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Nationality Matters: The Geographic Origin of Multinationals and the Productivity of their Foreign Affiliates

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Nationality Matters: The Geographic Origin of Multinationals and the Productivity of their Foreign Affiliates [*†‡]

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Abstract

While quantifying the foreign ownership premium has received a lot of attention in the empirical literature, there is only little known about productivity variations between foreign affiliates of multinational firms. In order to enhance the understanding of the economic causes of this heterogeneity we analyze the impact of various institutional and economic characteristics of the countries in which the multinational parent companies are located on the productivity of their affiliates. Using a full record of the population of foreign-owned affiliates in Germany we find that affiliates' mean performances differ markedly when grouped by the country of their parent firm. We show that gravitational forces and institutional characteristics of the country of the parent, such as the availability of credit and the freedom to trade internationally, co-determine the foreign-owned affiliates' performances in a significant way. Moreover, the intensity of the impact depends on the intensity of the ownership link between the parent and its affiliate. Some residual impact of nationality remains.

JEL-Codes: F2, O2, O1
Keywords: foreign direct investment & productivity spillover & investor country characteristics

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1 Introduction

While FDI outflows from the European Union (EU) have declined by roughly 28% in 2009, FDI inflows into the EU have soared by 26% (Eurostat, 2011). These FDI inflows raise the equity capital of existing foreign affiliates or lead to the creation of new foreign-owned firms in the domestic economy. On average, these foreign-owned firms are more productive than purely domestic firms. This is not only the case in developing countries but also in developed economies. Looking at foreign-owned manufacturing firms in Sweden, Karpaty (2004) estimates that the productivity advantage of foreign-owned firms over domestic firms amounts to 2% to 7%; Arndt and Mattes (2010) find a productivity advantage of foreign-owned multinationals of about 6% over domestic multinationals in Germany. This premium is traditionally alleged to technology spillovers from the investing multinational enterprise (MNE) to its affiliate, to the value of the brand name, or to benefits of economies of scale within the MNE (Dunning, 1981).

While several authors have shown that the quality of institutions in the destination country of the *investment* matters for the success of affiliates (Buch et al, 2008, Chor and Manova, 2010, Nicolini, 2007, Bénassy-Quéré et al, 2007, or Spies, 2010), we examine in this paper, which characteristics at the level of the country of origin of the *investor* are linked to the productivity of foreign-owned affiliates in Germany. The existing empirical evidence on these investor country characteristics is scarce. Benfratello and Sembenelli (2006) find that 'nationality matters' for foreign-owned firms in Italy and conclude that the knowledge spillover from the foreign investor to the affiliate at home depends positively on the development gap between host and home countries.[1] Alfaro and Chen (2010) report that the downgrading of home country credit ratings during the economic crisis has spilled over to foreign affiliates, reducing their level of sales. Understanding the causes of cross-country heterogeneity in foreign affiliates' productivities is crucial for economic policy making. Since foreign affiliates exhibit positive spillovers to domestic firms (e.g. Girma et al, 2008, Javorcik, 2004, or Driffield and Girma, 2003), policy makers in FDI host countries may have an interest in obtaining information on the question from which country to attract FDI.

We argue that institutional characteristics of the country of the investor, such as the degree to which a country's economic policy relies on personal choice and markets, the ease of international economic exchange, credit tightness and the transparency of legal and regulatory regimes, as well as the average level of productivity are linked to the productivity level of its foreign affiliate. First, these country characteristics should encourage firms to invest in R&D and education to build up R&D assets and thus contribute to the existence of high performing international firms. Second, they should determine the scope and costs of productivity spillovers from the foreign multinational to its foreign affiliate. Moreover, this impact should be stronger the tighter the hierarchical link between investor and affiliate is, thus, it should be stronger in the case of a wholly-owned subsidiary than in the case of a partially-owned affiliate.[2] In order scrutinize the role of the nature of the capital link further, we will trace the chain of possibly subsequent international investors up to the *ultimate beneficial owner* (UBO). In a similar line of reasoning,

[1] The authors merge all investor country characteristics into dummy variables without identifying the home country drivers of the observed productivity differences.

[2] We use the notions 'subsidiary' and 'affiliate' synonymously. We refer thereby to firms with equity shares of at least 10% that are attributable to a foreign owner, unless otherwise indicated.

we expect a weaker impact from the institutional background of the UBO as compared to the environment of the multinational firm to which the first-tier investment link exists.

Theoretically, the direction of the impact is not clear. On the one hand, good institutions could facilitate the technology spillover from the productive parent to its foreign affiliate. On the other hand, good institutions could allow more and less productive firms to engage in FDI, potentially driving down the average productivity level of these firms' affiliates. Finally, the spillover might be co-determined by gravitational forces, the size of the economy of the investor, and her distance from Germany.

We test our hypotheses with a micro database that is collected and maintained by the Deutsche Bundesbank. It is the most comprehensive available data source for Germany since it contains the full population of all cross-border capital links of foreign-owned firms above a certain threshold in all industries from 1996 to 2006. It allows to estimate suitable productivity measures, to control for the industrial and regional affiliation of the subsidiary, and to identify the country of the investor for foreign-owned firms in Germany. In order to retrieve the investor country-specific determinants, we enrich our micro data with aggregated information from CEPII, the World Bank (Beck et al, 2000) and the Fraser Institute (Gwartney et al, 2011) at the country level.

Our empirical approach is as follows: we examine the potentially different impacts of the investor's home country characteristics on its affiliate's economic and technological performance by embedding an augmented productivity function into a production function. First, we estimate 'foreign ownership premia' in the spirit of Bernard et al (2007) and show that the foreign-owned affiliates' productivities vary considerably at the level of the geographic origin of the multinational parent company. Second, in order to retrieve the institutional and gravitational impact we regress the affiliates' performances on investor country characteristics, such as its distance from Germany, the size of the economy, the average productivity level, two economic freedom indicators, and the rule of law, while controlling for the industrial composition, regional disparities within Germany and global business cycle effects with respective sets of dummy variables. Finally, we analyze the mean residuals at the level of the world region of the investor countries and ask thereby if 'nationality still matters'.

Our main results are the following: we find that the institutional quality and gravitational forces of the country of the investor drive the extent of the productivity premium of foreign-owned firms. More specifically, affiliates of investors from countries with a freer trade environment and better credit availability are significantly more productive. The average productivity level of the country of the investor, measured as GDP per capita, does not affect the productivity of the affiliate. The geographical distance reduces the premium, which suggests that geographical or cultural distance hinders international technological spillovers. These results are robust to alternative ways of measuring productivity. Moreover, we find that the institutional impact is more pronounced the closer the hierarchical ties along the investment chain. By splitting the sample into wholly-owned affiliates and joint ventures and by repeating the regressions for the ultimate owner instead of the investor, we can show that the institutional environment matters more when the link between the affiliate and the superordinate firm is strong and direct. Finally, after controlling for institutional and gravitational influences some heterogeneity at the level of the country of the investor remains: affiliates of MNEs in Africa, the Commonwealth of Independent States, Australia and New Zealand, as well as affiliates with FDI stocks belonging to

investors from different countries are more productive than affiliates of MNEs that are located within the Euro area. This may point to the fact that multinationals from emerging economies are increasingly acquiring ownership advantages and 'become leading outward investors' (see e.g. Goldstein and Pusterla, 2008).

The remainder of the paper is organized as follows: In the next section we briefly discuss the economic nexus between characteristics on the level of the country of the investor and the performance of the investor's foreign affiliate. In Section 3 we describe our empirical approach and the data used for this study. In Section 4 we present and discuss our results. Section 5 contains our conclusions.

2 Links between the Multinational's Country of Origin and its Foreign Affiliates' Productivities

Starting with the seminal contributions of Caves et al (1982) and Dunning (1981), economists have investigated the role of multinational firms in the international economy. These early studies name ownership, location and internalization advantages as factors influencing the choice of FDI (possibly in contrast to other forms of internationalization). Recent research has formalized the idea of firm-specific factors driving the establishment of affiliates abroad (see e.g. Helpman et al, 2004) and the choice between trading assets inside or outside the firm's boundaries (see e.g. Antràs and Helpman, 2008). One of the key insights of this literature is that because of differing market entry costs, only the most productive firms engage in FDI, while firms with an intermediate productivity level export and the least productive (of the surviving) firms serve only the domestic market.

In parallel to these theoretical advancements, an empirical literature has emerged trying to quantify the productivity premium of foreign ownership. For firms in the UK, Girma (2005), e.g., reports Total Factor Productivity (TFP) improvements of acquisitions by US and European firms. Karpaty (2004) finds that Swedish multinationals are 2% to 7% more productive than domestic firms. Further, impacts as well as selection issues regarding foreign take-overs have been discussed in the literature. For Germany, Mattes (2010) shows that although foreign owned establishments are more productive than domestically owned establishments, there is no significant productivity effect of a foreign takeover. Arndt and Mattes (2010) conclude that medium-sized firms with relatively low or relatively high profits and sales are likely to be subject to a cross-border M&A. Hence, neither 'cherry' nor 'lemon' picking seems to be an important phenomenon with respect to inward FDI into Germany. Yet, evidence on productivity variations between foreign-owned affiliates grouped at the level of the investor's country does, to the best of our knowledge, not exist.

The theoretical literature offers little guidance on investor country characteristics that influence productivity variations at the level of multinational firms' affiliates. Dunning and Rugman (1985) perceive knowledge and technology transfers as rent-yielding assets. In these cases, the creation of an internal market (namely the MNE) is superior to using external markets. Berkowitz et al (2006) argue that contractual difficulties arise especially when complex products are traded, whose characteristics are difficult to fully specify. High quality institutions in the exporter's country help to overcome these frictions and create a comparative advantage.

Bustos (2011) focusses on the multinational's ability to finance the technology transfer which eventually influences the performance of its affiliate. If a foreign affiliate partly relies upon technological inputs from its parent, the extent of credit tightness they face may impede costly knowledge transfers and impact the affiliate's performance. In line with this hypothesis, Alfaro and Chen (2010) find that foreign affiliates from countries whose credit ratings have deteriorated during the crisis, perform worse in terms of sales.

Keuschnigg and Egger (2010) model financial market efficiency (especially in terms of monitoring capacity) as a critical determinant of R&D expenditures: innovative firms are financially constrained because R&D spending uses up the firms' own assets, which in turn restricts their access to external finance. This credit rationing might constrain their ability to exploit potentially profitable investment opportunities. The expansion of innovative industries thus relies on the degree of development of the financial system. Keuschnigg and Egger (2010) specifically model the quality of financial intermediation by examining the monitoring capacity of a country's banking sector, which is determined by the presence of active intermediaries.[3] Efficient monitoring is supposed to raise firms' debt capacities because it prevents managerial misbehavior. In short: financial sector development in terms of high monitoring capacity of financial intermediation relaxes firms' financing constraints and thereby encourages R&D investments. The quality of the financial sector becomes a source of comparative advantage in the R&D intensive and financially dependent sector.

The empirical evidence on investor country drivers of varying affiliates' performances is scarce as well. Most studies focus on host country determinants of FDI. In the context of financial institutions, Buch et al (2008) find evidence that access to internal and external finance co-determines the amount of FDI invested into an affiliate. Chor and Manova (2010) report that U.S. imports from countries with restricted access to credit have particularly suffered during the recent financial crisis. Nicolini (2007) shows evidence that host country institutions affect the offshoring volume between U.S. multinationals and their affiliates, in particular, for intermediate goods where contract enforcement is crucial. Bénassy-Quéré et al (2007) study the role of various governance indicators and find a particularly strong impact of bureaucracy, corruption, information, the banking sector and legal institutions. The authors also report that weak capital concentration has detrimental effects on attracting new affiliates, thus relating to studies that emphasize the role of network effects (see e.g. Spies, 2010). Since networks are frequently used to informally pass on information, they could induce spillover effects and thereby support the superior performance of other affiliates operating in the same sector or originating in the same home country.

More related to the perspective we focus on in this study, Globerman and Shapiro (2002) argue that good institutions do not only stimulate the volume of FDI inflows but also the volume of FDI outflows because they create favorable conditions for investments (domestic and abroad) and, thus, for the emergence of MNEs. In particular, competition-promoting policies, transparent legal and regulatory regimes and the effective delivery of government services are found to stimulate bi-directional flows, whereas educational investments are a significant determinant of inflows only. The effect of governance infrastructure on outward FDI is thereby strongest for large countries. Allred and Park (2007) find that patent strength stimulates firm-level R&D in-

[3] These include main banks (so-called 'Hausbanken' in German) or specialized investment banks that engage in relationship lending as opposed to standard, passive banks.

vestments, but the significant impact is limited to developed countries. Apart from governance standards and financial market development, differences with respect to cultural aspects between the investor's country and the country of investment may hamper the transfer of technology from the multinational parent to the foreign affiliate. Lensink et al (2008) point out that a high degree of economic similarity facilitates efficient economic action in the affiliate.

Against the background of the literature emphasizing the complementary nature of trade and FDI (see e.g. Helpman et al, 2004), national barriers to trade internationally could induce multinational parents to transfer their efficient production technology to a foreign country which they may use as an export-platform. With trade costs increasing in distance and similarity decreasing in distance, the sign of the variable is, ex-ante, unclear. Finally, the home-market size of the parents may matter. Size differences between the home country and the countries which the multinational parents are serving could induce economies of scale at the level of the multinational firm, allowing it to allocate resources more efficiently within their group.

Note that from a theoretical point of view, institutional quality, like governance and financial market development, may have an impact on the affiliates' productivity abroad which goes into two directions: a positive impact is to be expected, if good institutions at home induce R&D investments and contribute thereby to the existence of high performing international firms, or if they facilitate technology spillovers from the parent to the affiliate.[4] But, in the spirit of Helpman et al (2004), a good institutional quality in the investor's country may, however, reduce the fixed costs of FDI (e.g. by facilitating the raising of foreign capital for financing FDI), leading to a drop of the productivity cut-off-level for sorting into FDI. Consequently, investing abroad would become profitable also for less productive investors and a lower average productivity of the affiliates from countries with high institutional quality would be the result.[5] Therefore, we will control in the empirical analysis also for the average level of productivity as a proxy for the existence of high performing international firms in the foreign country.

3 Empirical Methodology and Data

3.1 Micro-Level Data on Multinationals' Affiliates in Germany

We use the Micro database Direct Investment (MiDi), which is collected and maintained by the Deutsche Bundesbank. The MiDi covers all international capital links from and to Germany above certain thresholds since 1989. German legislation currently requires firms to report their inward and outward bound capital links (FDI-stocks) for investment objects with a balance sheet total exceeding the amount of 3 million €, or, expressed in terms of ownership shares, of at least 10%.[6] The MiDi contains comprehensive information on the foreign affiliates' balance sheets,

[4] Likewise, it may be argued that bad institutions impede R&D investments and technology transfers.

[5] Fosfuri and Motta (1999) bring forward a related argument: firms which lag behind might have greater incentives to invest abroad in order to acquire location specific knowledge, whereas firms with a competitive edge might be tempted to limit the extent of their multinationalization to preserve their advantages. This could mean that relatively low-productivity firms (potentially from countries with bad institutions) also have strong incentives to invest in countries with good institutions and in relatively high-productivity firms.

[6] This holds, in principle, for direct (first-tier investments) and indirect (second- and lower tier investments) interests. More in detail, indirect interests are reported for all dependent firms. These are affiliates in which the

as well as turnover, industry (2-digit NACE) and the number of employees. Whereas information regarding the affiliate in Germany is detailed, information on the foreign owner reduces to a few key variables, such as the country of origin. Other variables like the degree of participation and multiple ownership can be constructed thanks to the investment-level nature of the data. Since the MiDi allows to track these investor-investment relations over time from 1996 to 2006, we aggregate the original data on the level of the affiliate. For our analyses, we thus use a firm-level panel data set from 1996 to 2006. Our estimation sample contains over 47,000 observations representing more than 12,000 affiliates.

Investments are sometimes stacked along hierarchical chains of firms and even across multiple countries. Naturally, in the case of such investment chains, the country of residence of the immediate owner may be different from the country of the final, or, ultimate beneficial owner. Further, the data allow to identify firms with investors from one single foreign country, firms with investors from several foreign countries, and firms that are jointly owned by German and foreign investors. For further information on this database, see Lipponer (2008).

3.2 Estimation of Foreign Affiliates' Productivity

We specify a Cobb-Douglas production function at the affiliate level with capital K and labor L as inputs,

$$Q = \Phi K^{\alpha} L^{\beta}, \tag{1}$$

where Φ captures the level of technology, or, the Total Factor Productivity (TFP) of the affiliate. We predict Φ using the well-known approach of calculating the in-sample residuals of industry-specific regressions of the natural logarithm of turnover on the logs of fixed assets and employment. Olley and Pakes (1996) propose a straightforward refinement of this estimation that uses investment as an instrument and handles simultaneity and selection issues. Levinsohn and Petrin (2003) propose to use intermediate inputs as proxies for investment, instead. Since our data do not provide any appropriate investment proxy, we estimate TFP based on equation 1 in 32 separate industry group Fixed Effects (FE) regressions.[7] In addition, we use Ordinary Least Squares (OLS) and also report results for labor productivities, Q/L.

3.3 Embedding Productivity Functions

We assume that affiliates' productivities Φ depend on a vector of observable and unobservable productivity determinants X,

$$E[\Phi|X] = e^{f(X)}. \tag{2}$$

direct investor holds more than 50%, or in which another dependent firm holds 100% of the voting rights.

[7] On the one hand, leaving material inputs out of the TFP regressions does not allow us to fully correct the simultaneity bias if firms base input decisions on their efficiency level. On the other hand, it enables us to partly abstract from mere profit shifting strategies. Given the fact that Germany is a relatively high-tax country, such strategies might be persecuted by multinationals from low-tax countries by systematically overvaluating the material used for production. Such profit-shifting would partly obscure the country-specific factors, we aim at identifying in this study.

In order to retrieve the determinants of productivity differences between foreign-owned affiliates we log-linearize equation (2). In a first step, we isolate world region characteristics from the industry composition, productivity changes over time and federal state-specific effects, employing a set of standard premium regressions in the style of Bernard et al (2007). We specify the log-linearized productivity function as

$$\varphi_{it} = \eta_i + \eta_1 \boldsymbol{DR}_{it} + \eta_3 \boldsymbol{DI}_{it} + \eta_4 \boldsymbol{DS}_i + \eta_5 D_t + \epsilon_{it}, \tag{3}$$

where η_i are affiliate-specific fixed effects and $\boldsymbol{DR}_{it}$ contains dummy variables for eleven selected world regions. We use the Euro area as the reference group, hence η_1 is a column vector that contains the estimated productivity premia for affiliates i with capital links to region r as compared to affiliates of investors residing in the Euro area. $\boldsymbol{DI}_{it}$, $\boldsymbol{DS}_i$ and D_t are dummy variable sets for 2-digit NACE industry groups, 16 German federal states and the eleven years of our sample. Note that $\boldsymbol{DR}_{it}$ and $\boldsymbol{DI}_{it}$ are affiliate and time-specific, since the affiliates may be established by or sold to investors from other world regions or change their industrial affiliation over time.

In a second step, we augment equation (3) in order to model two potential channels through which productivity differences may arise: upon establishment, affiliates can improve their productivity by tapping into external (country of origin-specific) and internal (affiliate-specific) knowledge sources:

$$\varphi_{ijt} = \gamma_i + \gamma_1 \boldsymbol{EX}_{jt} + \gamma_3 \boldsymbol{DR}_{it} + \gamma_4 \boldsymbol{DI}_{it} + \gamma_5 \boldsymbol{DS}_i + \gamma_6 D_t + \nu_{ijt}. \tag{4}$$

According to equation (4), an affiliate i which makes intensive use of external knowledge sources ($\boldsymbol{EX}_{jt}$) from its investor country j and internal, affiliate-specific, knowledge sources (γ_i) should have a higher productivity level. $\boldsymbol{DR}_{it}$, $\boldsymbol{DI}_{it}$, $\boldsymbol{DS}_i$ and D_t are the same sets of dummy variables that capture technological differences across world regions, industries, federal states and years, as already used in equation (3). Since the previous literature has identified productivity spillovers within regional supplier-buyer networks (Javorcik, 2004), crisis-induced productivity effects (Alfaro and Chen, 2010), and sector-dependent technology transfers associated with differing contractual difficulties (Berkowitz et al, 2006), the use of a wide set of dummy variables is necessary to isolate the effect of external and internal knowledge sources. The extent to which the affiliate is able to use external knowledge sources depends on the ease with which technology can be transferred from its parent as well as from other members of the firm network. In the previous section we have argued that the institutional and financial market development of the country of residence of the investor should play a role. We use information on the quality of institutions, employing selected political and business indicators from the Fraser Institute and the World Bank. First, we use indicators of economic freedom, namely (1) the size of the government and (2) the freedom to trade internationally. The indicators range from 0 to 10 with 10 representing the maximum degree of economic freedom. The government indicator measures 'the degree to which a country relies on personal choice and markets rather than government budgets and political decision-making' (Gwartney et al, 2011). High levels of freedom to trade coincide with low tariffs, a large trade sector, freely convertible currency and few controls on the movement of capital. Second, we use information on the rule of law from the World Bank's Worldwide Governance Indicators. The indicator ranges from -2.5 to 2.5, with higher values

corresponding to better governance outcomes. Third, an indicator reflecting the availability of credit is included to capture financial market restrictions that could impede costly technology transfers. The variable is taken from a recent update of Beck's financial structure database (Beck et al, 2000). Distance, GDP as well as per capita GDP (from CEPII) capture gravitational forces that might influence productivity differences. Descriptive statistics on the employed explanatory variables are provided in Table A.2.

The extent to which the affiliate is able to use internal knowledge depends on several (unobservable) characteristics of the affiliate i, such as the size of its group, R&D investments, and the structure of its workforce. Even though the MiDi contains detailed balance sheet information, there are only very few additional variables available. We control for any potential heterogeneity at the level of the affiliate i with fixed effects γ_i. In contrast to the different degrees of usage of (unobservable) internal knowledge sources, we interpret significant (observable) country-level variables as sources of external knowledge spillover.

4 Empirical Results

We start with demonstrating that affiliates' TFPs, $\hat{\Phi}$, vary at the level of the geographic origin of the multinational parent company (Section 4.1) and explain these differences through various investor country characteristics (Section 4.2). In order to analyze this link more closely, we offer a number of additional results in Section 4.3. First, we investigate whether our results hinge on the intensity of the capital link between investor and affiliate, as hypothesized. Next, we look further down the chain of investment links and analyze if the institutional environment of the *ultimate beneficial owner*, who naturally may be located in another country than the multinational firm to which the direct capital link exists, has a different impact. Finally, we provide evidence that our basic results do not change when we employ alternative productivity measures.

4.1 The Heterogeneity of Affiliates' Productivities at the Level of the Investor Country

Figure 1 depicts the box-plots of our in-sample productivity estimations, $\hat{\Phi}$, from equation (1), grouped by their respective *country of origin*, in descending order of their group-specific medians. A clear ranking emerges and the medians of TFP vary considerably across the selected countries of origin, even though a high level of overlap of the respective interquartile ranges remains. The median Japanese affiliate is more productive than the median affiliate from any other country. Also, firms with investors from several foreign countries (MIX) appear to hold a productivity advantage. US affiliates rather locate at the lower end. Finally, the group of affiliates with parents stemming from all other countries (Rest) is, as expected, rather heterogeneous and has the biggest interquartile range.

In order to isolate these differences from productivity variations at the sector, federal state, world region or time level, we continue with reporting results of premia regressions as outlined in equation (3).[8] We report our empirical evidence for $\hat{\Phi}$ obtained from the fixed effects estimation,

[8] Descriptive statistics on productivity variations across selected world *regions* from which the affiliates originate

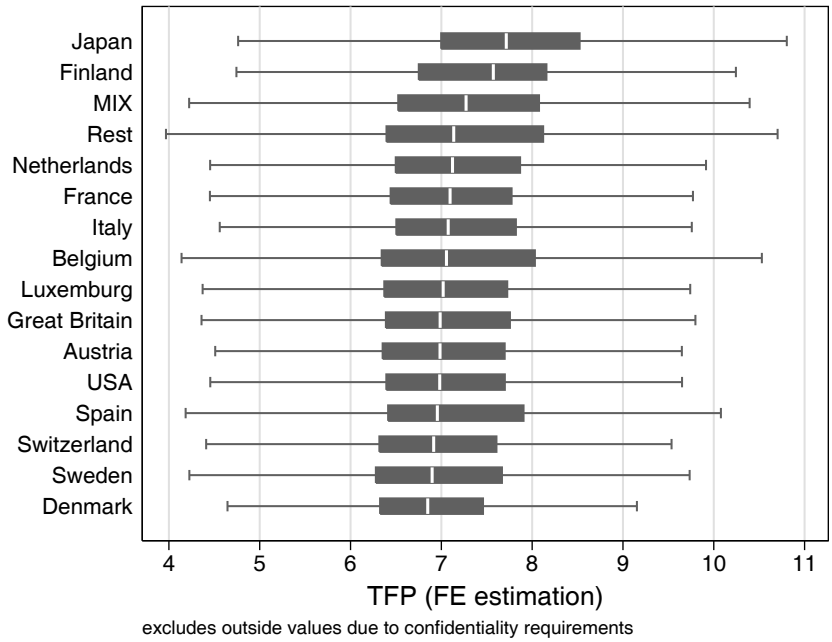

Figure 1: The productivity distribution of foreign owned affiliates in Germany grouped by selected investors' countries.

Note: This figure shows box-plots of the distribution of the estimated TFP for a selection of countries pooled over the years 1996-2006. TFP is calculated with a fixed effects estimation method.

Source: Own calculations, data from Bundesbank.

but we will later show that they are robust to $\hat{\Phi}$ obtained from OLS estimation and to the use of labor productivities.

Columns (1) and (2) of Table 1 summarize the premia regressions. Two results are worthwhile to be mentioned: first, in the basic dummy regression in column (1), Latin American affiliates appear to be more productive, and Australian and New Zealand affiliates appear to be less productive than affiliates from the Euro area reference group (although these results are only significant at the 10%-level). These results can be explained by industry, federal state and time effects as they loose their significance with the introduction of these dummy variables. Instead, investors from European non-Euro countries are now found to own less productive affiliates. Second, affiliates owned by investors from the Commonwealth of Independent States (CIS) or by multiple investors from at least two different countries show a higher productivity across both specifications.

are provided in Table A.1 in the Appendix. It becomes evident that the Far East, Japan and the Commonwealth of Independent States (CIS) have, on average, the most productive affiliates in Germany.

4.2 The Role of Institutional Quality in the Country of the Investor

After demonstrating that there are substantial performance differences among foreign affiliates depending on the geographic origin of their multinational parent company, we aim at identifying country-specific factors that drive these disparities.

Columns (3) and (4) of Table 1 report the results for gravitational forces and institutional controls. The distance to the host country has a negative impact on the affiliates' productivities, confirming the hypothesis that similarity matters for the transfer of technology across borders. The investor country's GDP shows a positive impact only as long as the institutional indicators are not taken into account (column 3), their inclusion in column (4) absorbs the effect of GDP. This puts the expected role of economies of scale that might be induced by the market size of the foreign parent into perspective. A greater freedom to trade internationally and a higher availability of credit in the investor country foster the productivity performance of affiliates in Germany. This finding is in line with our hypothesis that sound institutions facilitate international technology spillovers, or more generally, that they support the existence of high performing multinational firms. Our rule of law variable is, however, not significant.

While the results of Table 1 indicate that investor country-specific determinants exhibit a significant impact on affiliates' performances, some of the country group-specific heterogeneity in affiliates' productivities persists. In comparison to column (2), we find that the residual country premia for the CIS and for multiple-country investors stay unchanged, while affiliates from Africa, from Australia and from New Zealand turn out to be on average significantly more productive than affiliates whose investors reside in the Euro area. The fact that the persisting premia in column (4) belong to affiliates whose parents originate from remote and difficult environments could point to a selection effect where only the most productive firms manage to establish affiliates abroad. Indeed, emerging economies increasingly engage in FDI and the presence of only few, very productive firms from these countries could explain the performance premia of African and CIS affiliates. Furthermore, this finding is in line with the argument that has been brought forward by Fosfuri and Motta (1999) that less productive firms from countries with bad institutions have an incentive to invest in high-productivity firms abroad.

To properly model selection into FDI on the firm level, one apparently would need the entire population of firms in each investor country. As such data is not available, we approximate selection with per capita GDP which turns out to be no significant explanatory variable for affiliate level productivity. Since the inclusion of country-level controls overrides the significant negative coefficient of the European countries not belonging to the Euro, the identified economic and institutional factors seem to explain, in particular, the productivity premia of affiliates with parents from this investor region.

4.3 Additional Results

In the remainder of the empirical part we analyze whether the link between the institutions in the country of origin of the investor and the performance of their affiliates in Germany depends on the intensity of the capital link between the investor and its affiliate. We argue that this might be the case since (good) institutions might be more important for financing greenfield investments than for establishing joint ventures. Therefore, we split our data into greenfield investments and

Table 1: The determinants of productivity of foreign-owned firms in Germany

Dependent variable: TFP (FE estimation)	(1)	(2)	(3)	(4)
Gravitational forces				
distance from Germany			-0.010*	-0.013**
			(0.006)	(0.006)
GDP			0.021***	-0.006
			(0.005)	(0.013)
GDP per capita			0.021	0.026
			(0.03)	(0.039)
Institutional indicators (at the level of the country of the investor)				
freedom to trade internationally				0.074***
				(0.019)
size of government				0.007
				(0.01)
credit availability				0.035***
				(0.013)
rule of law				-0.013
				(0.031)
Mean residuals (by the geographic origin of the investor, set of DR_{it})				
Europe non-Euro	0.021	-0.027*	-0.026*	-0.021
(*ref: Euro area members*)	(0.022)	(0.013)	(0.013)	(0.013)
CEES	-0.086	-0.089	-0.031	-0.046
	(0.145)	(0.174)	(0.191)	(0.192)
Africa	0.067	0.077	0.263**	0.270**
	(0.043)	(0.06)	(0.126)	(0.124)
US & Can.	-0.008	0.029	0.022	0.016
	(0.031)	(0.028)	(0.026)	(0.019)
Las Americas	0.127*	0.06	0.179	0.226
	(0.074)	(0.083)	(0.125)	(0.142)
Near East	0.052	0.003	0.065	0.061
	(0.089)	(0.081)	(0.065)	(0.066)
Far East	0.073	0.006	0.097**	0.02
	(0.06)	(0.062)	(0.039)	(0.068)
Japan	0.015	0.026	0.068*	0.057
	(0.038)	(0.037)	(0.038)	(0.04)
Australia & New Zealand	-0.060*	-0.063	0.097	0.183*
	(0.035)	(0.042)	(0.109)	(0.104)
CIS	0.349**	0.273*	0.300**	0.340***
	(0.152)	(0.156)	(0.132)	(0.123)
firm with investors	0.087***	0.074***	0.080***	0.080***
from > 1 country	(0.026)	(0.023)	(0.026)	(0.023)
constant	7.168***	7.512***	6.707***	5.887***
	(0.014)	(0.023)	(0.409)	(0.499)
DI_{it}, DS_i, D_t	no	yes	yes	yes
observations	47861	47861	47861	47861
number of foreign owned firms	12694	12694	12694	12694
R^2	0.001	0.140	0.140	0.141

Note: Fixed effects (FE) panel regression results. The results displayed in columns (1) and (2) refer to the estimation of equation (3). The results displayed in columns (3) and (4) refer to the estimation of equation (4). The institutional indicators are defined as follows: *trade freedom, size of government*: 0-10; 10=freest; *rule of law*, -2.5-2.5; 2.5=best. The Euro countries build the reference group. The region dummies for Oceania and for other countries have been omitted due to collinearity. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level. From column (2) on, all estimations contain industry, federal state dummies and time dummies. Abbreviations: CEES - Central and Eastern European States, CIS - Commonwealth of Independent States.

Source: Own calculations, data from Bundesbank.

joint ventures and re-estimate equations (3) and (4). Further, we examine if the institutional background of the ultimate beneficial owner has a measurable impact on the performance of the affiliates, too. Finally, we show that our results are not driven by the way of measuring productivity.

Financial market development in the home country might, in particular, matter for firms that establish cross-border greenfield investments, as these *ceteris paribus* involve higher fixed costs than joint ventures. In the following, we recognize affiliates as having originated from a greenfield investment if they are completely owned by only one single foreign investor. More in detail, we aggregate all ownership shares for each affiliate and each year. For aggregate ownership shares of $>95\%$, the share of the German owner is negligible and hence, we assume that the affiliate is a greenfield investment. For aggregate ownership shares of $\leq 95\%$, the German owner has a non-negligible influence and hence, we assume that the affiliate is a joint venture of shared foreign and domestic participating interests. Table 2 indicates that, indeed, credit availability in the home country enhances the productivity performance of greenfield affiliates whereas it does not have any significant impact on joint venture affiliates. Also, the freedom to trade, partly reflecting a free movement of capital, does not explain productivity in the case of joint ventures. Hence, the tighter the capital link between the foreign multinational parent and its affiliate, the bigger the impact of country characteristics.

The institutional environment of the country of the ultimate beneficial owner (UBO) of the affiliate could be important if investment decisions are rather taken by the UBO than by the investing firm. We make use of the fact that the MiDi allows to track hierarchical chains of firms. The results are summarized in Table A.3 in the Appendix. Comparing the estimated effects to the results presented in Table 1, a few important deviations become evident. First, freedom to trade is not a significant explanatory variable at the UBO-level, i.e. policies regulating the free movement of goods and capital are relevant only at the level of the first-tier investor country. Second, GDP per capita exhibits a weakly significant negative impact on the productivity of affiliates. Note also that no residual productivity premium remains for the group of African countries. In the case of UBOs, per capita GDP thus seems to absorb the 'cherry-picking' effect of firms from difficult markets.

To ensure that our results do not hinge on the way TFP has been calculated, we repeat our regressions for alternative productivity measures, namely for TFP estimated by OLS and for labor productivities. Table A.4 in the Appendix shows that our results are robust to the inclusion of alternative productivity measures. The only notable difference to our TFP with FE estimations is that the affiliates of other European investors do not perform significantly worse in the premia regressions.

5 Conclusions

This study's objective has been to disentangle the widely studied and well-confirmed foreign-ownership premia with respect to firm productivity. We have focused on the dimension of the investor country, arguing that its institutional characteristics have an impact on an MNE's ability to transfer its productive technology to the foreign affiliate. We have assessed if investor country-specific variables, such as the geographic location, market size, as well as the legal,

Table 2: The determinants of productivity of foreign-owned firms in Germany – sample split

Dep. var.:		greenfield investments				joint ventures		
TFP (FE)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gravitational forces								
distance			-0.012	-0.021**			-0.026***	-0.011
			(0.009)	(0.008)			(0.006)	(0.009)
GDP			0.021**	-0.031			0.006	0.043
			(0.01)	(0.019)			(0.013)	(0.029)
GDP pc			0	-0.012			-0.045	0.017
			(0.048)	(0.057)			(0.027)	(0.049)
Institutional indicators (at the level of the country of the investor)								
freedom to				0.105***				-0.011
trade				(0.028)				(0.072)
size of				0.021				-0.035
government				(0.015)				(0.027)
credit				0.056***				-0.041
avail.				(0.014)				(0.027)
rule of law				-0.022				-0.132*
				(0.037)				(0.074)
Mean residuals (by the geographic origin of the investor, set of DR_{it})								
Europe	0.025	-0.021	-0.02	-0.022	0.033	-0.007	0	0.026
non-Euro	(0.02)	(0.015)	(0.014)	(0.013)	(0.025)	(0.021)	(0.021)	(0.024)
CEES	-0.147	-0.138	-0.096	-0.12	0.343*	0.258*	0.223	0.362*
	(0.207)	(0.224)	(0.234)	(0.209)	(0.172)	(0.15)	(0.148)	(0.215)
Africa	0.092***	0.133***	0.337**	0.272	0.063	0.03	0.165	0.152
	(0.034)	(0.032)	(0.149)	(0.165)	(0.068)	(0.085)	(0.116)	(0.145)
US & Can.	0.012	0.057*	0.063	0.061*	0.054**	-0.001	0.088**	0.094**
	(0.032)	(0.032)	(0.038)	(0.033)	(0.023)	(0.026)	(0.036)	(0.041)
Las Am.	0.300***	0.239***	0.348**	0.425***	-0.038	-0.197	-0.1	-0.173
	(0.076)	(0.073)	(0.136)	(0.125)	(0.089)	(0.14)	(0.164)	(0.146)
Near East	-0.211	-0.195	-0.147	-0.168	-0.027	-0.149	-0.135	-0.171
	(0.189)	(0.167)	(0.169)	(0.174)	(0.063)	(0.122)	(0.133)	(0.143)
Far East	0.074	0.014	0.149*	0.017	-0.045	-0.115	0.007	0.063
	(0.063)	(0.065)	(0.076)	(0.138)	(0.08)	(0.099)	(0.07)	(0.169)
Japan	0.05	0.059	0.117**	0.088	-0.052	-0.077	0.016	0.05
	(0.05)	(0.048)	(0.057)	(0.056)	(0.086)	(0.112)	(0.089)	(0.089)
Australia &	-0.049	-0.048	0.145	0.300*	-	-	-	-
NZ	(0.036)	(0.041)	(0.158)	(0.151)	-	-	-	-
CIS	1.363***	1.286***	1.295***	1.243***	0.118***	0.053*	0.039	-0.117
	(0.037)	(0.038)	(0.04)	(0.041)	(0.03)	(0.027)	(0.042)	(0.11)
firm from	0.101***	0.109***	0.118***	0.115***	0.149***	0.050**	0.070***	0.076***
>1 country	(0.037)	(0.033)	(0.034)	(0.031)	(0.03)	(0.025)	(0.025)	(0.026)
constant	7.158***	7.516***	6.957***	6.086***	7.178***	7.985***	8.317***	8.244***
	(0.014)	(0.021)	(0.731)	(0.795)	(0.013)	(0.075)	(0.525)	(1.107)
DI_{it}, DS_i, D_t	no	yes	yes	yes	no	yes	yes	yes
observations	40,136	40,136	40,136	40,136	7,721	7,721	7,721	7,721
no. of foreign owned firms	10,881	10,881	10,881	10,881	2,516	2,516	2,516	2,516
R^2	0.001	0.121	0.121	0.122	0.002	0.269	0.27	0.271

Note: Fixed effects (FE) panel regression results for a sample split into greenfield investments and joint ventures. The results displayed in columns (1), (2) (5) and (6) refer to the estimation of equation (3). The results displayed in columns (3), (4), (7) and (8) refer to the estimation of equation (4). The institutional indicators are defined as follows: *trade freedom, size of government*: 0-10; 10=freest; *rule of law*, -2.5-2.5; 2.5=best. The Euro countries build the reference group. The region dummies for Oceania and for other countries (as well as for Australia and New Zealand in the case of joint ventures) have been omitted due to collinearity. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level. From column (2) and (5) on, all estimations contain industry, federal state dummies and time dummies. Abbreviations: CEES - Central and Eastern European States, CIS - Commonwealth of Independent States.

Source: Own calculations, data from Bundesbank.

institutional and financial environment drive the extent of the premium characterizing foreign-owned affiliates in Germany. For our empirical analysis we have used full coverage data on the population of foreign-owned firms in Germany, enriched with information at the investor country level supplied by different institutions, such as CEPII, the World Bank and the Fraser Institute.

The descriptive analyses have shown that the means and the distribution of TFP vary considerably across the different affiliates when grouped by their parents' country of origin. The estimations have confirmed that investor country characteristics partly explain these differences: affiliates from geographically close countries with a high freedom to trade, and a good availability of credit outperform their competitors from countries that are further away or countries with poorer institutions. By contrast, a good rule of law is not found to foster spillovers to foreign affiliates. Interestingly, the impact of institutional quality on the performance of foreign affiliates hinges on the intensity of the capital link between investor and affiliate. We have verified the institutional impact in the case of greenfield investments, but not in the case of joint ventures. Similarily, we have not detected any effect of the trade and investment policy regime of the country of the ultimate beneficial owner who may be located at the end of possibly complex investment chains.

Investigating the nexus between investor country characteristics and affiliates performance delivers new insights into the well-known phenomenon of the productivity advantage of foreign ownership. However, even though we have been able to identify home country characteristics driving the performance differences of foreign affiliates in Germany, some heterogeneity at the level of the geographic origin of the investor remains unexplained: affiliates of MNEs from Africa, the Commonwealth of Independent States, Australia and New Zealand, as well as affiliates with FDI stocks belonging to investors from different countries are more productive than affiliates of MNEs within the Euro area. We offer a potential explanation for this finding: a few, highly productive multinationals from emerging economies are increasingly acquiring ownership abroad and may either establish or buy out highly productive affiliates in Germany. While beyond the scope of this study, we believe that this finding points to a potentially interesting and policy relevant strand for future research.

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A Appendix

Table A.1: Descriptive statistics of TFP measures, by world regions (1996-2006)

		prod (FE)	prod (OLS)	ln(labprod)	cap	turnover	emp
EURO	mean	7.199696	6.15025	5.803719	19449.94	115327.2	282.0102
	sd	1.155436	1.166773	1.116707	167680.2	681792.8	992.8029
	count	19552	19552	19552	19552	19552	19552
Eur. non-Euro	mean	7.057738	5.980342	5.653423	16179.72	74540.78	231.707
	sd	1.101487	1.131012	1.082746	197858.7	313154.8	672.9665
	count	15424	15424	15424	15424	15424	15424
CEECs	mean	7.156258	6.635816	6.05308	3690.042	46243.94	135.0865
	sd	1.488146	1.666157	1.99968	16131.26	182859.6	288.6266
	count	578	578	578	578	578	578
Africa	mean	7.388225	6.146246	5.81123	12575.46	116028.6	240.9571
	sd	1.057097	0.9476232	0.8836533	32728.85	291978.3	521.1974
	count	70	70	70	70	70	70
USA & Can.	mean	7.074187	5.991622	5.624919	19066.37	116779.2	373.5334
	sd	1.026242	1.042709	0.9634731	131622.2	826507.7	1952.134
	count	6757	6757	6757	6757	6757	6757
Las Americas	7.350265	6.516628	6.273205	7960.344	81254.1	250.6066	
	sd	1.520979	1.670974	1.607132	28183.98	194001.3	756.71
	count	122	122	122	122	122	122
Near East	7.351194	6.661226	6.575496	10894.38	101019.8	102.0949	
	sd	1.42424	1.670083	1.623424	34237.51	269832.1	249.2201
	count	253	253	253	253	253	253
Far East	7.785978	7.077831	6.711229	4985.281	158641.5	86.46124	
	sd	1.575119	1.705076	1.618107	16887.18	418286.6	153.1216
	count	516	516	516	516	516	516
Japan	7.760613	7.040564	6.61538	6096.363	90926.12	101.0124	
	sd	1.11943	1.276895	1.162854	17284.12	218810.8	167.271
	count	2098	2098	2098	2098	2098	2098
Austr. & NZ	mean	7.229534	6.095564	5.697169	12083.09	54620.69	194.2069
	sd	1.197926	1.313284	1.17939	33332.82	133783.5	368.6024
	count	58	58	58	58	58	58
CIS	8.714666	8.272236	7.983079	100285.6	397336.3	32.32743	
	sd	2.069067	1.88243	1.811004	385768.4	910843.1	70.30475
	count	113	113	113	113	113	113
total	7.170259	6.135866	5.787955	17408.69	100671.5	264.256	
	sd	1.148106	1.19697	1.146042	168307.7	584879.3	1072.987
	count	45541	45541	45541	45541	45541	45541

Source: Descriptive statistics on the dependent variables for the estimation sample. Own calculations, data from Bundesbank.

Table A.2: Descriptive statistics for explanatory variables (1996-2006)

variable	GDP (in bn $)	per cap. GDP	dist (in thousand km)	free trade	governm. size	credit (in bn $)	rule of law
mean	2816.761	42596.51	1.944835	7.526459	5.698412	39900	1.602475
sd	4321.51	12727.19	2.825991	0.6483098	1.495312	157000	0.4247317

Source: Descriptive statistics on the independent variables for the estimation sample. Own calculations, data from Bundesbank.

Table A.3: The determinants of productivity of foreign-owned firms in Germany – results for the ultimate beneficial owner

Dependent variable: TFP (FE-estimator)	(1)	(2)	(3)	(4)
Gravitational forces				
distance from Germany			-0.002	-0.016**
			(0.005)	(0.006)
GDP			0.017*	-0.013
			(0.009)	(0.015)
GDP per capita			-0.071***	-0.064*
			(0.026)	(0.034)
Institutional indicators (at the level of the country of the UBO)				
freedom to trade internationally				-0.01
				(0.018)
size of government				0.006
				(0.009)
credit availability				0.036***
				(0.013)
rule of law				0.007
				(0.03)
Mean residuals (by the geographic origin of the UBO, set of DR_{it})				
Europe non-Euro	0.060***	0.026*	0.035**	0.017
(*ref: Euro area members*)	(0.017)	(0.015)	(0.017)	(0.017)
CEES	0.143*	0.078	0.024	0.038
	(0.084)	(0.079)	(0.089)	(0.093)
Africa	0.039	0	-0.094	-0.04
	(0.081)	(0.067)	(0.082)	(0.089)
US & Can.	0.071***	0.029*	-0.003	0.017
	(0.017)	(0.017)	(0.023)	(0.027)
Las Americas	0.180***	0.167**	0.071	0.192
	(0.047)	(0.064)	(0.095)	(0.122)
Near East	0.036	0.075	0.044	0.041
	(0.031)	(0.057)	(0.061)	(0.058)
Far East	-0.011	-0.073	-0.121*	-0.066
	(0.077)	(0.081)	(0.067)	(0.073)
Japan	0.109***	0.057*	0.04	-0.036
	(0.038)	(0.032)	(0.046)	(0.043)
Australia & New Zealand	0.110***	0.082**	0.121	0.302***
	(0.036)	(0.038)	(0.076)	(0.084)
CIS	0.809***	0.733***	0.644***	0.626***
	(0.154)	(0.149)	(0.151)	(0.144)
firm with investors	0.112***	0.092***	0.083***	0.075***
from > 1 country	(0.021)	(0.018)	(0.019)	(0.018)
constant	7.128***	7.482***	7.765***	7.579***
	(0.01)	(0.021)	(0.35)	(0.428)
DI_{it}, DS_i, D_t	no	yes	yes	yes
observations	47,467	47,467	47,467	47,467
number of foreign owned firms	12,620	12,620	12,620	12,620
R^2	0.002	0.143	0.144	0.144

Note: Fixed effects (FE) panel regression results. The results displayed in columns (1) and (2) refer to the estimation of equation (3). The results displayed in columns (3) and (4) refer to the estimation of equation (4). The explanatory variables refer to the country of the ultimate beneficial owner. The institutional indicators are defined as follows: *trade freedom, size of government*: 0-10; 10=freest; *rule of law*, -2.5-2.5; 2.5=best. The Euro countries build the reference group. The region dummies for Oceania and for other countries have been omitted due to collinearity. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level. From column (2) on, all estimations contain industry, federal state dummies and time dummies. Abbreviations: CEES - Central and Eastern European States, CIS - Commonwealth of Independent States.

Source: Own calculations, data from Bundesbank.

Table A.4: The determinants of productivity of foreign-owned firms in Germany – alternative productivity measures

Dep. var.:	TFP (OLS estimation)				labor productivity			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gravitational forces								
distance			-0.010*	-0.017***			-0.012**	-0.019***
			(0.005)	(0.005)			(0.005)	(0.007)
GDP			0.019***	-0.017			0.019***	-0.02
			(0.005)	(0.015)			(0.006)	(0.018)
GDP pc			0.016	0.018			0.033	0.039
			(0.032)	(0.041)			(0.031)	(0.043)
Institutional indicators (at the level of the country of the investor)								
freedom to trade				0.079***				0.081***
				(0.016)				(0.02)
size of government				0.015				0.014
				(0.01)				(0.012)
credit avail.				0.042***				0.047**
				(0.015)				(0.019)
rule of law				-0.012				-0.016
				(0.033)				(0.036)
Mean residuals (by the geographic origin of the investor, set of DR_{it})								
Europe non-Euro	0.035*	-0.013	-0.013	-0.014	0.038	-0.004	-0.005	-0.005
	(0.019)	(0.013)	(0.013)	(0.012)	(0.024)	(0.017)	(0.018)	(0.015)
CEES	0.007	-0.167	-0.118	-0.142	-0.064	-0.173	-0.106	-0.129
	(0.215)	(0.211)	(0.229)	(0.229)	(0.209)	(0.178)	(0.194)	(0.193)
Africa	0.077*	0.086	0.256**	0.255**	0.016	0.024	0.240**	0.246**
	(0.04)	(0.056)	(0.122)	(0.115)	(0.038)	(0.052)	(0.115)	(0.111)
US & Can.	0.005	0.022	0.024	0.018	0.001	0.021	0.03	0.028
	(0.029)	(0.026)	(0.026)	(0.021)	(0.034)	(0.03)	(0.031)	(0.025)
Las Am.	0.028	-0.047	0.064	0.121	0.008	-0.059	0.088	0.156
	(0.052)	(0.059)	(0.097)	(0.116)	(0.048)	(0.054)	(0.083)	(0.101)
Near East	0.097	0.036	0.092	0.085	0.072	0.02	0.094	0.086
	(0.084)	(0.085)	(0.071)	(0.07)	(0.121)	(0.131)	(0.117)	(0.117)
Far East	0.041	-0.002	0.086*	0.001	0.019	-0.024	0.082	-0.001
	(0.078)	(0.073)	(0.051)	(0.08)	(0.097)	(0.09)	(0.07)	(0.103)
Japan	0.007	0.022	0.068*	0.053	-0.013	-0.007	0.049	0.027
	(0.037)	(0.035)	(0.039)	(0.043)	(0.041)	(0.04)	(0.036)	(0.045)
Australia & NZ	-0.036	-0.043	0.122	0.243**	-0.03	-0.042	0.148	0.290**
	(0.038)	(0.035)	(0.094)	(0.096)	(0.046)	(0.039)	(0.095)	(0.111)
CIS	0.406***	0.327**	0.350***	0.387***	0.490***	0.418**	0.460***	0.496***
	(0.146)	(0.15)	(0.127)	(0.118)	(0.172)	(0.175)	(0.148)	(0.142)
firm from >1 country	0.072***	0.067***	0.075***	0.072***	0.073***	0.067***	0.077***	0.075***
	(0.024)	(0.022)	(0.025)	(0.023)	(0.026)	(0.022)	(0.023)	(0.022)
constant	6.126***	7.271***	6.602***	5.739***	5.791***	5.798***	4.925***	3.999***
	(0.012)	(0.018)	(0.429)	(0.537)	(0.015)	(0.019)	(0.432)	(0.613)
DI_{it}, DS_i, D_t	no	yes	yes	yes	no	yes	yes	yes
observations	47,861	47,861	47,861	47,861	49,047	49,047	49,047	49,047
no. of foreign owned firms	12,694	12,694	12,694	12,694	13,010	13,010	13,010	13,010
R^2	0.001	0.13	0.131	0.131	0.001	0.025	0.025	0.026

Note: Fixed effects (FE) panel regression results for alternative productivity measures. The results displayed in columns (1), (2) (5) and (6) refer to the estimation of equation (3). The results displayed in columns (3), (4), (7) and (8) refer to the estimation of equation (4). The institutional indicators are defined as follows: *trade freedom, size of government*: 0-10; 10=freest; *rule of law*, -2.5-2.5; 2.5=best. The Euro countries build the reference group. The region dummies for Oceania and for other countries have been omitted due to collinearity. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level. From column (2) and (5) on, all estimations contain industry, federal state dummies and time dummies. Abbreviations: CEES - Central and Eastern European States, CIS - Commonwealth of Independent States.

Source: Own calculations, data from Bundesbank.

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