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DISCUSSION PAPER

German FDI and Integration of Production in the EU

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ABSTRACT

In this paper, we investigate internationalization strategies of German manufacturing firms in the European Union. We give reasons for the hypothesis that traditional market strategies had been replaced by border-crossing production networking based on the comparative advantage of host countries and on specialisation and scale economies. Our empirical test of this hypothesis shows, on the one hand, that traditional market strategies are not outdated. On the other hand, there are clear signs of international network strategies. They form an important component in internationalization strategies of multinationals in the Internal Market. The location of foreign production of German multinationals is, among others, oriented towards the technological potential of host countries indicating the importance of asset-seeking strategies. Furthermore, the positive connection between foreign production and both exports and imports points at the significance of efficiency-oriented strategies with foreign affiliates taking over an active part and not only being recipient of components of the German parent companies. However, there is hardly evidence that significant changes towards network strategies took place between 1996 and 2000.

Keywords: Foreign Direct Investment; European Integration; Internationalization strategies

JEL code: F150, F210, F230

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1 INTRODUCTION[#]

Progress in European economic integration is often analysed on the basis of foreign trade data. Increasing intra-EU trade relative to total production of the EU economies gives an indication of intensified specialisation in the EU. In the following, we look at the integration process from a slightly different perspective. We study foreign direct investment (FDI) as an element of economic integration, namely manufacturing production of German firms in partner countries. We ask whether there are indications that FDI leads to productivity-increasing specialisation by establishing interlinkages of production and of know how. This purpose requires a closer analysis of the pattern of "German" production in the EU and of the underlying strategies of German investors.

In their international expansion of foreign production, firms can follow different strategies in order to increase profits and achieve growth (*Dunning* 1998; *UNCTAD* 1998). FDI can, first, aim at conquering new markets or stabilise sales in markets challenged by new competitors or protected by government action (market-seeking strategies). A second strategy would be to get hold of resources available in the host country, be it natural resources or cheap labour (resource seeking). Thirdly, FDI by multinationals can aim at improving efficiency by realising scale economies and exploiting favourable conditions (other than cheap labour) in host countries (efficiency-seeking). Finally, a fourth strategy would be strategic asset-seeking which aims at accessing knowledge available in host countries. These strategies¹ cannot always be considered as alternatives. The labels rather point out the overriding aim of investments. A differentiation by these aims seems to be meaningful since the strategies could bring about different implications for economies and for economic policy.

Traditionally, market and resource seeking have dominated FDI strategies. However, according to studies of the past five years, investment strategies have changed (*UNCTAD* 1998, *Dunning* 1998 b, *Braunerhjelm/Ekholm* 1998). Efficiency and asset-

This discussion paper is partially based on a HWWA study (C. *Borrmann* et al. 2001) on the relevance of "new" international business strategies for the German economy and economic policy. Thanks for helpful comments go to HWWA colleagues, Joachim Wagner (University Lüneburg), Fred Hennebrger (Hochschule St. Gallen) and Alexandre Ziegler (University Lausanne).

1 Another category of investment would be "Strategic" investment (*Ganslandt* 1998; *Helpman/Krugman* 1989). This can, however, be regarded as a variant of the four types mentioned above. "Strategic" investment is driven by the aim to erect barriers to entry against new competitors or to counter advantages of established competitors.

seeking are presumed to have gained importance. A common feature of these strategies is that international operations take the form of border-crossing production and information networks. In the following, they are, therefore, referred to as network strategies. More specialisation and networking of international activities may have implications for economic policy making. This makes internationalisation strategies an interesting subject of economic research. Implications result from two characteristics of network-oriented investments (*Borrmann et al. 2001*). First, requirements for national/regional conditions of production are especially high in terms of administrative and business infrastructure as well as knowledge and workforce available. Second, location choice will be especially flexible if competitiveness of production primarily results from scale economies that could be realised at almost any place. Thus, policies for increasing the attractiveness of locations become much more urgent.

Network strategies should be of particular importance where transaction costs of foreign trade and FDI are lowest. It can, therefore, be presumed that the relevance of network strategies could well be investigated in the EU Internal Market (IM). Completion of the European IM has strongly reduced transaction costs both for border-crossing trade and investment. Borders have lost much of their restricting character. This has opened up or improved possibilities to "rationalise" production on an EU-wide level and profit from both economies of scale and access to the knowledge base of partner countries. Parallel production of same goods in several EU countries for reasons of market access (defensive import-substituting FDI, *Yannopoulos 1990*) may often be no longer necessary. Companies can concentrate production of the various final products and value added stages (increasingly including services) at the most competitive locations and where scale economies can best be realised. This could, on the one hand, lead to more specialised FDI.² On the other hand, market-oriented FDI originally motivated by overcoming trade barriers, could become unnecessary (*Segre 2000; Dunning 1997*) leading to less FDI.

The development of "German" affiliates in EU partner countries compared to other host regions and with economic development in Germany can give some impression as to the reaction of German investors to European integration. According to Bundesbank data, the main features of this development were the following:

2 These are re-organisation and rationalised investments in *Yannopoulos'* (1990) terms.

- The EU countries have been a traditional focus of German investors. Roughly half of all foreign manufacturing production of German firms took place there in the late 1980s before the Internal Market program was realised. The share of EU(15) in foreign employment of German firms was clearly lower since European production is less labour-intensive compared with other regions. In 2000, a workforce of over 1.5 m was employed by German firms in the EU(15), almost 800 000 of which in manufacturing affiliates.
- After the IM measures were realised in 1992, German manufacturing in the EU roughly doubled in current values. Employment increased by almost 20 per cent between 1992 and 2000. Contrary to that, there was a loss in total manufacturing employment in Germany in the early 1990s and stagnation after the mid 1990s. This means: Europeanization of German manufacturing firms has proceeded.
- On the other hand, table 1.1 shows that EU locations have clearly fallen behind compared to other regions. This does not mean that new chances arising from economic and political integration are less important than rationalisation (i.e. cutback) of existing involvement. It has to be kept in mind that above-average growth of FDI in other regions largely results from fast growth (from a low basis) at newly opened-up locations in CEE or Asia-Pacific countries and from large-scale acquisitions in non-European industrialised countries. The EU only fell behind in relative terms.
- Europeanization was driven by a broad spectrum of sectors employing up to over 40 % of their total foreign employees in the area.³ In absolute terms the four largest sectors (chemical ind., motor vehicles, mechanical and electrical engineering) clearly dominate with about 60 % of all employees in "German" manufacturing affiliates in the EU. With regard to regional structure, neighbouring countries clearly lost ground in relative terms. They are host to about 20 % of "German" production in the EU now, compared to one third in the early nineties. However, the market share of German affiliates in neighbouring Belgium and particularly Austria exceeds by far the average share (*Borrmann et al. 2001, p. 77*).

3 This applies to food, rubber/plastic products, metal products, "other" transportation equipment (aeroplanes). Service industries not included here (trade, financial sector, hotels, transportation and business services) are even stronger oriented towards EU locations.

Table 1.1: Regional structure of manufacturing affiliates of German firms

Host region	Sales of affiliates								employment	
	1992	1996	2000	1992	1996	2000	1996/92	2000/1996	2000	
	€million			%					1000	(%)
EU(15)	97 145	142 900	198 400	47	48	33	+47	+38	786	(29)
Neighbouring countries ^a	69 528	82 686	115 100	34	28	19	+19	+39	424	(16)
Non-European industrial countries	60 414	94 190	281 000	29	32	46	+56	+198	773	(29)
USA	44 595	68 712	192 980	22	23	31	+54	+181	550	(21)
Canada	3 568	4 126	23 450	2	1,4	3,9	+16	+468	43	(2)
Japan	6 391	9 060	45 140	3	3,1	7,5	+42	+398	82	(3)
Industrialising countries Asia ^b	3 972	8 349	23 890	2	2,8	3,9	+110	+186	166	(6)
Poland, Czech Rep., Hungary	2 300	10 778	26 390	1	3,6	4,4	+368	+145	293	(11)
World total	207 071	297 438	605 580	100	100	100	+44	+104	2681	(100)

^a Denmark, Belgium, Luxemburg, The Netherlands, France, Switzerland, Austria; ^b Hongkong, Malaysia, Singapur, South Korea, China

Source: Own calculations based on information of the Deutsche Bundesbank

We can conclude from the pattern of German manufacturing production in the EU that the removal of trade and investment barriers in the IM did not lead to net disinvestments. The seizing of new chances obviously exceeded the reduction of defensive market-oriented investments formerly induced by trade barriers. This is in line with the results of most studies available on the relationship of trade and FDI (*Chakrabarti* 2001, p. 92). The relative falling behind of EU locations has to be seen against the background of high investment penetration in the late 1980s.

In the following, we explore whether there is empirical evidence of network strategies in FDI of German firms in the Internal Market. We first substantiate our hypotheses in more detail on the basis of general arguments regarding internationalisation strategies (section 2). Section 3 contains a brief survey of the literature available on the subject. Then, the data base and our research methodology are spelled out (section 4), and in the main section (5) empirical tests are undertaken primarily on the basis of detailed Bundesbank data on foreign production in Western Europe, section 6 concludes.

2 HYPOTHESES

Changes in the firms' IM strategies as mentioned above can be initiated by various changes in demand and supply conditions leading to intensified competition and wider options for the firms: Deregulation and opening-up of domestic markets for foreign competitors lead to the appearance of new competitors; rapid technological progress leads to shorter product cycles and to uncertainty regarding the medium term market position; hence the necessity increases for rapid innovation and exploitation of complementary foreign knowledge (*Beckmann 1997, Pearce 1995*); progress in information, communication and transportation technologies improves possibilities of border-crossing coordination within a firm, and in view of the increased pressure of competition the widened possibilities are used in practice.

Efficiency strategies

Intensified competition thus brings about tendencies to break up and re-organise the value added chain. A pressure for "rationalisation" of international production structures is generated.⁴ "...many internationally operating companies are facing the challenge to change from expansion to efficient integration of their international activities" (*Kutschker 1998, p. IX*). The spatial re-organisation of foreign production aims at exploiting advantages of locations and scale economies on plant level by increasing specialisation.⁵ International business activities will then be organised in networks of affiliated or cooperating firms, based on division of labour (*Dunning 1998a and b; UNCTAD 1993 and 1998*).

Specialisation within these networks can be horizontal or vertical.⁶ In case of horizontal specialisation, production of the various final products will be regionally concentrated.

4 Increasing pressure of competition does not only lead to rationalisation of production, but also to more aggressive pursuit of market strategies in fields where closeness to the market is important for business success.

5 Scale economies on plant level can lead to specialisation in individual plants. Scale economies on firm level, on the other hand, essentially concern headquarter services and can be considered a core determinant of FDI in general.

6 Vertical FDI is dealt with in the model of *Helpman/Krugman (1985)*, while *Markusen/Venables (1998)* model horizontal FDI which, however, is not of a specialised nature as is assumed here. It rather is traditional market-seeking FDI with affiliates in all countries involved in doing the same type of production.

In the extreme, each product is manufactured at one location only, be it foreign or domestic. Vertical specialisation takes place along the value added chain. In such cases, the various foreign plants are responsible for the manufacture of individual stages of production, the output of which is then sent to other affiliated or co-operating firms for further processing or assembly. The choice of location is a result of the interplay of several factors: Potential of scale economies, production conditions at the various locations and conditions of market access which will be improved by local production. Efficiency-seeking by increasing specialisation necessarily goes along with intensified intra-firm trade (*Tavares/Pearce* 1998)⁷ and transactions with co-operation partners and third parties.

Asset-seeking strategies

A trend towards asset-seeking can be explained by an ever stronger dependence of the firms' competitiveness on intangible (or "tacit") knowledge. This term comprises strategically important knowledge which could not be comprehensively documented and thereby transferred to third parties. Intangible knowledge can be made up of technical or marketing competence as well as of routines and organisational structures within a firm⁸ (*Audretsch* 1995, p. 12). Companies using external knowledge for the development of competitive strengths will be most successful to stand up to international competition (*Dunning* 1998a). Then, internationalisation strategies do not only aim at exploiting know how already available in the firm, but at enhancing existing know how. Foreign subsidiaries are supposed to supply complementary knowledge to the parent company or affiliated firms in other countries.

7 This proposition differs from *Venables'* (1999) conclusion that only international fragmentation of production along the value added chain leads to increased trade, while horizontal FDI is a substitute for foreign trade. In his model of horizontal FDI, Venables only considers import substituting market-oriented FDI thus neglecting important aspects of the internationalisation process.

8 The increasing importance of this knowledge becomes obvious from a comparison of the total book value of a firm and its material assets. Some estimations put the total value of a firm at 2 ½ to 5 times the value of material assets (*Blair* 1995; *Edvinson* 1997). In 1982, the relation was put at 1 ½ only. *Stewart* (1997) estimates the importance of the knowledge component at 70 % of the total value of industrial firms, compared with 20 % in the 1950s (cf. also *Dunning* 1998a). Such estimates are confirmed by a study of the trade marks agent INTERBRAND concluding that only 30 % of the market capitalisation of the 350 firms traded at the London Stock Exchange can be explained from the balance sheet positions. About 70 % are estimated to result from the value of the respective trade marks (FAZ of 13.10.1999).

Strategic asset-seeking has a profound regional component, according to the reasoning of New Economic Geography (*Krugman 1991*). Knowledge often develops within regionally confined agglomerations. Only there, services, intermediate products, and infrastructure needed are available, and the firms can tap the common pool of qualified labour. Knowledge-based activities are, therefore, regionally concentrated in a few competence centres (*Porter 1990; Krugman 1991; Audretsch/Weygand 1999*). (Foreign) investors intending to profit from this knowledge base have to invest in those regions since non-codifiable knowledge available there can often be transferred only by manifold personal contacts (*Audretsch, Feldman 1995*). The international and even the inter-regional spread of intangible knowledge by market transactions would face important barriers. Multinational investors setting up or acquiring an affiliate can strongly reduce such barriers to mobility of knowledge by internalising these markets. Transfer will be facilitated by intra-company border-crossing transfer of personnel and by organisation of efficient intra-company communication. Furthermore, the problem of evaluating information is less important when transactions take place within one group of firms.

The trend towards network strategies is facilitated and driven by several factors:

- With increasing level and regional spread of foreign investments (which traditionally may have been market-oriented), the share of greenfield investment in new markets will decrease; most FDI will be done as M&A and expansion or rationalisation at existing facilities (*Dunning 1994 and Tavares/Pearce 1998*). Information on investment conditions and opportunities at these locations will then improve.
- Integration of capital markets and advance of investment and pension funds increase the pressure on firms to improve efficiency and innovation.
- Investment banks, particularly from the USA, accelerate this competition pressure. These institutions are permanently analysing firms in order to identify unexploited profit and growth potential and trigger off restructuring.

True, traditional market orientation cannot be expected to become unimportant with the spread of network strategies within the EU Internal Market. Often, certain advantages of production close to a market will persist, especially in times of intensified competition. Furthermore, the scope for relocation of existing production is limited in view of sunk

costs of investing in human and real capital. Therefore, it can be expected that a change in strategies will be gradual and that the various types of strategy will increasingly overlap. "Complex integration strategies" (UNCTAD 1998, p. 111) will develop serving at the same time a stronger market position, improved efficiency and strengthening of innovative capacity by integration of foreign resources.

Nevertheless, network strategies should, if our reasoning reflects reality, become increasingly visible in the structure of foreign production in the Internal Market, in particular in recent years. We, therefore, hypothesise

Hypothesis H1:

German manufacturing in EU countries is significantly determined by comparative advantage of host countries and by the potential of scale economies on firm level of an investor. The importance of these factors should have increased in recent years with progressing adjustment to the IM.

Hypothesis H2:

German manufacturing in EU countries goes along with trade in the same sector. This does not only hold for trade in intermediate goods but also for total trade. The importance of this relationship should have increased in recent years with progressing adjustment to the IM.

3 EVIDENCE AVAILABLE FROM LITERATURE

A number of studies on FDI have explored internationalisation strategies both in general and in the EU, although most of them were not aiming at identifying new network strategies.⁹ While data base and research methods differ widely, the studies available have in common that size and growth of the host country market and geographical/

⁹ An overview of studies on determinants of foreign production and FDI with particular reference to integration processes can be found e.g. in Segre (2000); Braunerhjelm/Svensson 1998, pp. 104; World Investment Report of UNCTAD (1998), pp. 89 and Dunning (1997).

cultural proximity are conducive to FDI.¹⁰ Market size is mostly operationalised by GDP, while proximity is expressed by the distance between the economic centres of the countries concerned or by dummy variables for nearby countries or common language. Furthermore, sector- and firm-specific factors of competitiveness of the source country are ranked high, in particular indicators of innovative capacity (*Härtel/Jungnickel et al. 1998; Hubert/Pain 1999*).

Factors characteristic for strategic asset-seeking were also analysed by a number of authors. According to a study dating back to 1992, agglomerations in the host country, along with market size, were the most important factors influencing the FDI decision (*Wheeler/Mody 1992, p. 57*).¹¹ *Braunerhjelm/Svensson (1998)* consider the relative weight of an industrial sector in the various host countries compared with the average weight of the same sector in all host countries as determinant of inward FDI.¹² *Barrell/Pain (1999)* focus on the relative position of host countries in the Western European innovation base.¹³ Both studies show that foreign comparative advantages are conducive to FDI of Swedish and US firms respectively. *Braunerhjelm/Lipsey (1998)* support these results in a comparison of foreign production of Swedish and US firms. *Hubert/Pain (1999)*, on the other hand, do not assign significant importance to the technological knowledge of host countries for regional structure of German FDI to.

Common to these studies is that agglomeration or, in more general terms, specialisation of production and R&D is defined on the level of national data. In contrast, *Dunning/Wymbs (1999)* base their analysis about the sources of competitiveness of major multinationals on information directly supplied by investors. The authors find that the competitiveness of the entire firms indeed depends on foreign know-how just as much as on domestic. Similarly, a positive relationship between R&D strength of host countries and R&D efforts of foreign-owned subsidiaries can be established (*Borrmann et al. 2001; Cantwell/Piscitello 2002*).

10 See e.g. *Chakrabarti (2001), Ekholm (1998), Caves (1996), Braunerhjelm (1998), Barrell/Pain (1999), Wheeler/Mody (1992)* and *Kravis/Lipsey (1982)*. Concerning the size of a country, a positive relationship with FDI is a matter of course, assumed that foreign production is aimed at the host country market. Then, local production will start from a certain size of the economy supporting scale economies and increase more or less proportionately in the growth process. Enduring market orientation is also visible in the strong pro-cyclical development of FDI.

11 *Wheeler/Mody (1992)* investigate location decisions of US investors in 42 countries in the 1980s in a rather plain way. Country-specific variables, including "agglomerations factors", are operationalised by classification from 1 to 10.

12 This variable is named "agglomeration".

13 These definitions are largely equivalent to a comparative advantage variable.

With regard to efficiency-seeking strategies, studies available do not lead to unanimous conclusions. They leave open a number of questions, not least because there is no single variable indicating such strategy:

- Taking advantage of scale economies by foreign production is hard to test in a direct way, as has been said above. Measures of scale economies on plant level can indicate efficiency-oriented concentration of production in the home country (*Brainard* 1997 and *Ekholm* 1998). Rationalisation and thus relocation of production abroad is hardly covered by empirical studies. The work of *Braunerhjelm* and *Ekholm* (1999) is a certain exception. When exploring the location choice of Swedish firms in Western Europe, they did not find a "large-country bias" (which could indicate the realisation of scale economies abroad).
- The relationship between foreign production and foreign trade, as an indirect indicator of efficiency-seeking, has often been analysed.¹⁴ Studies concentrate on the relation of foreign production and exports from the home country. Although they widely differ in terms of concept (cross-section, longitudinal, panel analysis) and data base (firm data or secondary statistics), the results in general are not too different: FDI and exports are mostly found to be complements, although this relationship seems to have alleviated more recently and given room for some substitutability. This holds for a number of Western European countries, including Germany (*Härtel/Jungnickel* et al. 1998; *Svensson* 1996; *Pain/Wakelin* 1997; *Henneberger/Ziegler* 2000). Information on total trade (i.e. exports and imports) of foreign affiliates is scarce. Swedish data show a clearly strengthened position of foreign affiliates in the company-wide border-crossing division of labour in R&D intensive firms (1998).
- Also international cost differentials, measured by wage costs, can be an element of efficiency-seeking. These factors are mostly found to be insignificant for FDI (*Braunerhjelm/Lipse*y 1998, p. 35, *Wheeler/Mody* 1992, p. 59; *Brainard* 1997). Also, *Ekholm* (1998, p. 66) concludes that foreign production is - on balance - brought about by similarities rather than differences of home and host countries in

¹⁴ See e.g. *Chakrabarti* (2001); *Lim* (2001); *Henneberger/Ziegler* (2000); *Härtel/Jungnickel* (1998); *Pain/Wakelin* (1997); *WTO* (1996); *Pfaffermayr* (1996); *Svensson* (1996). These sources contain references to a host of further studies on the issue.

the endowment of human capital.¹⁵ Other studies, however, conclude that differences in unit labour costs, in fact, influence increasingly FDI (*Hubert/Pain* 1999; *Barrel/Pain* 1998; *Hatzius* 1997). The results obviously depend on the kind of FDI and on the countries and sectors considered (*Chakrabarti* 2001).

In the following, we discuss the presumed changes in internationalisation strategies of German firms on a broader empirical basis than it was done before.

4 DATA BASE AND METHODOLOGY

Our hypotheses are tested on the basis of data on foreign production of German firms in EU countries. The analysis differs in several ways from most other studies:

- It is confined to manufacturing subsidiaries. This helps to focus on the central issue "integration of *production* in the EU". We thereby exclude distortions by distribution outlets playing a significant role in German FDI.
- Production is defined as "sales of manufacturing subsidiaries". Sales data are superior to most commonly used FDI data since they are not blurred by strategic funding behaviour of multinationals. If, for example, German investors finance part of their investment by funds taken up by the subsidiaries themselves, such investment would not show up in the FDI statistics. FDI statistics can further be distorted by intra-firm loans which having nothing to do with investment and production. In contrast, sales data tie in with real production activities.
- Considering German production activities only in the EU Internal Market, means we focus on host countries directly competing with Germany for high-income production.
- By taking into account the relationship of foreign production with foreign trade, including imports, we can analyse internationalisation strategies more profoundly.

¹⁵ This reasoning is in line with theoretical thinking on horizontal FDI as modelled by *Markusen* (1984 and 1996).

- Thanks to special compilations of the Deutsche Bundesbank, a more detailed data set of foreign production is available compared with published statistics. Data on foreign production are available for two years (1996 and 2000) broken down by 11 partner countries (see table 4.1) and 20 manufacturing sectors. This allows a consideration of sectoral features and a more thorough analysis than in most other studies and it opens up the possibility of a certain assessment of integration strategies over time. Foreign production included in our analysis accounts for over one quarter of total German foreign production. The according share of foreign trade amounts to almost one half.

The tests of our hypothesis *H1* are based on a model explaining the pattern of German-owned manufacturing production in EU countries ($FPQU_{ij}$). Production values have been divided by the GDP of the host country and by the size of the German investing sector (measured as turnover) in order to rule out size effects. Indicators related to network strategies were – among others - added to the model as exogenous variables (section 5.1). For testing *H2* we constructed a model aiming at including foreign production as one out of several variables explaining foreign trade patterns with EU partner countries (section 5.2).

In our first regression (section 5.1), the crucial independent variables considered are taken from theoretical reasoning on the determinants of FDI focusing on firm-specific advantages and location-specific factors. In the test of our second hypothesis (section 5.2), our main interest is to find out the role of foreign production for foreign trade ($EXPQU_{ij}$ and $IMPQU_{ij}$ respectively). Furthermore, we include variables reflecting comparative advantages of locations and of firms/sectors as well as control variables. Thus, there is an overlap with determinants of foreign production. The independent variables included in our regressions are:

- Gross domestic product (GDP_j) at constant prices and constant exchange rates indicates the market size of host country j . The bigger a country, the bigger is the potential for inward FDI. Since our dependent variable $FPQU_{ij}$ was normalised by GDP (as well as by sector size), our GDP regressor merely measures the influence which goes beyond a proportionate size effect. A significantly positive effect would not indicate market-seeking in general, but a large-country bias of German investors.
- The variable S_{ij} denotes technological specialisation of host countries on a sectoral level. This variable is of particular interest to us since it can be considered an

indicator of technological competence of host countries and hence be helpful for identification of asset-seeking strategies. Following *Braunerhjelm/Svensson* (1998)¹⁶, S_{ij} is defined as the share of sector i 's R&D expenditure in a host country in relation to the according share in all countries considered. Although this indicator is defined on a national and not on a regional basis, it should reflect competence within industrial and technological clusters as R&D expenditure is mostly concentrated regionally within a country (*Krugman* 1991, *Audretsch/Weygand* 1999). In case of asset-seeking we expect a positive impact on foreign production.

- Sector-specific R&D intensity in Germany ($RDINT_{iG}$) is an indicator of technological competence of investors. It is operationalised by the relation of R&D expenditure to turnover. The impact of $RDINT_{iG}$ on foreign production and exports should be positive as technological competence is a core factor of firm-specific competitiveness which can be exploited by FDI or exports alike.
- Sectorspecific transportation costs ($TRANS_{iG}$) indicate natural barriers to trade. Following *Ekholm* (1998), this variable is expressed by the share of German exports destined for adjacent countries in total German exports in the respective sector. The impact of transportation costs on foreign production is indeterminate: On the one hand, high transportation costs induce market-seeking horizontal direct investment, on the other hand, they impede horizontally and vertically organised border-crossing networks by making intra-company trade more expensive.
- Economies of scale at firm level in Germany ($SCAL_{iG}$) are included since they can be considered an important general determinant of FDI (*Wagner* 1998). This variable is expressed by the average size of enterprises within an industry measured as turnover. We expect a positive relationship between $SCAL_{iG}$ and foreign production indicating the international use of the parent company's competence, especially in headquarter services. It is important to note that the scale economies variable based on the situation in Germany cannot give indications of any specialisation and realisation of scale economies on the side of the foreign production units. This issue could best be approached in an indirect way by analysing changes in the regional concentration of foreign production and the resulting trade relations. Foreign trade can profit from scale economies on plant level as well as from headquarter resources. We use the

¹⁶ Instead of R&D expenditure *Braunerhjelm/Svensson* take turnover. As agglomeration advantages are mostly assumed to result from technology spillovers, R&D expenditure seems to be a better indicator.

average plant size in a sector as variable for scale economies when discussing determinants of exports (*H2*). Quite in line with the results of a number of studies (*Caves* 1996; *Wagner* 1995 and 2003), we expect a positive relationship (which may, however, hide firm-specific effects, *Wagner* 2003).

- $LCOST_j$ denotes labour cost per hour in manufacturing of host country j related to the respective costs in Germany. If this indicator mainly reflects the pressure of wage costs, there should be a negative relation to foreign production. If, however, $LCOST_j$ rather reflects human capital and qualification of labour, a positive relation could be expected since the qualification of workforce is an important country-specific determinant of FDI. Likewise, the effects of wage costs on trade are not as clear-cut as one might think.
- NL is a dummy variable for West European host countries adjacent to Germany.¹⁷ The expected relation to foreign production is ambiguous, since geographical and cultural proximity do not only favour foreign production, but also foreign trade which could be a substitute. The result is, therefore, an empirical question. Most empirical studies found a positive relationship which could be an indicator of efficiency-seeking if foreign trade were related positively, too.
- yd is the dummy variable for the year (1996 = 0; 2000 = 1).
- e_{ij} denotes the error term.

All variables (except dummies) were expressed as logarithms. This has the consequence that all cases with zero value have to be excluded. Excluding cases with zero value of the dependent variable causes a sample selection bias which is corrected by implementing Heckman's lambda (λ_{ij}).¹⁸ The statistical sources of the variables included in our computations are shown in table S.1.

¹⁷ These countries are Austria, Belgium/Luxemburg, Denmark, France and the Netherlands.

¹⁸ For this purpose a two-stage analysis was performed. In a first step Heckman's lambdas were computed via a probit model. In a second step the lambdas were used in an OLS-model as independent variables (*Johnston/DiNardo* 1997, pp. 446. and *Braunerhjelm/Svensson* 1998, pp. 99). *Braunerhjelm/Svensson* 1998 point out that this method is not indisputable.

Table 4.1: Statistical sources of regression variables

Variable name	Description	Year	Source
FPQU _{ij}	Turnover of German manufacturing affiliates in sector i and in host country j, divided by turnover of German sector i, and GDP of host country j	1996, 2000	Data of Deutsche Bundesbank
GDP _j	Gross domestic product at constant prices and exchange rates in country j	1996, 2000	OECD, National Accounts
S _{ij}	specialisation indicator: share of sector i's r&d expenditures in industry in host country j in relation to the respective share of all regarded host countries	1996, 2000	OECD - ANBERD
SCAL _{iG}	Indicator for economies of scale at the firm level in sector i in Germany: average firm size in terms of turnover	1997, 2000	Statistisches Bundesamt, FS 4, R. 4.1.1
TRANS _{iG}	Transportation costs in sector i in Germany: share of exports in adjacent countries in total exports of sector i	1997, 2000	Statistisches Bundesamt, FS 7, R. 7
RDINT _{iG}	R&D intensity of sector i in Germany: R&D expenditure / turnover	1995, 1999	Stifterverband, Forschung und Entwicklung in der Wirtschaft 1995 bis 1997 Statistisches Bundesamt, Fachserie 4, Produzierendes Gewerbe, Reihe 4.1.1
LCOST _j	Labour cost per hour in ECU in host country j divided by German labour costs	1992, 1997	EUROSTAT
SSEC _{iG}	Size of German sector: Turnover	1996, 2000	Statistisches Bundesamt, FS 4, R. 4.1.1
ESTSIZE _{iG}	Average size of establishments in German sector i: Turnover	1996, 2000	Statistisches Bundesamt, FS 4, R. 4.1.1
EXP _{ij}	German exports of manufactured goods in sector i to host country j	1996, 2000	Statistisches Bundesamt, FS 7, R. 7
IMP _{ij}	German imports of manufactured goods in product group i from host country j	1996, 2000	Statistisches Bundesamt, FS 7, R. 7

a Regressions were performed for 11 EU-countries and 21 manufacturing sectors; host countries: Austria, Belgium/Luxemburg, Denmark, France, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom

5 EMPIRICAL EVIDENCE

The following computations are intended to estimate empirically the importance of networking strategies of German firms. To this end, multiple regressions on the determinants of foreign production and foreign trade were performed. Determinants of foreign production primarily provide indications of asset-seeking strategies while determinants of foreign trade should shed some light on efficiency-oriented internationalisation strategies.

5.1 Evidence on asset-seeking: Determinants of foreign production

The regression equation does not only include individual variables as indicated above. Additionally, we allow for five interaction variables which are the product of the year dummy variable (yd) and a regressor variable. The interaction variable is zero for the year 1996 and it takes the value of the regressor variable for the year 2000. Therefore, it measures the change in regression coefficients between 1996 and 2000. A positive interaction variable's coefficient means that the corresponding regression coefficient is higher in the year 2000 than in 1996 indicating increased influence during the period under review. The regression runs as follows:

$$(1) \quad \ln FPQU_{ij} = \beta_0 + \beta_1 \ln BIP_j + \beta_2 \ln S_{ij} + \beta_3 \ln RDINT_{iG} \\ + \beta_4 \ln TRANS_{iG} + \beta_5 \ln SCAL_{iG} + \beta_6 \ln LCOST_j + \beta_7 NL_j \\ + \beta_8 \ln S_{ij} yd + \beta_9 \ln RDINT_{iG} yd + \beta_{10} \ln SCAL_{iG} yd + \beta_{11} \ln LCOST_j yd \\ + \beta_{12} NL_j yd + \beta_{13} \lambda_{ij} + e_{ij}$$

The results of the computations are displayed in table 5.1. They essentially confirm our expectations.

Table:5.1 Determinants of "German" manufacturing in EU countries 1996 and 2000^a

I			II	
Regressors	Regr.coeff.	beta	Regr.coeff.	beta
constant	-20.27**(-14.2)		-20.21**(-14.0)	
BIP	-0.04 (-0.5)	-0.03	-0.17 (-1.8)	-0.11
specialisation index	0.55**(4.1)	0.33	0.45**(5.0)	0.26
R&D intensity	0.28**(3.4)	0.32	0.22**(2.9)	0.25
transport intensity	-0.34 (-0.8)	-0.06	-0.07 (-0.2)	-0.01
economies of scale	0.37**(3.5)	0.23	0.36**(3.7)	0.22
labour cost per hour	-0.72*(-2.5)	-0.19	-0.77**(-3.4)	-0.20
neighbouring countries	0.93**(3.9)	0.33	0.86**(5.1)	0.31
lambda	0.46 (1.0)	0.06	-0.42 (-0.9)	-0.05
interaction variables:				
y _d * specialisation index	-0.15 (-0.8)	-0.07	-	
y _d * R&D intensity	-0.11 (-1.2)	-0.09	-	
y _d * economies of scale	0.12 (1.5)	0.19	0.15**(4.8)	0.23
y _d * labour cost per hour	-0.28 (-0.7)	-0.06	-	
y _d *neighbouring countries	-0.01 (0.0)	0.00	-	
R ²	0.38		0.38	
Shapiro-Wilk test ^b	1.32 (0.09)		0.80 (0.21)	
Ramsey reset test ^c	0.22 (0.88)		0.19	
Cook-Weisberg test ^d	0.09 (0.76)		0.91	
number of observations	335		335	

III			IV	
Regressors	Regr.coeff.	beta	Regr.coeff.	beta
constant	-19.93**(-13.7)		-19.59**(-13.20)	
Gross Domestic Product	-0.16 (-1.6)	-0.10	-0.18 (-1.9)	-0.12
specialisation index	0.43**(4.7)	0.25	0.46**(4.9)	0.27
R&D intensity	0.20**(2.7)	0.23	0.20**(2.7)	0.23
transport intensity	-0.18 (-0.5)	-0.03	-0.22 (-0.5)	-0.04
economies of scale	0.47**(4.8)	0.28	0.48**(4.9)	0.29
labour cost per hour	-0.31 (-1.3)	-0.08	-0.55*(-2.4)	-0.14
neighbouring countries	0.82**(4.8)	0.29	0.49*(2.5)	0.17
lambda	-0.38 (-0.8)	-0.05	-0.39 (-0.8)	-0.05
interaction variables:				
y _d * specialisation index	-		-	
y _d * R&D intensity	-		-	
y _d * economies of scale	-		-	
y _d * labour cost per hour	-0.86**(-4.4)	-0.19	-	
y _d *neighbouring countries	-		0.54**(2.8)	0.16
R ²	0.38		0.36	
Shapiro-Wilk test ^b	0.57 (0.28)		0.45 (0.33)	
Ramsey reset test ^c	0.76 (0.51)		0.11 (1.00)	
Cook-Weisberg test ^d	0.01 (0.90)		0.41 (0.51)	
number of observations	335		335	

^a a regression with robust standard errors (Huber/White/sandwich estimator of variance); The table contains regression coefficients, t-values in brackets, and beta coefficients; ** significant at 1 % level; * significant at 5 % level; ^b test for normal distribution of residuals: test statistic and P-value (in brackets); ^c test for misspecification: test statistic and P-value (in brackets); ^d test for heteroscedasticity: test statistic and P-value (in brackets).

With an R^2 value of around 0.40, the explanatory power is fairly high for cross-section analyses. Nearly all variables (except transport costs and interaction variables) are highly significant and display the expected sign.¹⁹

- What is most interesting to us, we found a positive relationship between specialisation index of the EU partner countries and German-owned manufacturing production taking place there. This could indicate that strategic asset-seeking plays a role for foreign production.
- As expected, German R&D intensity exhibits a positive influence. This shows that existing firm-specific competitiveness of the investor is an important precondition for direct investment.
- Economies of scale at firm level also display a significant positive impact. Obviously, firms that can realise scale economies in headquarter services are most prone to invest in EU partner countries.
- The labour cost variable displays a negative sign, implying that it rather reflects the cost of labour than the qualification.
- While proximity displays the highest positive influence on foreign production, transportation costs do not seem to be significant at all. This is not too surprising given the dismantling of trade barriers in the EU and the well developed infrastructure.
- The GDP-variable is not significant at all. Apparently, this does not speak against market seeking strategies, since the dependent variable was normalised by GDP of the host countries. The coefficients rather indicate that there is no large-country bias in the German EU involvement.²⁰

19 The Ramsey Reset Test gives no indication of the model's misspecification. According to the Shapiro-Wilk Test, regression residuals are normally distributed. Robust standard errors have been computed. One outlier (manufacture of computing and office machines in the United Kingdom) has been removed from the sample as the Cook distance indicator displayed a rather high value. We can, therefore, interpret the results as statistically significant.

20 Further regressions (not reported separately) with absolute values for both foreign production and GDP and control variables as in table 5.1 showed a highly significant positive relationship between the two thus indicating the importance of market-seeking.

None of the interaction variables is significant. Apparently, the underlying relationships hardly changed over time. This could mean, on the one hand, that adjustment to changed institutional settings in the Internal Market had taken place already by the mid 1990s. However, it could also be a consequence of M&A being the most important mode of FDI. Voluminous M&A projects may still await restructuring and integration after merger. However, the insignificance of interaction variables may as well be caused by collinearity among them. Thus we computed regressions II to IV providing indications to an increased role of economies of scale, proximity and labour cost between 1996 and 2000.

5.2 Evidence for efficiency seeking: Determinants of foreign trade

This part deals with the relationship of foreign production and foreign trade. A complementary relationship of the two would be an indication of specialisation and networking strategies. Determinants of German foreign trade were assessed via multiple regressions. German exports and imports resp broken down by sectors and partner countries were taken as dependent variables ($EXQU_{ij}$ resp. $IMQU_{ij}$). Exports and imports were normalised by the GDP of the host country; in addition exports were divided by the size of the investing German sector (turnover) in order to rule out size effects. Foreign production, the exogenous variable we are most interested in, was not considered in absolute terms either. It was also normalised by sector and market size in the same way as described in section 4.1. The foreign production variable $FPQU_{ij}$ is thus defined as sales of German manufacturing affiliates in sector i and host country j , divided by German sector size ($SSEC_{iG}$), divided by GDP of host countries. It gives an indication of sector-specific "German" production in one host country compared to the average "German" production in the various sectors and host countries.

The other potential determinants of German trade with EU countries are largely the same as those used in our regressions explaining "German" production in the EU since conventional theories on foreign trade and FDI are based on similar factors (competitiveness of firms and quality of locations). The regression equations for determinants of foreign trade thus run as follows:

$$\begin{aligned}
(3) \quad \ln EXQU_{ij} = & \beta_0 + \beta_1 \ln FPQU_{ij} + \beta_2 \ln RDINT_{iG} + \beta_3 \ln ESTSIZE_{iG} \\
& + \beta_4 \ln LCOST_j + \beta_5 (\ln LCOST_j)^2 + \beta_6 NL + \beta_7 \ln FPQU_{ij} yd \\
& + \beta_8 \ln RDINT_{iG} yd + \beta_9 \ln ESTSIZE_{iG} yd + \beta_{10} \ln LCOST_j yd \\
& + \beta_{11} (\ln LCOST_j)^2 yd + \beta_{12} NL yd + e_{ij}
\end{aligned}$$

$$\begin{aligned}
(4) \quad \ln IMQU_{ij} = & \beta_0 + \beta_1 \ln FPQU_{ij} + \beta_2 \ln RDINT_{iG} + \beta_3 \ln LCOST_j \\
& + \beta_4 NL + \beta_5 \ln FPQU_{ij} yd + \beta_6 \ln RDINT_{iG} yd + \beta_7 \ln LCOST_j yd \\
& + \beta_8 NL yd + e_{ij}
\end{aligned}$$

There are two aspects of special interest concerning the relationship of foreign production and foreign trade. First, we are interested to know whether foreign production is a substitute or a complement of foreign trade. Network strategies would imply complementary relations. The second and more important question will be whether there is a positive relationship not only between foreign production and export but also between foreign production and import. Only if this were the case, an efficiency-oriented balanced division of labour between domestic and foreign establishments could be assumed. A third aspect could be whether such division of labour is of horizontal or vertical character. In the literature, international production networking is mostly assumed to be vertical along the value added chain. Foreign production should then go along with trade in intermediate goods only. However, as was said above, specialisation can as well take place in final products. We, therefore, do not differentiate by kind of product traded.

Table 5.2: Determinants of German exports and imports^a

Regressors	exports		imports	
	Regr.coeff.	beta	Regr.coeff.	beta
constant	0.56 (0.08)		11.82**(12.3)	
foreign production	0.17**(5.1)	0.26	0.25**(4.9)	0.26
R&D intensity	0.12**(2.7)	0.21	0.21**(3.3)	0.25
economies of scale	0.13*(2.3)	0.11	-	-
labour cost per hour	3.92**(6.3)	1.61	0.12 (0.4)	0.03
labour cost ²	1.95**(6.2)	1.30	-	-
neighbouring countries	0.01 (0.1)	0.01	0.63**(2.7)	0.24
interaction variables:				
Y _d *foreign production	0.06*(2.4)	0.60	0.01 (0.6)	0.08
Y _d * R&D intensity	-0.02 (-0.4)	-0.03	0.00 (0.0)	0.00
Y _d * economies of scale	-0.01 (-0.1)	-0.03	-	-
Y _d * labour cost per hour	-2.46**(-2.9)	-0.87	-0.34 (-0.8)	-0.08
Y _d *labour cost ²	-0.92 (-1.9)	-0.39	-	-
Y _d *neighbouring countries	0.67**(3.4)	0.32	-0.30 (-1.0)	-0.10
R ²	0.53		0.23	
Shapiro-Wilk test ^b	0.91 (0.18)		0.50 (0.31)	
Ramsey reset test ^c	0.21 (0.10)		1.24 (0.30)	
Cook-Weisberg test ^d	0.00 (0.95)		1.11 (0.29)	
number of observations	351		351	

^a a regression with robust standard errors (Huber/White/sandwich estimator of variance). The table contains regression coefficients and t-values in brackets; significance level: **: 1 %, *: 5 %; ^b test for normal distribution of residuals: test statistic and P-value (in brackets), ^c test for misspecification: test statistic and P-value (in brackets), ^d test for heteroscedasticity: test statistic and P-value (in brackets).

Table 5.2 shows the regression results. Explanatory power (R^2) is high for exports, although considerably lower for imports. This is due to the fact that an economy of scales variable has not been included in the import's regression. Most independent variables are highly significant and they have the expected sign, thus supporting our hypothesis.

The main result, from our perspective, is: Foreign production has a strong positive relationship with exports as well as imports indicating a non one-sided specialisation of German manufacturing activities in the EU. Imports are significantly impeded by geographical and economic distance, as the adjacent countries variable displays a highly significant positive coefficient. Quite in line with our expectations, there is a positive

relationship between establishment size and exports indicating an important role of scale economies.²¹ Labour costs display a positive influence on exports but not on imports. In case of exports, the positive relationship indicates that the labour cost variable mainly reflects the level of income and hence qualification. A quadratic term has been added as there appeared to be a non-linear relationship between exports and labour cost. This means that exports will rise overproportionately as host countries' labour costs increase.

As to interaction variables, foreign production and proximity are significantly positive in the case of exports. With respect to foreign production, this indicates an increased importance of efficiency-seeking strategies.

6 CONCLUSIONS

In this paper, we investigated internationalization strategies of German manufacturing firms in the European Union. More specifically, we empirically tested the thesis that traditional market strategies had been replaced by border-crossing production networking based on comparative advantage of host countries and on specialisation and scale economies. Our study was based on more detailed data on foreign production, compared with published Bundesbank statistics. Production data are more telling than FDI data mostly used, and by taking into account detailed sectoral/regional structures, the results should be more representative than studies only based on sectorally/regionally roughly disaggregated data.

Our results show, on the one hand, that traditional market strategies are not outdated. On the other hand, there are some indications of (wage) cost orientation and clear signs of international network strategies. They form an important component in internationalization strategies of multinationals in the European Internal Market (IM). Insofar, our results support UNCTAD's view that complex integration strategies are evolving with elements of market-, asset-, and efficiency-seeking alike. The location of foreign production of German multinationals is, among others, oriented towards the technological potential of host countries indicating the importance of asset-seeking

²¹ Note that this relationship could as well be the result of unobserved heterogeneity of the firms (Wagner 2003).

strategies. Furthermore, the positive connection between foreign production and both exports and imports points at the significance of efficiency-oriented strategies with foreign affiliates taking over an active part and not only being recipient of components of the German parent companies.²²

However, there is hardly evidence that significant changes towards network strategies took place between 1996 and 2000.²³ Therefore, it seems to be safe to conclude that German FDI, at least to a large extent, was oriented towards comparative advantage of host countries already before the mid 1990s. Similarly, specialisation and realisation of scale economies could have played a role from the beginning of engagements in EU countries. Obviously, German FDI contributes to productivity enhancing international division of labour and mobility of know how in the EU.

Prevailing international network strategies mean greater mobility of investment and knowledge and hence loosened ties of economic activities to certain locations. Locational conditions at the regional level have gained in importance especially for knowledge-intensive production since relations with nearby firms and other institutions as well as the realisation of external effects play an important role for knowledge-based production.

Network strategies lead to intensified competition between locations accross national borders. Policy improving the quality of a location hence plays an ever more important role. It comprises a broad spectrum of policy areas (*Borrmann et al. 2001*). Location policy would include the improvement of local/regional resources in order to attract mobile resources from elsewhere as well as the promotion of complementarity of domestic and foreign resources. Both should have always been elements of a policy for economic growth. Prevailing network strategies of firms thus do not lead to completely new requirements for a growth-oriented policy. They do, however, increase the pressure to follow such policy. Furthermore, intensified economic links and interdependence of EU countries and locations increase the importance of following common rules of location competition and hence could be a good basis for greater cohesion also in fields of general policy.

22 A more specific assessment of the internationalization of (German) firms and their role in European economic integration is impeded by the lack of operational data of foreign affiliates, such as sourcing, exports, R&D activities, and forward and backward links with affiliated companies.

23 Unfortunately, it was not possible to cover a longer period of time since changes in sectoral composition of official statistics occurred in 1995 which could not be corrected for.

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