing industry. It covers general firm characteristics, technological indicators as well as detailed information with regard to the embeddedness of foreign investors into the East German innovation system. All technological indicators (innovation, R&D) have been collected according to the guidelines of the Oslo- and Frascati-Manual.

Theoretical framework

Cantwell (1989) offers a dynamic theory of foreign direct investment. According to his view, the technological capability of an enterprise is a specific advantage that provides a precondition for the internationalisation process. However, the strength of the technological capability is not only dependent on the home but also the host country conditions. The internationalized firm transfers innovation and technology through internal networks and achieves internal economies of scale. In addition, the internationalized firm could benefit from the presence of other firms via external effects. Thus, Cantwell assumes a cumulative process between investment decisions of international companies and technological spillovers.

Cantwell (1992, 1993) has argued that firms with research facilities in foreign locations may be able to transcend limitations in the technological specialisations of their home country and take advantage of different specializations abroad. This claim has been bolstered with evidence that industrialised countries are becoming more technologically specialised and differentiated from each other over time (Archibugi and Pianta, 1992), leading to the emergence of 'pockets' of expertise and advanced technology in regions around the world (Cantwell 1993; Porter 1990, Storper, 1992, Cantwell and Iammarino 2003). Notwithstanding the intuitive appeal of this argument, evidence that multinationals actually utilize this technological diversity to generate innovations is contradictory (Cantwell 1992, Dunning and Narula 1995, Zander 1994).

From the organisational perspectives the locus of technological innovation resides not only within the boundaries of the innovating organisation, but also outside it, at the interfaces between firms, universities, research laboratories, suppliers, and customers (Powell et al. 1996). Thus, many innovations intrinsically require collective efforts, involving different stakeholders to act cooperatively to generate new knowledge and ideas (Chesbrough 2003). These ideas are also reflected in the evolutionary assumptions of cumulativeness of innovation present in the literature on regional innovation systems. They are defined as networks of regionally interacting actors and institutions from the private and public sector that generate, modify, and diffuse new technologies (Cooke et al. 1997). The capacity of a region to adapt and apply external knowledge determines its attractiveness as investment location as well as its potential for technological spillovers (Fagerberg et al. 1994). Thus external resources constitute an important element in the regional knowledge accumulation (Cantwell and Iammarino 2003).

A number of studies show a relation between foreign subsidiaries' technological capability and the existence of local external innovation networks (Holm and Fratocchi 1998, Birkinshaw and Ridderstrale 1999, Pearce and Papanastassiou 1999; Yamin and Otto, 2004). However, which foreign subsidiaries form external network linkages to other firms, universities, or research labs? Frost (2001) differentiates between foreign subsidiaries following an exploitive vs. explorative strategy. An exploitive strategy reinforces the existing knowledge base of the firm through reproduction and incremental extension. The focus on refinement and adaptation is more likely to preserve the existing search routines of the organisation, which are strongly associated by internal knowledge flows and the parent firm's existing external network in the home base. In contrast, with an explorative strategy the scope of subsidiaries' search may be broadened, and it is more likely to incorporate resources that lie outside of the existing external network (ibid).

Frost's (2001) basic argument relates very well to earlier international business literature on R&D strategy and structure. Here, often a distinction is made between international technological duplication vs. diversification (Zander 1999). Subsidiaries following an international duplication strategy carry out local market adaptation and depend to large extent on a central research unit generating new technology in the home country of the MNE (Ronstadt, 1978; Hakanson and Nobel, 1993). In contrast, MNEs with an internationally diversified R&D strategy unify geographically dispersed foreign units representing unique fields of technological expertise, so-called competence centres (Zander 1999). In a similar vein one can discern between home base/competence exploiting vs. augmenting subsidiaries (Kuemmerle 1997, Cantwell and Piscitello 1999, Cantwell and Mudambi 2005).

In sum, we would conclude that foreign investors' decisions to locate technological activities are not random. They are attracted into regions that offer external technological economies, and in turn foreign investment can reinforce such externalities. However, this 'virtuous circle' depends on existing regional endowments and capabilities as well as subsidiaries' strategy. If foreign locations offers appropriate technological capabilities and foreign investors follow an explorative or competence augmenting strategy, linkages between the foreign subsidiary and other actors in a regional innovation system are more likely, and so are technological externalities from FDI.

Data description

Up until recently, there existed only three data sources for the analysis of FDI in East Germany. The German Bundesbank registers foreign equity participation for companies having a balance sheet over three million Euro, however, only at the principle office in Germany. This leads to a systematic underestimation of regional FDI and thus foreign investors in East Germany (Günther 2005, Votteler 2001). Furthermore, the Mannheim Innovation Panel (MIP), which is the German contribution to the Community Innovation Survey (CIS), as well as the IAB-establishment panel offer firm level data including information about ownership and innovation activities. However, both datasets are representative only for East Germany as a whole, however, not for the subgroup of foreign investors within in East Germany. This is due to the fact that sample selection criteria are industries, firm size and location (East, West Germany), but not ownership structure.

In order to get access to a representative firm level dataset the authors had to build up a new database of the total population of foreign investors in East Germany. This total population is not generally available. In our study, the population is defined as all manufacturing firms with a foreign equity stake of at least 10 per cent and its seat in East Germany (including Berlin). Foreign owner or shareholder can be a foreign person, industrial firm, finance investors, or foundation. The population was generated using four existing company database namely Markus, European Investment Monitor, R&D Scoreboard, and a list compiled by the East German investment promotion agency (IIC). From this four sources 1.090 valid manufacturing companies were identified as total population in 2006. Only for a comparison: the German Central Bank identifies only 360 companies with foreign equity stake in the new German states (including Berlin) in 2006. In 2005 the IAB-establishment panel surveyed 127 companies with majority foreign ownership (i.e. at least 50 per cent and not 10 per cent) within the East German manufacturing and estimates its total population with 828.

Out of the 1.090 companies from the total population 222 participated in the survey conducted as computer assisted telephone interviews (CATI) during the winter 2006/2007. This constitutes a rate of return of 20,37 per cent. According to the Chi-Square-tests the resulting sample is representative at the NACE 2-digit sectoral level as well as for the 23 counties within East Germany (Raumordnungsregionen). At the more aggregate level of the six federal states the sample is only significantly underrepresented for Berlin but representative for all other federal states. The distribution of the companies in the sample across size classes measured by the number of employees does not deviate significantly from the total population. Although, the average number of employees is with 144 significantly lower compared to 190 employees in the total population.

Table 1: Distribution of foreign investment subsidiaries in the total population of East Germany and in the sample, by size-classes and federal states

	Total population	Sample
Size classes (in employment brackets)		
1 to 9	17,8 %	14,4 %
10 to 49	28,7 %	32,9 %
50 to 249	37,2 %	40,0 %
above 249	16,3 %	12,6 %
Federal states		
Berlin	17,8 %	9,0 %
Brandenburg	12,5 %	14,0 %
Mecklenburg	7,4 %	7,7 %
Saxony-Anhalt	15,0 %	17,1 %
Saxony	28,7 %	31,1 %
Thuringia	18,6 %	21,2 %

Source: IWH FDI-database, own calculations.

Sectoral concentration and technology intensity of FDI

The analysis of sectoral concentration (at NACE 2 level) across the total population of foreign firms shows that they are particularly concentrated (measured in terms of employment shares) in the chemical industry (15%), electrical engineering (10%) and food industry (10%). The concentration ratio employment within the three strongest sectors relative to total employment by foreign firms (CR3) is lower compared to the total East German manufacturing (see table 2). In contrast, at the level of federal states the concentration level are higher.

Table 2: Degree of industrial branch-concentration in the total population of East Germany 2005 and in the sample, by employment

	Total population		Sample	
	CR3	Top three industries (NACE)	CR3	Top three industries (NACE)
B	38	Electrical industry (31) Printing and publishing (22)	59	Chemicals industry (24) Nutrition industry (15)
BB	39	Chemicals industry (24) Nutrition industry (15) Metal products (28)	55	Transport equipment (35) Transport equipment (35) Basic metals (27)
MV	49	Mechanical engineering (29) Nutrition industry (15) Metal products (28)	57	Paper, paper products (21) Other transport equipment (35) Nutrition industry (15)
ST	41	Mechanical engineering (29) Metal manufacturing (28)	51	Rubber and plastic (25) Chemical industry (24) Mechanical engineering (29)
SA	46	Mechanical engineering (29) Nutrition industry (15) Nutrition industry (15) Metal manufacturing (28)	48	Nutrition industry (15) Electrical industry (31) Radio, TV, communication (32)
TH	38	Mechanical engineering (29) Metal manufacturing (28) Nutrition industry (15)	44	Chemicals industry (24) Motor vehicles, trailers (34) Radio, TV, communication (32)
Total	40	Mechanical engineering (29) Nutrition industry (15)	35	Metal manufacturing (28) Chemical industry (24)

		Metal products (28)		Electrical industry (31)
		Mechanical engineering (29)		Nutrition industry (15)

Notes: B...Berlin; BB...Brandenburg; MV...Mecklenburg Western Pomerania; ST...Saxony-Anhalt; SA...Saxony; TH...Thuringia.

CR3 is the employment share of the three largest industries at NACE 2-digit.

Source: Federal Employment Office Germany, IWH FDI-database, own calculations.

Thus, the federal states of East Germany attract foreign investors not only in various degrees but also in different sectoral compositions. However, the specialisation patterns of foreign investors differ at aggregate as well as federal levels from total East German manufacturing industry. It follows that foreign direct investment does not predominantly flow into the employment intensive sector of East German manufacturing. Yet, it seems that foreign investors operate in regionally different key industries and are particularly frequently present in sectors with high-technological intensity (chemical industry, communication technology) as well as medium-high technological intensity (electrical engineering, other vehicle manufacturing). Whereas, the food (Low-Tech) and metal manufacturing (Medium-Low-Tech) play a more dominant role in total East German manufacturing.²

Technological capability of foreign subsidiaries

At this stage, we do not know whether foreign subsidiaries are actually technology exploiting or technology seeking. Therefore, we turn to the survey evidence that provides information on the scope and intensity of technological activities in foreign subsidiaries. Our evidence shows that 55 per cent of interviewed companies conducted R&D in 2005. This is, compared to the average of the total East German manufacturing industry, a very high proportion. According to the IAB-establishment panel, only 12 per cent of East German establishments reported R&D activity in 2004³. However, this can be at least partially explained by the above described sectoral specialisation. In contrast, R&D intensity (measured as total expenditure of R&D in per cent of turnover) stands only at 3 per cent for the interviewed foreign investors. This is far below the 8 per cent observed for the total East German manufacturing (the latter is provided by Euronorm 2007). The picture is very similar if we measure R&D intensity by the share of R&D personnel in per cent of total employees. Again R&D intensity of the foreign firms stands at 7 per cent vs. 13 per cent for the total East German manufacturing (for the latter *ibid.*). However, this apparent paradox between a relatively high degree of R&D activity combined with low R&D intensity among foreign investors compared to the total of East German manufacturing can be explained by differences in the size structures of foreign and other firms. In East Germany the number of foreign investors is relatively small, however, their average size in terms of employment is very large (see table 3). In general large companies show lower R&D intensity in comparison to SMEs (see Janz et al. 2003, Kleinknecht 1989).

² The OECD-classification of branches regarding technology intensity differentiates High-Tech, Medium-High-Tech, Medium-Low-Tech and Low-Tech. see: HATZICHRONOGLOU (1997).

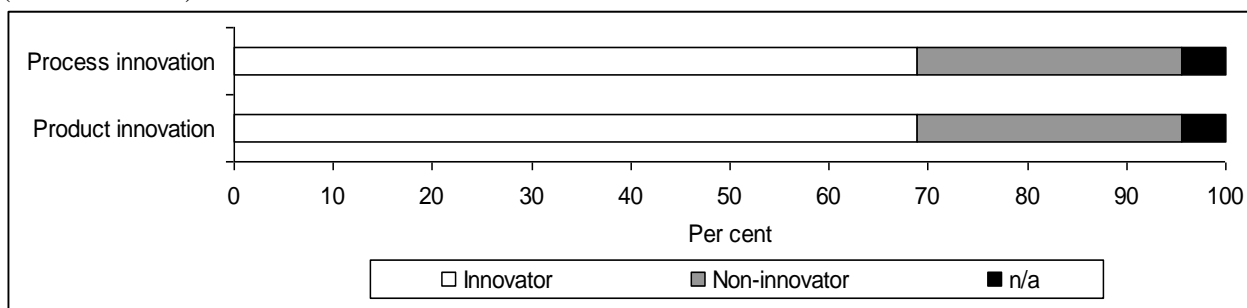
³ All of the used information in this survey from the IAB business panel are values, which were projected on the basic population for the five newly-formed German states and East-Berlin.

Table 3: Manufacturing companies in East Germany, by origin of owners and average size

Majority ownership	Share of companies (% of total population)	Average size (employment)
Foreign	2	125
West German	12	61
East German	83	12
other ^a	3	38
Total	100	21

Note: ^a majority owner not identifiable, majority publicly owned.
 Source: IAB-business panel, calculations IWH.

As an additional indicator for technological capability, the survey provides information on product and process innovation activity of foreign subsidiaries over the last three years. The 69 per cent of firms reported product innovations and a similar share reported process innovation. Therefore, foreign subsidiaries seem to indicate a higher level of innovation activity compared to total East German manufacturing. According to the German Community Innovation Survey (MIP) the proportion of the product and process innovation within the manufacturing constitutes 47% and 31% respectively in East Germany. Looking at the innovation output, which is measured as proportion of business volume with new products, the difference is less pronounced. The interviewed foreign subsidiaries obtain 26 per cent of turnovers from new or considerably improved products compared to 22 per cent for the total manufacturing (see ZEW 2007).



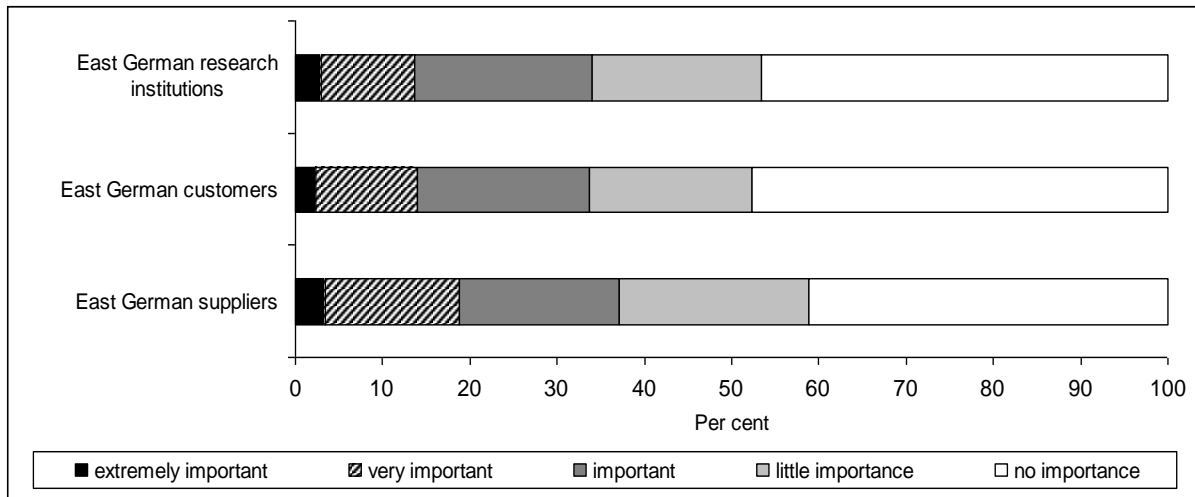
Note: An Innovator has produced at least one product (or one process) innovation between 2002 and 2005. Bars represent per cent shares of foreign subsidiaries in the IWH FDI database.
 Source: IWH FDI-database, own calculations.

Figure 1: Innovators and non-innovators (product and process) amongst foreign subsidiaries in manufacturing industries in East Germany, 2005

The technological capability of foreign investors in East Germany could be summarised as follows: Their R&D and innovation activity is higher in comparison to the total manufacturing. This might be partially explained by the sectoral specialisation pattern of foreign investors. R&D intensity is below average due to differences in the size structure between foreign and total manufacturing. This result is consistent with prior evidence (Günther and Gebhardt 2005). From this it seems that the majority of foreign investors surveyed decided to locate technological activities in their East German subsidiaries. These subsidiaries participate actively in technological processes of their foreign parents and enterprise groups.

Interaction of foreign subsidiaries with the East German innovation system

The survey gathered information about the relevance of customers, component suppliers as well as research institutions (universities and research labs) for R&D and innovation activities in East German subsidiaries. The analysis shows that 59 per cent of foreign subsidiaries report that East German component suppliers are of importance for locally conducted R&D and innovation activities (see figure 2). Furthermore, 52 per cent and 53 per cent of foreign investors attribute East German customers and science organisations respectively importance.

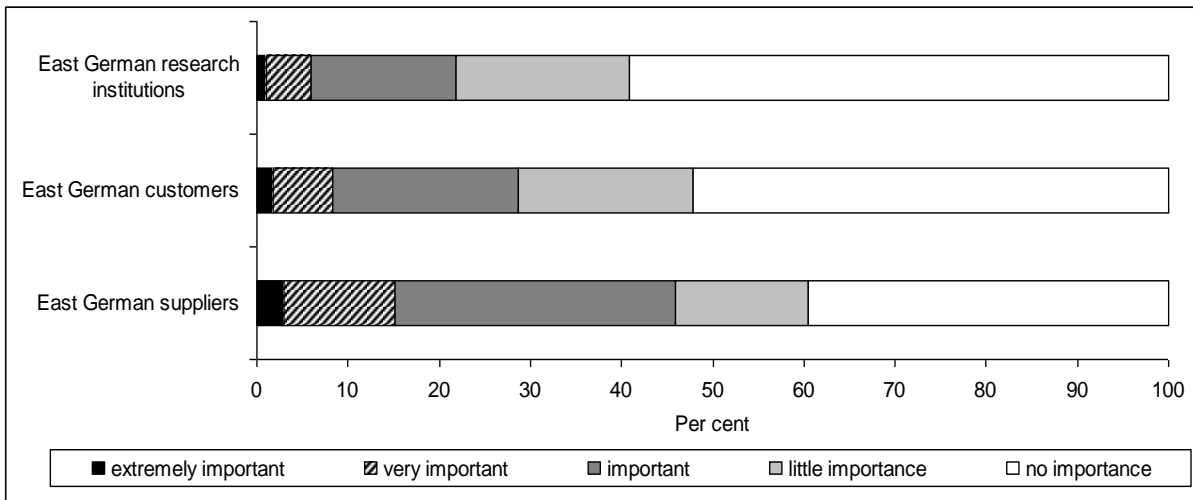


Source: IWH FDI-database, own calculations.

Figure 2: Importance of actors of the East German innovation system for technological activities (R&D and innovation) of foreign investors (*technology seeking*), 2005

Foreign subsidiaries were also asked to judge whether they believe to be themselves an important source for R&D and innovation activities of external network partners (suppliers, customers, competitors). This question could also be interpreted as an indicator to which extent external network partners are actually able to benefit from a co-operation with foreign subsidiaries i.e. the potential for spillover effects. The analysis shows that 60 per cent of foreign subsidiaries report that they consider themselves as important for R&D and innovation of their East German suppliers. That is also true for 48 per cent of foreign subsidiaries in respect to their East German customers, whereas only 41 per cent come to this conclusion in respect to their East German competitors (see figure 3).

These results show, that about half of all foreign subsidiaries surveyed are embedding their technological activities (R&D and innovation) with actors from the private sector (suppliers, customers) as well as public sector (universities and research labs) of the East German innovation system. Further, there are indications that spillover effects from foreign subsidiaries should be expected to be of vertical (suppliers and customers) rather than horizontal nature (competitors). The latter would be in line with findings for East and Central Europe (Stephan 2006).



Source: IWH FDI-database, own calculations.

Figure 3: Importance of foreign investors for technological activities (R&D and innovation) of actors of the East German innovation systems (*spillover potential*), 2005

Interaction with the East German innovation system depending on the technological capability of foreign subsidiaries

So far, we know from our analysis that foreign subsidiaries are above average technologically active and subsidiaries interact to different degree with that external network partners from the East German innovation system. We do not yet know whether technological activities conducted in East German subsidiaries are of exploitive or explorative nature. If technological active subsidiaries would interact with selected external network partners from the East German innovation system they clearly would broaden the knowledge base of their investing company. According to Frost (2001) this could be an interpreted as an indicator for an explorative innovation strategy in East German subsidiaries. If this does not apply, technological active subsidiaries predominantly rely and reinforce parents' existing internal and external knowledge base.

Therefore, the following section analyses the interaction between foreign subsidiaries and selected external networks partners as a function of the technological activity of foreign subsidiaries. We use R&D intensity (measured as the share of R&D employees in total employment, and R&D expenditures as a share of total turnover) as well as innovation activity (existence of product and process innovation) as indicators for technological activity of foreign subsidiaries.

Lets take first a look at the relationship between technological activity and the degree of importance of external network partners for R&D and innovation conducted in foreign subsidiaries. The analysis shows a positive correlation between R&D intensity and the importance of local actors. The correlation coefficients are positive and significant for East German customers, suppliers as well as scientific organisations (see table 4).

Table 4: Correlation between importance of actors of the East German innovation system for technological activities in foreign subsidiaries (*technology seeking*) and subsidiaries' R&D intensities, 2005

	East German customers	East German suppliers	East German research institutions
R&D employment share	0.159**	0.144*	0.387***
R&D expenditure share	0.186**	0.213**	0.155*

Notes: Correlation coefficients according to Spearman-Rho.
 *significant on 10%-level, **significant on 5%-level, ***significant on 1%-level.

Source: IWH FDI-database, own calculations.

Differentiating foreign subsidiaries by product and process innovation activity and testing for difference in means of the degree of importance attributed to our selected external network partners yields a similar relationship (see table 5). That means, foreign subsidiaries that are product or process innovators attribute on average higher importance to East German network partners than non-innovators. The differences seem most pronounced for East German research institutions.

Thus, the evidence seems to indicate a positive relationship between foreign subsidiaries' technological activity and the strength of external network links to partners from the East German innovation system as a source for R&D and innovation within foreign subsidiaries. We could conclude that the technologically active subsidiaries seem to follow an explorative (Frost 2001) or home base/competence augmenting strategy (Kuemmerle 1997, Cantwell and Piscitello 1999, Cantwell and Mudambi 2005) in East Germany. On the other hand, less technologically active subsidiaries seem not to interact strongly with the East German innovation system and are more likely to follow an exploitive innovation strategy (ibid.)

Table 5: Mean comparisons between importance of actors of the East German innovation systems for technological activities in foreign subsidiaries (*technology seeking*) and subsidiaries' innovation activities, 2005

	East German customers			East German suppliers			East German research institutions		
	mean	σ	sign.	mean	σ	sign.	mean	σ	sign.
Product innovator	2.15	1.18	.018**	2.32	1.24	.012**	2.20	1.17	.001***
Non-innovator	1.71	1.09		1.86	1.14		1.61	1.07	
Process innovator	2.12	1.15	.070*	2.33	1.22	.009***	2.19	1.18	.002***
Non-innovator	1.82	1.19		1.83	1.17		1.65	1.07	

Notes: Mean-comparison with one-sided t-tests.
 *significant on 10%-level, **significant on 5%-level, ***significant on 1%-level.

Source: IWH FDI-database, own calculations.

Let us now turn to the importance of foreign subsidiaries for technological activities of external network partners in the East German innovation system as a function of foreign subsidiaries' technological activity. The correlation analysis using R&D intensity as a proxy shows that only East German customers (only R&D employment intensity) and suppliers seem to benefit more from their cooperation with technologically more active subsidiaries (see table 6).

Table 6: Correlations between importance of foreign investors for technological activities of actors of the East German innovation system (*spillover potential*) and subsidiaries' R&D intensities, 2005

	East German customers	East German suppliers	East German research institutions
R&D employment share	0.219***	0.137*	-0.012
R&D expenditure share	0.111	0.193**	0.029

Notes: Correlation coefficients according to Spearman-Rho.
*significant on 10%-level, **significant on 5%-level, ***significant on 1%-level.

Source: IWH FDI-database, own calculations.

Comparing the means across the groups of product/process innovators vs. non-innovators shows that only East German suppliers seem to be able to benefit more with regard to own R&D and innovation activities from their cooperation with innovating foreign subsidiaries.

Table 7: Mean comparisons between importance of foreign investors for technological activities of actors of the East German innovation system (*spillover potential*) and subsidiaries' innovation activities, 2005

	East German customers			East German suppliers			East German research institutions		
	mean	σ	sign.	mean	σ	sign.	mean	σ	sign.
Product innovator	1.88	1.07	.409	2.40	1.19	.007***	1.67	0.98	.240
Non-innovator	1.84	1.09		1.89	1.08		1.78	0.98	
Process innovator	1.88	1.04	.428	2.38	1.16	.015**	1.67	0.94	.248
Non-innovator	1.85	1.16		1.93	1.20		1.78	1.08	

Notes: Mean-comparison with one-sided t-tests.
*significant on 10%-level, **significant on 5%-level, ***significant on 1%-level.

Source: IWH FDI-database, own calculations.

Thus, the evidence seems to indicate that the spillover potential from foreign subsidiaries seems as a function of the technological activity of foreign investors only to increase for East German suppliers. Although a certain share of foreign subsidiaries imagines that East German competitors and customers could benefit technological from their presence, this effect does not seem to increase with the extent of technological activities in foreign subsidiaries. One explanation for the weak spillover potentials to East German customers and competitors might be that absorptive capacity, meaning the ability to absorb external knowledge and use it productively, is insufficiently developed. It is also possible that foreign investors actively try to prevent leakages of R&D and innovation knowledge to East German competitors.

Conclusions and Policy Implications

The main objective of this paper was to assess whether there is a systematic relationship between technological activities of foreign investors, their interaction with actors of the East German innovation system, and the extent of technological externalities from FDI. In fact our results indicate that the technological activity of foreign subsidiaries positively correlates with the importance of external network partners from the East German innovation system. However, the potential for external spillovers increases with high technological activity of foreign subsidiaries only for East German suppliers.

In contrast to existent assumptions, the East German innovation system seems to be able to attract research and innovation activities of foreign investors. We would suggest that this could be partially related to the substantial investment into the scientific infrastructure and favourable endowment in particular in respect to Max-Planck, Fraunhofer and Leibniz institutes in East Germany (Pasternak 2007, Roth 2006). Therefore, the East German innovation system should not be underestimated as a strategic locational factor. This particularly applies against the background of apparent deficits in this regard to competing locations in Central and East Europe (McGowan et al 2004). However, several Asian location seem to be quickly catching-up in terms of aligning their innovation systems to the needs of international cutting- edge technological vestment projects (Legler et al. 2007)

In respect to innovation policy it seems advisable to continue to use instruments that foster external network links between different actors within the East German innovation system. Such programmes have already been in place in East Germany for some time (e.g. InnoRegio, NEMO, ProInno). We would recommend that the role of external knowledge flows that come through FDI and trade is recognised more prominently. This applies to the potential contribution of inward FDI as well as domestic companies that internationalise trough exports or outward FDI. While exports of East German firms have been increasing in recent years (Zeddies 2007), outward FDI and the emergence of multinational headquarters within East Germany are still weak.

In addition the introduction of a general tax allowance for R&D activities should be considered in German economic and innovation policy. The vast majority of OECD countries has already introduced tax allowances for R&D performing firms. This provides an additional incentive to international investors to locate new or to keep and upgrade technological activities in East Germany.

Finally, industrial promotion programmes at the federal level (GA-promotion programmes) emphasise the potential effects of investment projects mainly in terms of employment. Furthermore, with the exception of Saxony and Brandenburg there is no regional or sectoral focus in the project design (Titze 2007). However, it might be appropriate to measure the potential effects of funded investment projects in view of R&D and innovative capability. Greater selectivity in the distribution of investment funds might also strengthen the absorptive capacity of the East German innovation system. This is change is particularly pressing under the expected budgetary reduction of funds available.

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