

Mühlen, Henning

Working Paper

Firm-Level Productivity Spillovers from FDI in Latin American Countries

IEE Working Papers, No. 196

Provided in Cooperation with:

Institute of Development Research and Development Policy (IEE), Ruhr University Bochum

Suggested Citation: Mühlen, Henning (2013) : Firm-Level Productivity Spillovers from FDI in Latin American Countries, IEE Working Papers, No. 196, ISBN 978-3-927276-82-6, Ruhr-Universität Bochum, Institut für Entwicklungsforschung und Entwicklungspolitik (IEE), Bochum

This Version is available at:

<https://hdl.handle.net/10419/183550>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

HENNING MÜHLEN

FIRM-LEVEL PRODUCTIVITY SPILLOVERS FROM
FDI IN LATIN AMERICAN COUNTRIES



Institut für
Entwicklungsforschung und
Entwicklungspolitik

Institute of
Development Research and
Development Policy

WORKING PAPER

VOLUME | 196 BOCHUM 2013

IEE WORKING PAPERS

196

Henning Mühlen

**FIRM-LEVEL PRODUCTIVITY SPILLOVERS FROM FDI
IN LATIN AMERICAN COUNTRIES**

Copyright 2013

Herausgeber:

© Institut für Entwicklungsforschung und Entwicklungspolitik
der Ruhr-Universität Bochum
Postfach 10 21 48, D-44780 Bochum

E-Mail: ieeoffice@ruhr-uni-bochum.de
www.development-research.org

ISSN 0934-6058
ISBN 978-3-927276-82-6

Abstract

Foreign direct investment (FDI) projects are assumed to be accompanied by potential external effects – so-called FDI spillovers – which are supposed to affect productivity levels of other firms in a host country. Empirical results on this topic are inconclusive and most studies focus on one country. I contribute to the literature by employing comparable firm-level panel data from ten Latin American (developing) countries in order to estimate the spillover effects from FDI on firms' productivity levels. The impact is assessed as an average effect for the full set of countries as well as for each economy separately. The results indicate that there is a small negative spillover effect from foreign presence within industries across Latin American countries. Furthermore, I find that the negative intra-industry spillover is caused by wholly owned foreign affiliates. The country-specific investigation indicates that the spillover effects differ between the considered economies with a tendency that the presence of FDI in a sector (region) has a negative (positive) impact.

Keywords: Foreign direct investments, spillovers, firm-level panel data, Enterprise Surveys, Latin America, developing countries

JEL classification: F21, F23, O33

CONTENTS

List of Tables.....	iv
1 Introduction	I
2 Theoretical Issues and Related Literature.....	4
3 Sample Construction and Data Description	7
4 Economic Model and Empirical Methodology	10
5 Empirical Results.....	15
5.1 Baseline Estimations	15
5.2 Effects on Domestic Firms and Sources of Intra-Industry Spillovers	17
5.3 Country-Specific Analysis	19
5.4 Robustness Checks.....	21
6 Concluding Remarks.....	23
References.....	24
Appendix.....	27

LIST OF TABLES

Tab. 1: Number of Firms and Distribution on Industries by Country	8
Tab. 2: Share of Foreign Owned Firms by Country	9
Tab. 3: First-Stage TFP Estimation	12
Tab. 4: Descriptive Statistics of Foreign Presence Measures by Country.....	14
Tab. 5: Baseline Estimations	16
Tab. 6: Effects on Domestic Firms and Sources of Intra-Industry Spillovers.....	18
Tab. 7: Country-Specific Spillover Effects	20
Tab. 8: Robustness Checks – Labor Productivity Model.....	22

1 INTRODUCTION

Positive effects? Negative effects? Or are there any effects at all? Productivity spillover effects from foreign direct investment (FDI) constitute one of the most debated issues in the literature on potential impacts of FDI. The topic is relevant in several aspects. One main – if not the most important – aspect is that FDI is not only seen as a source of capital but is also believed to foster economic growth and to make a contribution to the development process by bringing new technologies and knowledge to FDI host countries. In this regard, it is assumed that some of the technologies and the know-how located in the affiliates of multinational enterprises (MNEs) diffuse or – as in common parlance of the literature (for instance, Görg & Greenaway, 2004; Smeets, 2008) – “spill over” to other host country firms and affect their productivity levels positively. This is why the governments of many developed and developing countries make considerable efforts to attract FDI inflows. However, theoretical considerations also conceive negative spillovers. The question arises as to which effect is predominant and whether an economy ultimately benefits from externalities in form of spillover effects, is affected adversely or remains unaffected. Therefore, the topic at hand is also highly relevant from the development policy angle.

Although there exists already a vast literature in this field, the understanding of some issues is relatively limited, especially when it comes to comparable firm-level analyses across (developing) countries. In this study, I employ comparable survey data taken from the Enterprise Surveys provided by the World Bank (World Bank, 2011) and build a firm-level panel data set which covers establishments¹ from ten Latin American economies. I use the firm characteristics to construct two indicators that measure foreign presence² in an industry sector as well as in a region and estimate potential intra-industry and intra-regional productivity spillovers across Latin American economies.

Theoretically, technology and knowledge are transferred to firms in FDI host countries through various channels. As for some of these transmission channels there are plausible considerations for both positive and negative impacts, the net effect depends on what influence dominates. Regarding the existing literature, the results on the outcome of spillover effects are mixed which is also documented in some surveys and meta-analyses on this topic (for instance, Blomström & Kokko, 1998; Görg & Strobl, 2001; Görg & Greenaway, 2004). Görg & Strobl (2001) point out that the inconclusive results stem largely from methodological problems. In particular, they emphasize that the results of studies based on cross-sectional data are biased whereas analyses resting upon panel data come up with more accurate findings. Furthermore, Javorcik (2004) summarizes that positive spillover effects are mainly found for industrialized countries, while the outcome for developing countries is more pessimistic. For instance, Aitken & Harrison (1999) and Waldkirch & Ofosu (2010) show negative productivity spillovers at the firm-level for Venezuela and Ghana, respectively. However, most of the previous studies focus on one particular country. Although it is explicitly suggested to examine FDI spillovers in a multicountry analysis (Javorcik, 2008), only few investigations attempt to consider more

1 Throughout this paper, “establishments” refers to “firms”. I use both terms synonymously.

2 “Foreign presence” refers to the “presence of FDI”. I use both terms interchangeably throughout this paper.

than one economy (for instance, Konings, 2001; Yasar & Morrison Paul, 2007). This shortcoming is mainly due to the lack of comparable (firm-level) data. Accordingly, the comparison of findings from different economies is very difficult and the investigation related to a set of countries is in most cases not possible.

Against this background, I contribute to the existing literature in several respects. First, I employ comparable survey panel data on the firm-level from ten Latin American (developing) countries in order to estimate productivity spillover effects from FDI. More precisely, I measure foreign presence at the sectoral and at the regional level, and assess the impact of both measures on manufacturing firms' total factor productivity (TFP) levels as an average effect for all included economies. In this regard, I particularly analyze the effect on domestic firms. Second, I investigate what kind of ownership structure (within the FDI projects) induces spillover effects. That is, I consider the ownership structure of a MNE's affiliate and differentiate between foreign presence in terms of minority and majority owned foreign firms as well as partly and wholly owned foreign establishments. Third, I estimate the spillovers for each country separately and compare the outcomes for the ten Latin American economies.

Latin America portrays an interesting case as the findings from different firm-level country studies are mixed. For example, Aitken & Harrison (1999) find negative spillovers for Venezuela, while Kokko et al. (2001) show positive effects for Uruguay. Furthermore, to the best of my knowledge, there exists no panel analysis that covers firm-level spillover effects for various Latin American economies to date.

In my study, I focus on intra-industry (also referred to as "horizontal") and regional spillovers as I understand spillovers as externalities. Various studies on this topic take also inter-industry ("vertical") spillovers into account which arise through forward and backward linkages between firms from different industry sectors. However, it is debatable whether the term vertical *spillover effects* is accurate. Smeets (2008) argues that empirical studies on vertical FDI spillovers actually measure technology and knowledge *transfer* rather than technology and knowledge *spillovers*. Following this argument, these effects are most likely not externalities or spillovers, respectively. Hence, I do not explicitly consider vertical measures in the following analysis.³

My empirical findings suggest that there are negative productivity spillover effects from the presence of FDI in an industry sector across developing countries in Latin America. Furthermore, I find that the negative intra-industry spillover is caused by wholly owned foreign affiliates. The country-specific investigation indicates that the spillover effects differ between the considered economies with a tendency that the presence of FDI in a sector (region) has a negative (positive) impact.

The remainder of the paper is structured as follows. In the next section, I provide some principles. I discuss theoretical issues on spillover transmission channels as well as rele-

3 Please note that a strict separation of horizontal and vertical spillovers is difficult in the empirical analysis. I compute the measure of foreign presence in a sector on the basis of two-digit industry codes. Consequently, some spillovers may not be purely horizontal. However, the analysis mainly captures horizontal effects. Moreover, I implicitly account for some vertical spillovers by applying a regional measure. It is calculated based on the presence of FDI in a country region no matter in which industry the firms with a foreign ownership are active.

vant aspects of the related empirical literature. Thereafter, I explain the data preparation and provide a description of the data sample in Section 3. After describing the empirical methodology in Section 4, I present and discuss the empirical results in Section 5, and end the paper with concluding remarks in Section 6.

2 THEORETICAL ISSUES AND RELATED LITERATURE

According to Helpman et al. (2004) only the most productive firms engage in FDI projects. These MNEs possess productivity advantages over domestically oriented firms due to “some ownership-specific assets in knowledge, technology, organization, management, or marketing skills” (Blomström & Kokko, 2003, p.4). By entering a foreign market through FDI, MNEs transfer some superior knowledge and technology to their affiliates. It is assumed that some of these assets spill over to other (domestic and foreign) firms in the host country.

Theoretically, horizontal productivity spillovers are expected to work through four main channels – demonstration, competition, trade, and labor mobility (for instance, Görg & Greenaway, 2004; Damgaard, 2011). Although positive spillovers are anticipated, the resulting effect is a priori ambiguous, as there are also negative externalities conceivable for local firms in the host countries. First, the demonstration effect works through the imitation of technologies and skills. In this regard, domestic firms can benefit from observing and imitating some innovative managerial structures or advanced production strategies which are likely to boost their productivity (Das, 1987; Wang & Blomström, 1992). Second, the competition effect is either positive or negative. Due to the entry of MNEs in a host country market the level of competition increases. In order to compete with the new rivals, domestic firms are forced to act and produce more efficiently which leads to a rise in their productivity levels. On the other hand, the presence of MNEs may reduce the scale of some firms already serving the host country market. Ultimately, some firms may even be forced to exit the market as they cannot compete at all (Wang & Blomström, 1992; Glass & Saggi, 2002). Third, regarding the labor mobility channel, positive knowledge spillovers occur through the migration of workers from MNEs to other firms. In this case, potential state-of-the-art know-how and managerial skills are transmitted to (domestic) firms in the host country. In contrast, highly skilled workers might have an incentive to migrate from domestic firms to MNEs because the latter tend to pay higher wages. Consequently, domestic firms lose some amount of their human capital and thus, incur productivity losses (Fosfuri et al., 2001; Glass & Saggi, 2002). Fourth, spillovers may occur through the trade channel. Generally, MNEs also serve foreign markets through exports. Due to experiences in this field, they have advanced export strategies and networks. As many MNEs pursue to export through their affiliates, they establish distribution networks and trade infrastructure in host countries. In this context, local firms can benefit in several aspects and improve their productivity. For instance, they can imitate export strategies or use the trade infrastructure to engage in exporting. Nonetheless, there are also probable negative impacts to consider. A crowding out of domestic suppliers due to substitutes from foreign suppliers is possible, as MNEs might purchase their inputs from suppliers resided in other countries instead of buying intermediates from local firms (Aitken & Harrison, 1997; Greenaway et al., 2004).

Moreover, it is assumed that the four transmission channels are linked to geography, that is, spillovers occur due to spatial proximity to MNEs. For instance, it is argued that the factor labor is relatively immobile, which implies that spillovers through worker mobility occur mainly in the same region (Smeets, 2008).

The ownership structure also plays a role when it comes to the determining factors of spillovers. When engaging in an FDI project, MNEs face a trade-off which depends on the extent of the technology/knowledge transfer to its affiliate and the potential leakage of productivity advantages within joint ventures (Müller & Schnitzer, 2006). In order to prevent the leakage of technology/knowledge advantages, MNEs might choose larger ownership shares or even the wholly owned option, where they internalize most of their technology/knowledge and reduce potential spillovers.

The empirical evidence on productivity spillover effects is mixed. This applies to developed as well as developing countries and is also documented in several surveys and meta-analyses on this topic (for instance, Blomström & Kokko, 1998; Görg & Greenaway, 2004). Haddad & Harrison (1993) use panel data from Morocco. They find no evidence for horizontal spillovers, although domestic firms operating in sectors with higher foreign presence have higher productivity levels. In line with that, Javorcik (2004) also finds no intra-industry spillovers from FDI at the firm-level in Lithuania. Bwalya (2006) investigates potential spillover effects on firms in Zambia and shows that there is little evidence for positive intra-industry spillovers. Furthermore, his results suggest that there are positive effects at the regional level. Due to proximity to MNEs domestic firms are affected positively in manufacturing industries. Waldkirch & Ofosu (2010) employ panel data of manufacturing firms in Ghana. They report that foreign presence in a sector has a significant negative effect on domestically-owned firms, but a positive effect on foreign-owned plants. Turning to studies that cover Latin American countries the picture is similar – that is, the results are mixed. Aitken & Harrison (1999) apply panel data for Venezuela and conclude that there is a negative effect from foreign presence on the productivity of domestic firms, whereas Kokko et al. (2001) find evidence for positive spillovers in their cross-sectional study for Uruguay. A more recent study by Kugler (2006) reports no evidence for intra-industry spillovers in Colombia.

Studies that take the ownership structure into account show similarly mixed results. Blomström & Sjöholm (1999) find positive spillovers for Indonesian firms and these effects arise from minority as well as from majority owned foreign firms. They conclude that the ownership structure does not determine the spillover effects. By contrast, Javorcik & Spatareanu (2008) show that the ownership type of FDI projects affects spillover effects in Romania, that is, horizontal spillovers are larger if induced by wholly owned foreign affiliates compared to spillovers that arise from the presence of partially owned foreign affiliates.

Finally, the literature comes up with some general suggestions for further empirical research. First, Görg & Strobl (2001) emphasize using plant-level panel data to account for firm heterogeneity in order to overcome the self-selection problem⁴ and thus, to obtain more accurate results. Second, Javorcik (2008) suggests employing cross-country firm-level panel data. I follow these two proposals and create a plant-level panel data set using comparable survey data from manufacturing industries in ten Latin American countries. This opportunity may provide new insights with regard to a simultaneous analysis of a considerable part of the developing world as well as a comparison of FDI spillovers be-

4 The self-selection problem may arise due to the fact that more productive firms may be the ones that attract FDI.

tween countries. Moreover, I also consider the ownership structure as a determinant of horizontal spillovers and analyze whether particular ownership shares of FDI projects induce the effects.

Few studies conduct a cross-country firm-level analysis related to FDI spillovers. Konings (2001) as well as Barrios et al. (2004) investigate efficiency spillovers in each case for three European economies. Konings (2001) finds negative spillovers to domestic firms in Bulgaria and Romania but no effect to establishments in Poland. Whereas Barrios et al. (2004) find evidence for positive effects on firms in Spain as well as in Ireland. Yasar and Morrison Paul (2007) investigate intra-industry spillover effects from FDI for five transition countries. They make use of World Bank firm-level data for Poland, Moldova, Tajikistan, Uzbekistan, and the Kyrgyz Republic. Their results indicate that domestic firms are positively affected by the presence of MNEs in a sector on average across these five countries. Tondl & Forneo (2010) come close to my approach and analyze sectoral spillover effects for 14 Latin American economies. They find evidence for positive horizontal spillovers. However, there is a crucial difference to my work as their study is based on aggregated industry data. In conclusion, I can say that some approaches are close to mine; nevertheless, there are distinctive differences to each of those studies which ensure the uniqueness of the analysis at hand.

3 SAMPLE CONSTRUCTION AND DATA DESCRIPTION

The data is taken from the Enterprise Surveys provided by the World Bank (World Bank, 2011). The selected sample covers ten Latin American countries (Argentina, Bolivia, Chile, Colombia, Ecuador, Guatemala, Panama, Paraguay, Peru, and Uruguay) and provides firm-level information for the years 2006 and 2010.

I construct the sample from separate panel datasets for each of the aforementioned countries. The original datasets cover firms from manufacturing, retail, and services industries. I am able to match the firm-level data of those countries as each dataset contains the same relevant and applied information of a firm for the same time periods. In this regard, the World Bank uses standardized questionnaires for all interviewed firms in Latin American countries in order to collect comparable firm-level information. In the analysis, however, I use a reduced sample of the data. I exclude those firms from the sample that were interviewed in only one of the two years, as I intend to perform a panel analysis. Also, all firms belonging to the retail or services industries are excluded from the analysis.⁵ Finally, the sample includes 1,584 firms from different manufacturing sectors.

With respect to the following analysis, a global adjustment of the data is necessary. All monetary values from the original datasets are given in local currency units (LCUs). For standardization, I convert those values into U.S. dollars and thereafter, I deflate them by using the GDP deflator (in U.S. dollars with 2006 as the base year).⁶

Turning to the description of the data, Tab. 1 illustrates the number of firms that are located in each country and how these firms are distributed over the manufacturing sectors. A closer look at the distribution of the firms across industries is in so far relevant as the study investigates intra-*industry* spillovers and, therefore, two measures of principal interest of the following empirical analysis – firm-level productivity and the measure for foreign presence in an industry – are calculated separately for each industry sector. Beginning with the number of firms interviewed in each economy, Argentina is the country with the highest number of establishments (375 firms which is 24 percent of the total sample). In contrast, the country with the lowest number of firms in the survey sample is Guatemala where 47 firms (about three percent of the total sample) were interviewed. In total (across all countries), the two predominant sectors of the survey sample are the “Food” and the “Textiles & Garments” sector. The former corresponds to the International Standard Industrial Classification (ISIC) 15 and the latter to ISIC 17 and 18. More than half of all firms (i.e. 896 of 1,584) are active in those industries. This holds also for most of the countries except for Chile, Ecuador and Paraguay where the firms are distributed differently. In Chile and Paraguay firms from “Chemicals, Rubber & Plastics” industries are more represented. Furthermore, the sector “Fabricated Metals & Machinery” (ISIC 28

5 This exclusion is due to the fact that quantifying the effect of foreign presence on firms’ productivity levels is based on estimating a common – “Solow-style” – production function which holds in particular for firms from manufacturing industries, but is more complicated with respect to firms from the retail sector or services industries. Furthermore, the exclusion of retail firms is also reasonable in the present case as there is a large number of missing values in the variables within the first wave of the data collection process regarding retail firms.

6 The definition of the exchange rate and the corresponding values for all countries are stated in the appendix (see Tab. 9).

and 29) plays a major role in Chile as well as in Argentina where in each country one quarter of all firms belong to those industries. 85 percent of all firms from ISIC 28 and 29 in the Latin American economies are located in Chile or Argentina. Overall, few establishments are active in industries of “Non-metallic & Basic Metal Products” (ISIC 26 and 27). Finally, “Other Manufacturing” includes firms from “Electronics” (ISIC 31) and firms which could not be exactly matched to an industry category.

Tab. 1: Number of Firms and Distribution on Industries by Country

Country	Number of Firms	Firm Distribution on Industries by Country					
		Food	Textiles & Garments	Chemicals; Rubber & Plastics	Non-metallic & Basic Metals	Fabricated Metals & Machinery	Other Manufacturing
Argentina	375	103	99	44	3	92	34
Bolivia	76	30	19	12	6	4	5
Chile	315	65	56	83	15	78	18
Colombia	205	47	100	47	1	3	7
Ecuador	65	21	11	9	0	7	17
Guatemala	47	16	19	6	1	3	2
Panama	55	21	7	3	9	6	9
Paraguay	70	18	7	22	6	4	13
Peru	200	64	74	57	1	1	3
Uruguay	176	67	52	38	0	2	17
Total	1,584	452	444	321	42	200	125

Having reviewed the industry structure of the firms within the countries, I turn to Tab. 2 that describes the presence of foreign ownership within the sample for each of the two years given by the share of firms which are partly or fully foreign owned in each country. Column (1) refers to establishments that have a foreign ownership at all (one percent or more⁷), column (2) covers firms that are majority foreign owned (51 percent or more), and column (3) depicts the share of fully foreign owned establishments (100 percent). Regarding the total sample over all countries, the share of (partly and fully) foreign owned establishments does not vary from one period to the other and stays at 10.92 percent in column (1). In columns (2) and (3) the structure of foreign ownership changes very slightly from 2006 to 2010. The share of firms that are foreign owned by 51 percent or more, as well as the part that covers only fully foreign owned firms, decreases from 8.21 percent to

7 There is no firm within the sample that has a foreign ownership share between zero and one percent in any of the two years. Moreover, all firms have integer percentage values with respect to the foreign ownership share.

8.14 percent and from 6.44 percent to 5.93 percent, respectively. This indicates a small tendency towards disinvestments between 2006 and 2010, which might reflect reactions of foreign investors caused by the financial crisis beginning in that period.

Looking at the countries separately, the picture is somehow mixed. In the economies of Bolivia, Chile, Ecuador, Guatemala, Panama, and Peru, the share of all partly and fully foreign owned establishments increases as can be seen in column (1) – whereas in Argentina, Colombia, Paraguay, and Uruguay the share decreases. The share of fully foreign owned firms only increases in Guatemala and Peru, while it remains at the same level or decreases in the other economies. However, considering the number of interviewed firms within each country given in Tab. 1, the change of the share of foreign owned firms over time appears to be relatively moderate as it is driven by few establishments.

Tab. 2: Share of Foreign Owned Firms by Country

	(1) Foreign Ownership: 1% or more		(2) Foreign Ownership: 51% or more		(3) Foreign Ownership: 100%	
	2006	2010	2006	2010	2006	2010
Argentina	12.80	12.00	10.93	10.67	8.53	8.00
Bolivia	13.16	14.47	9.21	7.89	7.89	5.26
Chile	9.21	9.84	6.67	7.94	5.71	5.71
Colombia	4.93	3.41	3.41	2.44	2.44	1.95
Ecuador	10.77	16.92	9.23	10.77	6.15	6.15
Guatemala	10.64	17.02	6.38	10.64	6.38	8.51
Panama	12.73	16.36	10.91	5.45	9.09	5.45
Paraguay	17.14	12.86	8.57	10.00	8.57	8.57
Peru	10.00	11.50	6.50	8.00	3.50	4.50
Uruguay	14.77	10.80	11.36	8.52	9.09	6.82
All countries	10.92	10.92	8.21	8.14	6.44	5.93

4 ECONOMIC MODEL AND EMPIRICAL METHODOLOGY

The aim of this paper is to assess the impact of multinational activity on firms' productivity levels in Latin America. In order to analyze this effect, I derive an econometric model where TFP is dependent on firm characteristics and two different spillover measures. In a first step, I calculate TFP, that is, I estimate a production function and use the resulting coefficients corresponding to the firms' inputs to compute a firm's TFP. In a second step, I set up the estimation equation.

The starting point is a standard Cobb-Douglas production function with constant returns to scale which is based on the seminal work by Solow (1957) and stated in equation (1)

$$Y_{ijct} = A_{ijct} MAT_{ijct}^{\beta_1} LAB_{ijct}^{\beta_2} CAP_{ijct}^{\beta_3} \quad (1)$$

where the dependent variable Y is the output which is defined as total annual sales of a firm i that is active in sector j and resided in country c at time t . MAT , LAB and CAP represent materials, labor, and capital, respectively, which are a firm's inputs used in the production process. The costs of raw materials and intermediate goods reflect the materials measure. Labor is defined as total labor costs and capital is measured by the costs for the establishment to re-purchase all of its machinery, vehicles, equipment, land, and buildings.⁸ Finally, A is the Hicksian neutral efficiency level of a firm which is defined as TFP as it affects all factors' marginal product at the same time. Taking the natural logarithm of equation (1) leads to a production function in linear form:

$$\ln Y_{ijct} = \beta_0 + \beta_1 \ln MAT_{ijct} + \beta_2 \ln LAB_{ijct} + \beta_3 \ln CAP_{ijct} + \varepsilon_{ijct} \quad (2)$$

with $(\ln A_{ijct} = \beta_0 + \varepsilon_{ijct})$, where β_0 is the average efficiency level across firms, sectors, countries and over time (Van Beveren, 2012). The residual term ε_{ijct} represents the firm-specific TFP at time t which cannot be observed by the researcher but (at least) partly by the decision makers within the firm. Consequently, firm decisions on factor inputs can be changed due to given efficiency levels. This implies that the factor inputs are dependent on TFP or the residual term, respectively, and therefore correlated with each other. This issue of endogeneity is well-known in the literature and common as the so-called simultaneity problem (for instance, Griliches & Mairesse, 1995; De Loecker, 2007). Ignoring this fact would lead to biased estimates of the input coefficients using the ordinary least squares (OLS) technique.

To address this issue, firstly, I split the residual term into two components ($\varepsilon_{ijct} = \gamma_{ijct} + u_{ijct}$) where the first part γ_{ijct} can be observed by the firm and thus, is correlated with the inputs. The second part u_{ijct} is a random term which cannot be observed by the firm and, therefore, is assumed to be independent as well as identically distributed. Secondly, I impose a further (and stronger) assumption on the first term γ_{ijct} , namely, that it is a firm-

8 These measures are suggested and also applied by Saliola & Seker (2011) who estimate TFP for a broader sample of countries from the Enterprise Surveys. Furthermore, detailed definitions of output, capital, labor, and materials are given in the appendix (see Tab. 10).

specific but time-invariant characteristic which leads to the following notation γ_i (Van Beveren, 2012). Given these conditions, the fixed-effects (FE) estimator is an appropriate method to obtain unbiased coefficients.

There are further common methods which are used to overcome the simultaneity problem like the semi-parametric estimation algorithms suggested by Olley & Pakes (1996) and Levinsohn & Petrin (2003). Unfortunately, both strategies do not fit with the data of this study. In short, the reasons are as follows. The Olley-Pakes method makes use of a firm's investments which are strictly required to be positive for all firms – this does not hold for over 30 percent of the observations in the present sample. The Levinsohn-Petrin strategy applies lags of relevant variables. Hence, I cannot apply this method with my panel data which covers only two time periods. However, following Van Beveren (2012), it turned out that the resulting estimates of different estimation techniques – including the FE estimator – are very similar.

A further advantage of the FE estimator in the present case is that it implicitly accounts for industry- and country-specific effects. To account for period shocks, I adjust the econometric model by adding a year dummy (δ_t) which leads to the following expression

$$\ln Y_{ijct} = \beta_0 + \beta_1 \ln MAT_{ijct} + \beta_2 \ln LAB_{ijct} + \beta_3 \ln CAP_{ijct} + \gamma_i + \delta_t + u_{ijct} \quad (3)$$

Now, I obtain TFP through estimating the coefficients of equation (3) by applying the FE technique and then predicting the two-component residual ($\gamma_i + u_{ijct}$). To account explicitly for industry heterogeneity, I estimate equation (3) for each sector separately.⁹ Tab. 3 reports the estimated coefficients of the production function, the first-stage TFP estimation results. Columns (1) to (6) show the estimates for the different industry groups.¹⁰ Overall, the results are mixed, but adequate and comparable to findings of other studies, for instance Görg & Strobl (2005) or Waldkirch & Ofosu (2010). The coefficient of materials is significant across all industry groups except for column (4). Regarding the estimates for “Non-metallic & Basic Metals” in column (4), only the labor coefficient is significant and, additionally, very large. Consequently, labor seems to be the driving input factor to explain output changes in this industry group. However, the outcome for this sector group is likely to be due to the relatively low number of observations. Turning to the estimates of the capital variable, the coefficients are low and insignificant except for column (2) where it is significant at the five percent level. When applying the FE estimator on Cobb-Douglas production functions, comparable findings of the capital coefficients are frequently observed (Van Beveren, 2012). In the present case, it is even more difficult to find

9 Estimating TFP for each industry or industry groups separately is reasonable as the estimated coefficients of factor inputs differ significantly across sectors. Therefore, this is a common strategy in the literature (for instance, Görg & Strobl, 2005).

10 Please note that the number of firms and observations, respectively, decreases compared to the full sample shown in Tab. 1 due to missing values within the employed variables. Nevertheless, the final number of observations included in the analysis largely reflects the picture of the full sample. That is, the share of each country with regards to the number of firms, the distribution of firms across industries and the share of foreign owned firms is largely identical to the full sample.

strong effects for all variables (inputs), as the estimation is based on the within variation of firms calculated from only two time periods.

Tab. 3: First-Stage TFP Estimation

	(1) FOOD	(2) TEXTILES & GARMENTS	(3) CHEMICALS, RUBBER & PLASTICS	(4) NON- METALLIC & BASIC METALS	(5) FABRICATED METALS & MACHINERY	(6) OTHER MANUFAC- TURING
lnMAT	0.211***	0.194***	0.221***	0.246	0.158***	0.415***
	(2.993)	(5.572)	(3.781)	(0.917)	(3.208)	(3.440)
lnLAB	0.284***	0.299***	0.228***	0.658**	0.093	0.245
	(3.799)	(5.452)	(2.950)	(2.301)	(1.203)	(1.425)
lnCAP	0.015	0.037**	-0.009	0.208	0.060	-0.020
	(0.669)	(2.508)	(-0.408)	(1.256)	(1.386)	(-0.456)
Constant	7.660***	7.044***	8.640***	0.061	10.02***	5.796***
	(6.917)	(10.94)	(7.292)	(0.0237)	(10.14)	(3.153)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	342	379	273	26	161	91
Observations	511	580	397	39	242	118
Within R ²	0.38	0.48	0.33	0.80	0.47	0.52
F	14.9	26.1	6.8	27.5	10.3	8.9
Notes: FE estimation. Dependent variable is the natural logarithm of sales. <i>t</i> -values obtained from robust standard errors in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.						

Having the predicted values of TFP ready, I formulate the econometric model in equation (4) where the logarithm of TFP is dependent on the following variables:

$$\ln TFP_{ijct} = \alpha + \beta_1 SL_{ijct} + \beta_2 \ln EMP_{ijct} + \beta_3 FDIsector_{jct} + \beta_4 FDIregion_{rct} + \gamma_i + \delta_t + u_{ijct} \quad (4)$$

SL_{ijct} is a control variable and represents a firm's skilled labor share. It is included to capture productivity differences arising from different compositions of skilled and unskilled production workers. A positive impact is expected as I assume that, on average, higher shares of skilled labor are associated with higher productivity levels. EMP_{ijct} is an estab-

lishment's amount of total employment and controls for firm size. The expected impact is positive as larger firms tend to be more productive due to economies of scale. I also control for period- and firm-specific effects where the latter is assumed to be time-invariant.

The main variable of interest is $FDI_{sectorjct}$. It measures the presence of foreign enterprises in sector j (in country c at time t) where firm i is active. The sector categories (j) are based on two-digit ISIC codes. Calculating the foreign ownership share at the sector-level, I follow a common strategy applied by Aitken & Harrison (1999), for example, where $FDI_{sectorjct}$ is computed as a weighted average of foreign ownership over all firms in a sector j . Particularly, it is weighted by a firm's size measured through total employment (EMP_{ijct}).¹¹ Furthermore, I run the calculation separately for each country c and year t due to the fact that this study employs cross-country panel data.

$$FDI_{sectorjct} = \frac{\sum_i (FDI_{ijct} \cdot EMP_{ijct})}{\sum_i (EMP_{ijct})} \quad (5)$$

In equation (5) FDI_{ijct} is a firm i 's private foreign ownership share at time t , ranging from zero percent (no foreign ownership) to 100 percent (fully foreign owned). As within some sectors (in the ten countries covered in the sample) only a few firms with a foreign ownership are active, one could argue that the measure FDI_{sector} is likely to be driven and dominated by one firm. Consequently, the measure would be biased, at least for that particular firm. To account for this issue, I adjust the measure FDI_{sector} calculated through equation (5) as follows. I subtract the weighted foreign ownership of firm i from the sum in an industry. Equation (6) presents the adjusted intra-industry spillover measure:

$$FDI_{sectorjct} = \frac{\sum_k (FDI_{kjct} \cdot EMP_{kjct}) - FDI_{ijct} \cdot EMP_{ijct}}{\sum_k (EMP_{kjct}) - EMP_{ijct}} \quad \text{with } (i \neq k) \quad (6)$$

The sum over k represents all other firms in the sector of a country where firm i is active. Finally, the coefficient β_3 can be interpreted as follows: If foreign presence in sector j in country c increases by one percentage point, TFP will increase or decrease, respectively, by β_3 percent. The impact of FDI_{sector} could be positive or negative as both directions are plausible. It depends on which effect is predominant given the potential theoretical considerations stated in Section 2.

Additional to assessing the impact of foreign presence in a country at the industry level, I also include a measure based on a firm's location at the regional level – FDI_{region} – in the

¹¹ An alternative measure would be the foreign ownership share averaged over all firms in a sector, weighted by each firm's share in sectoral sales. This measure is used by Javorcik (2004), for example. However, since the sales of a firm are more likely to fluctuate over time due to period shocks and employment is more stable the number of employees is the preferred firm-specific weight in this case.

model.¹² The calculation is similar to equation (6), that is, I calculate *FDIregion* as the weighted average of foreign ownership over all firms in a region *r* of country *c* at time *t*.¹³ The interpretation of this measure goes more in the direction that spillover effects occur because of proximity to foreign owned firms in whatever industry they are active. Again, a positive or negative impact is conceivable.

Descriptive statistics of *FDIsector* and *FDIregion* over the two time periods by country are reported in Tab. 4.¹⁴ Regarding foreign presence in a sector, the country with the highest (lowest) mean is Ecuador (Colombia); the mean over all countries is at 17.37 percent. With respect to foreign presence in a region, the economy with the highest (lowest) mean is Argentina (Colombia) and the mean of the full sample rests at 18.78 percent. Most notably in the table, there is considerable variation in the data (of every country) as shown by the standard deviation (SD) and the within standard deviation. The latter is of particular importance as I employ the FE estimation technique which makes (only) use of the within variation.

Tab. 4: Descriptive Statistics of Foreign Presence Measures by Country

	FDIsector				FDIregion		
	Mean	SD	Within SD		Mean	SD	Within SD
Argentina	24.77	12.45	4.23		30.06	15.50	6.22
Bolivia	10.68	11.85	4.44		14.61	3.08	1.01
Chile	14.45	17.63	5.39		12.38	6.77	3.30
Colombia	6.05	12.77	7.20		6.66	4.62	0.50
Ecuador	25.38	23.14	9.20		15.77	9.40	5.77
Guatemala	16.12	25.59	13.99		29.34	12.77	10.64
Panama	12.37	27.83	2.28		21.31	2.89	2.25
Paraguay	13.62	12.86	3.71		14.46	5.92	2.07
Peru	21.79	17.55	2.03		20.31	7.60	3.30
Uruguay	19.75	14.79	1.88		26.06	2.60	1.81
All countries	17.37	17.56	5.60		18.78	12.68	4.35

Notes: The calculation of the values is based on the same 1,862 observations included in all regressions of the following analysis.

12 This measure is also applied in other studies (for instance, Bwalya, 2006) to analyze the effect on the regional level.

13 A list of all regions within the countries is provided in the appendix (see Tab. 11).

14 Summary statistics of all other employed variables are shown in the appendix (see Tab. 12).

5 EMPIRICAL RESULTS

In this section of the study, I present and discuss the regression results. The first part covers baseline estimations in order to develop a benchmark result. Secondly, I examine how domestic firms are affected and what kind of multinationals trigger potential spillover effects. Thirdly, I analyze the impact from foreign presence for each country separately, that is, the investigation is related to country subsamples. This approach tries to compare spillovers between the economies. Finally, I report a set of robustness checks based on a labor productivity model in order to verify the findings.

5.1 Baseline Estimations

In Tab. 5, I aim to develop a benchmark specification and a benchmark result, respectively. In this regard, the comparable firm-level data enables us to estimate the impact of foreign presence on firm-level productivity as an average effect across all countries. In the first steps, in columns (1) and (2), I successively include the control variables *SL* – the skilled labor share – and *EMP* which measures the size of a firm. The applied estimation technique is the pooled OLS method where I also control for industry-, country-, and period-specific effects by including corresponding dummies while I do not account for firm-specific effects. The outcome indicates that different compositions of skilled labor do not play a role with respect to TFP as the coefficient of *SL* is negative but insignificant. The inclusion of *EMP* contributes enormously to the explanatory power of the model, that is, the size of a firm plays a major role in explaining differences in firm-level productivity (as shown by the F-value and the R^2). The coefficient is positive and highly significant at the one percent level. Consequently, larger firms tend to be more productive than smaller establishments.

In column (3), I include *FDIsector* – the main variable of interest – to assess the impact of foreign presence in an industry on TFP. The coefficient is positive but insignificant which would indicate that there are no intra-industry spillover effects. However, as mentioned earlier, the estimates obtained from a model which does not consider firm heterogeneity are likely to be biased (Görg & Strobl, 2001). Therefore, in the next step, I use the advantage of a panel data set to consider firm-specific effects and apply the FE estimator. The comparison of columns (3) and (4) demonstrates striking differences between the findings of the two models. As soon as I account for firm heterogeneity in the FE model reported in column (4), the *FDIsector* coefficient becomes negative and is now significant at the ten percent level, while the significance of the control variables remains at the same levels, whereby the coefficient of *EMP* is now smaller and the coefficient of *SL* is now positive. In column (5), I replace *FDIsector* by *FDIregion*, that is, I analyze the effect from foreign presence in a region on TFP. The estimated coefficient is positive but insignificant which leads to the conclusion that there are no spillover effects from spatial proximity to multinational firms. In the last step, I include both spillover measures in the specification. Qualitatively, the outcome remains the same, though the *FDIsector* coefficient is significant at the five percent level now. Regarding the F-value of roughly nine and the within R^2 , the overall fit of the model is also adequate. Finally, I consider column (6) as my benchmark result. The conclusion from this result is that, on average, I find a small

negative spillover effect from foreign presence in manufacturing sectors of the ten Latin American countries on firms' productivity levels. Quantitatively, an increase in foreign presence in a country's sector by ten percentage points leads to a decrease in a firm's TFP level by roughly 0.03 percent. This finding is in line with results from other (developing) countries in the literature, for instance, Aitken & Harrison (1999) or, more recently, Waldkirch & Ofosu (2010) who also find a negative intra-industry spillover effect for Venezuela or Ghana, respectively. However, the estimates from these studies are considerably larger, while the spillover effect at hand and its economic significance are relatively small. This may be due to the fact that the present study makes use of the within variation stemming from only two years where it is unlikely to find large effects. Moreover, one should remember that the estimate explains the average effect for ten countries where the spillovers from different economies may work in opposite directions and, hence, may (almost) equalize each other.

Tab. 5: Baseline Estimations

	(1) POOLED OLS	(2) POOLED OLS	(3) POOLED OLS	(4) FE	(5) FE	(6) FE
SL	-0.0653 (-0.898)	-0.0279 (-0.588)	-0.0267 (-0.562)	0.0331 (0.563)	0.0274 (0.468)	0.0278 (0.473)
lnEMP		0.624*** (48.37)	0.624*** (48.25)	0.292*** (5.467)	0.294*** (5.519)	0.290*** (5.504)
FDIsector			0.0018 (1.333)	-0.0028* (-1.803)		-0.0033** (-2.063)
FDIregion					0.0020 (0.607)	0.0032 (0.972)
Constant	0.0298 (0.265)	-2.313*** (-27.27)	-2.374*** (-23.87)	-1.072*** (-5.184)	-1.151*** (-5.558)	-1.104*** (-5.324)
Firm-specific effects	No	No	No	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	(Yes)	(Yes)	(Yes)
Country dummies	Yes	Yes	Yes	(Yes)	(Yes)	(Yes)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1,262	1,262	1,262	1,262	1,262	1,262
Observations	1,862	1,862	1,862	1,862	1,862	1,862
R ²	0.02	0.62	0.62	0.08	0.07	0.08
F	3.1	131.5	126.0	9.5	7.9	8.0
Notes: Dependent variable is the natural logarithm of TFP. <i>t</i> -values obtained from robust standard errors in parentheses. In columns (4) to (6) the R ² refers to the within R ² . *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.						

5.2 Effects on Domestic Firms and Sources of Intra-Industry Spillovers

Continuing with the investigation, I pursue two objectives. On the one hand, I examine the impact of foreign presence on purely domestic establishments. Therefore, I reduce the sample to domestically owned firms. More precisely, the subsample contains firms without any foreign ownership in both years. Investigating this issue is of big interest as many (developing) countries make considerable efforts to attract FDI in order to benefit from these investments. In this context, it is believed that these investments actually generate positive productivity spillovers – especially on domestic firms. However, given the benchmark results, I do not expect that there are positive effects on domestically owned firms – in particular, because the share of this group accounts for some 90 percent of the survey sample.

On the other hand, I consider FDI heterogeneity when assessing the intra-industry spillover effect to reveal the sources of the (negative) impact found in the benchmark regression. In this regard, I consider spillovers from minority versus majority foreign owned firms as well as spillovers from partly versus fully foreign owned establishments. To analyze the effect from these different types of FDI projects I replace *FDIsector* in equation (4) by *FDIminority* and *FDImajority* or by *FDIpartly* and *FDIfully*, respectively. All four measures are calculated based on the approach from Equation (6). Particularly, I calculate *FDIminority* (*FDImajority*) from all firms that have a foreign ownership share ranging from one to 50 percent (51 to 100 percent). Analogous to that, I compute foreign presence in terms of *FDIpartly* on the basis of all firms with a foreign equity share between one and 99 percent whereas foreign presence in terms of *FDIfully* is based on fully foreign owned establishments (100 percent). The estimation results are shown in Tab. 6.

For the sake of comparison, column (1) depicts the benchmark result again. Turning to column (2), I show the outcome for the subsample of domestic firms where the number of observations decreases to 1,626 from the initial 1,862. Both qualitatively and quantitatively the resulting estimates are hardly affected compared to column (1). The impact of the regional spillover measure *FDIregion* remains insignificant while the coefficient of *FDIsector* is still (negative) significant at the five percent level and increases slightly.

In the specifications corresponding to columns (3) and (4), I replace the intra-industry spillover measure by *FDIminority* and *FDImajority*. The coefficients of both variables are negative. But the striking difference is that the estimate of the former variable is insignificant, while the estimate of the latter variable is significant at the five percent level. Furthermore, when comparing columns (1) and (3) – regarding the full sample of firms – and columns (2) and (4) – regarding the subsample of domestic firms – the quantities of the coefficients of *FDImajority* are exactly the same as the estimates of *FDIsector*. Taking the investigation further, I insert *FDIpartly* and *FDIfully* instead of *FDIminority* and *FDImajority* in columns (5) and (6). The presence of partly foreign owned firms in a sector seems to play no role with respect to TFP as the coefficients are negative but insignificant. In contrast to that, the estimates referring to the presence of fully foreign owned firms are significant (and negative). Additionally, the estimates of *FDIsector* and *FDIfully* are almost similar in size regarding columns (1) and (5), as well as columns (2) and (6), respectively. From this finding, I conclude that the negative intra-industry spillover effect established through the benchmark regression is driven and induced by fully foreign

owned firms.¹⁵ This might be due to the fact that wholly foreign owned firms are assumed to prevent the leakage of (state-of-the-art) technologies to other firms in the host economy and therefore, the net impact from such FDI projects is negative with respect to TFP.

Tab. 6: Effects on Domestic Firms and Sources of Intra-Industry Spillovers

	(1) ALL	(2) DOMESTIC	(3) ALL	(4) DOMESTIC	(5) ALL	(6) DOMESTIC
SL	0.0278 (0.473)	0.0097 (0.160)	0.0278 (0.473)	0.0097 (0.160)	0.0288 (0.488)	0.0097 (0.159)
lnEMP	0.290*** (5.504)	0.315*** (6.057)	0.290*** (5.502)	0.315*** (6.058)	0.291*** (5.520)	0.316*** (6.056)
FDIsector	-0.0033** (-2.063)	-0.0039** (-2.377)				
FDIminority			-0.0032 (-0.475)	-0.0045 (-0.636)		
FDImajority			-0.0033** (-2.065)	-0.0039** (-2.378)		
FDIpartly					-0.0019 (-0.599)	-0.0033 (-0.829)
FDIfully					-0.0038** (-2.135)	-0.0041** (-2.228)
FDIregion	0.00322 (0.972)	0.00336 (1.010)	0.00323 (0.970)	0.00335 (1.006)	0.00308 (0.922)	0.00335 (1.004)
Constant	-1.104*** (-5.324)	-1.259*** (-6.438)	-1.104*** (-5.316)	-1.258*** (-6.424)	-1.111*** (-5.336)	-1.263*** (-6.429)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1,262	1,096	1,262	1,096	1,262	1,096
Observations	1,862	1,626	1,862	1,626	1,862	1,626
Within R ²	0.08	0.10	0.08	0.10	0.08	0.10
F	8.0	9.6	6.7	8.0	6.8	8.1
Notes: FE estimation technique. Dependent variable is the natural logarithm of TFP. <i>t</i> -values obtained from robust standard errors in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.						

¹⁵ As a check for this conclusion, I rerun the regression with three foreign presence measures. I simultaneously include FDIminority, FDIfully and a slightly modified version of FDImajority in the specification where FDImajority is now calculated on the basis of all firms with a foreign ownership share from 51 to 99 percent. The results (not reported in the table) show that only FDIfully has a negative significant effect on a firm's TFP.

Furthermore, regarding the comparison of the full sample and the subgroup of domestic firms only, the impact on domestic firms is slightly larger but, generally, it replicates the picture from the overall sample as the coefficients in each of the specifications are very similar. To sum up, there is a small negative spillover effect from foreign presence in manufacturing sectors (in the ten Latin American countries) on foreign and domestically owned firms' productivity levels. The effect is caused by fully foreign owned affiliates.

5.3 Country-Specific Analysis

Turning to the country-specific analysis, I estimate the TFP model separately for each country subsample. In this regard, the survey sample offers the valuable opportunity to assess comparable spillover effects for the considered economies. Consequently, I am able to analyze whether the findings differ between the Latin American countries. Tab. 7 illustrates the corresponding regression results in short form, that is, I only report the estimates related to the spillover variables for each country.¹⁶ The regressions are based on the specification of equation (4).

First, I focus on the interpretation of column (1). With respect to intra-industry spillovers measured by *FDIsector*, I find negative estimates for the majority (seven) of the ten countries where only two are statistically significant, namely, for Peru and Uruguay. In both economies, the estimates are similar in size and significant at the ten percent level. An increase in foreign presence in a sector from zero to 100 leads to a decrease in a firm's TFP by 3.1 percent. This impact is roughly ten times larger than the average cross-country effect for the full sample found in the previous section. The other five negative (but insignificant) coefficients refer to the subsamples of Argentina, Chile, Ecuador, Guatemala, and Paraguay and range from 0.0005 to 0.0106. I find positive but also insignificant estimates for Bolivia, Colombia, and Panama. My result for Colombia is in line with the outcome of Kugler (2006) who also finds no evidence for intra-industry spillovers in this country. In addition, the present negative effect for Uruguay is in contrast to the result of Kokko et al. (2001) who show a positive spillover effect for this economy. However, their findings are based on a cross-sectional analysis.

Regarding foreign presence in a region measured by *FDIregion*, the results are different. The majority (six) of the ten coefficients is positive. The striking difference with respect to all previous findings in this study is that I now also identify significant, positive impacts. In Argentina, Colombia, and Paraguay a firm's TFP is positively affected by foreign presence on the regional level as the related estimates are significant at the ten percent level, whereby the significance of the effect in Paraguay is questionable due to the relatively small number of observations for this subsample. The magnitude of the coefficients ranges from 0.0105 for Argentina to 0.0833 for Colombia, and I explain the results for these countries as follows: Due to spatial proximity to foreign owned establishments, domestic and other foreign owned firms benefit in terms of productivity spillovers. In all other countries the multinational activity within a region does not seem to play a role for a firm's TFP as I obtain insignificant coefficients for the corresponding subsamples.

16 I report a detailed illustration of the regression results in the appendix (see Tab. 13).

Finally, the country-specific regression results have to be interpreted with caution as the number of observations related to all subsamples is relatively low. Consequently, some estimates are likely to be biased. For this reason, I refrain from drawing a detailed (quantitative) comparison of the coefficients. Nevertheless, a more general conclusion is reasonable. This investigation with its heterogeneous findings indicates that the impact from foreign presence in an industry and in a region varies between the considered developing economies. However, there is an overall tendency that intra-industry spillovers (intra-region spillovers) are negative (positive) in Latin America as the majority of countries have negative (positive) estimates which is also suggested by the results from the previous section.

Tab. 7: Country-Specific Spillover Effects

Countries	Obs	(1) FDIsector	(2) FDIregion
Argentina	434	-0.0065	0.0105*
Bolivia	56	0.0067	-0.6490
Chile	456	-0.0005	0.0063
Colombia	277	0.0034	0.0833*
Ecuador	93	-0.0051	-0.0102
Guatemala	61	-0.0061	-0.0019
Panama	40	0.0503	0.0558
Paraguay	63	-0.0106	0.0263*
Peru	238	-0.0310*	0.0306
Uruguay	144	-0.0310*	-0.0266
<i>Notes:</i> FE estimation technique. Dependent variable is the natural logarithm of total factor productivity. The values in each row are related to a regression of the corresponding country subsample. A detailed illustration of the regression results is provided in the appendix (see Tab. 13). *significant at 10% level; **significant at 5% level; ***significant at 1% level.			

5.4 Robustness Checks

In order to verify the findings of the previous parts, I assess the impact of FDI on an alternative firm-level productivity measure, namely, labor productivity (*LP*) which is defined as output per employee. The related econometric model is given by equation (7):

$$\ln LP_{ijct} = \alpha + \beta_1 SL_{ijct} + \beta_2 \ln CAP_{ijct} + \beta_3 \ln CapEMP_{ijct} + \beta_4 FDIsector_{jct} + \beta_5 FDIregion_{rct} + \gamma_i + \delta_t + u_{ijct} \quad (7)$$

where the logarithm of labor productivity is dependent on *FDIsector* and *FDIregion*. Additional to the skilled labor share, I include the amount of capital (*CAP*) as well as the capital labor ratio (*CapEMP*) of a firm as further control variables.¹⁷ I consider these measures in the model to control for differences in the amount of capital as well as in the ratios of skilled to unskilled labor and capital to labor used in production, that is, I assume these three variables to explain a considerable part of the variation of labor productivity. Furthermore, I employ again the FE estimator to account for firm heterogeneity and report the regression results in

Tab. 8 where the structure is similar to Tab. 6. To have comparable results for the robustness check, all regressions are based on the same observations as in Tab. 6.

The coefficients of the skilled labor share are insignificant while the estimates for the capital variable and the capital labor ratio are highly significant throughout all columns. For *FDIsector* I find a significant negative coefficient in column (1) which indicates that an increase in foreign presence in a sector where firm *i* is active by 10 percentage points leads to a decrease in firm *i*'s labor productivity by 0.041 percent. The effect is slightly larger for domestic firms only as shown in column (2). Columns (3) to (6) reflect the picture found for the TFP regressions, namely, that the negative intra-industry spillover effect is caused by majority or fully foreign owned firms, respectively. Besides, multinational activity in a region does not affect a firm's labor productivity level as the coefficient of *FDIregion* is insignificant throughout all regressions.

I conclude that the results related to the labor productivity model clearly underpin and confirm the findings from the TFP model. Moreover, it is not only that TFP and labor productivity are affected similarly in quality terms by foreign presence in a sector, but also that the impact is of the same size as the (significant) coefficients are almost identical. Finally, I also replicate the country-specific investigation and estimate the effects from FDI on labor productivity separately for each economy.¹⁸ The outcome shows some differences with respect to the significance of the estimates compared to the TFP regressions. But in general, it supports the findings from the previous section as the estimated coefficients vary between the ten country subsamples and there is a tendency that intra-industry spillovers are negative while intra-regional effects tend to be positive.

¹⁷ The skilled labor share, the amount of capital, and the capital labor ratio are commonly used control variables in a labor productivity model (for instance, Waldkirch & Oforu, 2010).

¹⁸ I report the country-specific results from the LP regressions in the appendix (see Tab. 14).

Tab. 8: Robustness Checks – Labor Productivity Model

	(1) ALL	(2) DOMESTIC	(3) ALL	(4) DOMESTIC	(5) ALL	(6) DOMESTIC
SL	0.0004 (0.0042)	0.0121 (0.179)	0.0004 (0.0048)	0.0121 (0.179)	-0.0007 (-0.0088)	0.0124 (0.183)
lnCAP	-0.203** (-2.340)	-0.232*** (-3.988)	-0.203** (-2.338)	-0.232*** (-3.987)	-0.204** (-2.344)	-0.231*** (-3.977)
lnCapEMP	0.306*** (3.364)	0.308*** (4.624)	0.305*** (3.365)	0.308*** (4.624)	0.306*** (3.371)	0.307*** (4.620)
FDIsector	-0.0047** (-2.286)	-0.0052** (-2.446)				
FDIminority			-0.0068 (-0.745)	-0.0067 (-0.746)		
FDImajority			-0.0047** (-2.288)	-0.0052** (-2.450)		
FDIpartly					-0.0058 (-1.446)	-0.0050 (-1.099)
FDIfully					-0.0041* (-1.804)	-0.0052** (-2.191)
FDIregion	-0.0020 (-0.462)	-0.0020 (-0.525)	-0.0021 (-0.475)	-0.0020 (-0.534)	-0.0018 (-0.412)	-0.0020 (-0.518)
Constant	10.02*** (25.58)	10.26*** (41.92)	10.03*** (25.44)	10.26*** (41.77)	10.03*** (25.44)	10.26*** (41.43)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1,262	1,096	1,262	1,096	1,262	1,096
Observations	1,862	1,626	1,862	1,626	1,862	1,626
Within R2	0.07	0.08	0.07	0.08	0.07	0.08
F	5.0	5.0	4.3	4.3	4.4	4.3
<i>Notes:</i> FE estimation technique. Dependent variable is the natural logarithm of labor productivity. t-values obtained from robust standard errors in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.						

6 CONCLUDING REMARKS

I contribute to the literature that investigates productivity spillover effects from FDI. In this context, I employ comparable firm-level panel data from ten Latin American (developing) countries in order to estimate the spillover effects from FDI on firms' productivity levels. More precisely, I measure foreign presence at the sectoral and at the regional level, and assess the impact of both measures, first, as an average effect for all included economies and thereafter for each country separately.

The results indicate that (on average) there is a small negative spillover effect from foreign presence in an industry sector on a firm's productivity across countries in Latin America, while there seems to be no impact from multinational activity at the regional level. Furthermore, I observe that the negative intra-industry spillover is caused by wholly owned foreign affiliates. The country-specific investigation indicates that the spillover effects differ among the considered economies whereas there is a tendency that the presence of FDI in a sector (region) has a negative (positive) impact. However, I can show explicit negative intra-industry spillovers only for Peru and Uruguay and explicit positive intra-regional spillovers only for Argentina and Colombia. Given the estimated results based on firm-level data, the main contributions of my work are that I assess the spillover effects for a considerable set of developing economies and that I can show comparable findings for these countries in Latin America.

Based upon my results I am able to formulate some implications that are relevant from the development policy angle. As the negative horizontal spillover effects stem from wholly owned foreign affiliates, policy makers should consider granting incentives that attract joint ventures in order to prevent negative intra-industry spillovers. Furthermore, as there is a tendency of positive spillovers due to spatial proximity to MNEs in developing countries, governments should design some kind of industry zones where MNEs are located close to local firms and implement an advanced business environment with a good infrastructure to foster the exchange between firms as well as the potential for spillovers on the regional level.

For future research projects, it would be of advantage to have a more extensive panel data set that includes more firms of each economy on the one hand and covers more time periods on the other hand. The former aspect enables the estimation of more reliable results for each country and thereby permitting the differences between countries to be quantified. The latter aspect allows the use of more sophisticated estimation techniques and thus helps in strengthening the findings overall. Moreover, the questionnaires of surveys should also be geared towards the collection of information that is relevant for measuring the transmission channels of FDI spillovers, for instance, the migration of workers between firms.

REFERENCES

- Aitken, B. J. /Hanson, G. H. /Harrison, A. E. (1997): Spillovers, Foreign Investment, and Export Behavior. In: *Journal of International Economics*, 43 (1-2), pp. 103-132.
- Aitken, B. J. /Harrison, A. E. (1999): Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. In: *American Economic Review*, 89 (3), pp. 605-618.
- Barrios, S. /Dimelis, S. /Louri, H. /Strobl, E. (2004): Efficiency Spillovers from Foreign Direct Investment in the EU Periphery: A Comparative Study of Greece, Ireland, and Spain. In: *Review of World Economics*, 140 (4), pp. 688-705.
- Blomström, M. /Kokko, A. (1998): Multinational Corporations and Spillovers. In: *Journal of Economic Surveys*, 12 (2), pp. 1-31.
- Blomström, M. /Kokko, A. (2003): The Economics of Foreign Direct Investment Incentives. NBER Working Paper Series, No. 9489. National Bureau of Economic Research.
- Blomström, M. /Sjöholm, F. (1999): Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter? In: *European Economic Review*, 43 (4-6), pp. 915-923.
- Bwalya, S. M. (2006): Foreign Direct Investment and Technology Spillovers: Evidence from Panel Data Analysis of Manufacturing Firms in Zambia. In: *Journal of Development Economics*, 81 (2), pp. 514-526.
- Damgaard, J. (2011): Productivity Spillovers from FDI: Ownership Structures, Domestic Firm Characteristics, and FDI Characteristics. Danmarks Nationalbank Working Papers, No. 72. Danmarks Nationalbank.
- Das, S. (1987): Externalities, and Technology Transfer through Multinational Corporations: A Theoretical Analysis. In: *Journal of International Economics*, 22 (1-2), pp. 171-182.
- De Loecker, J. (2007): Product Differentiation, Multi-Product Firms and Estimating the Impact of Trade Liberalization on Productivity. NBER Working Paper Series, No. 13155. National Bureau of Economic Research.
- Fosfuri, A. /Motta, M. /Ronde, T. (2001): Foreign Direct Investment and Spillovers through Worker Mobility. In: *Journal of International Economics*, 53 (1), pp. 205-222.
- Glass, A. J. /Saggi, K. (2002): Multinational Firms and Technology Transfer. In: *Scandinavian Journal of Economics*, 104 (4), pp. 495-513.
- Görg, H. /Greenaway, D. (2004): Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment? In: *World Bank Research Observer*, 19 (2), pp. 171-197.
- Görg, H. /Strobl, E. (2001): Multinational Companies and Productivity Spillovers: A Meta-Analysis. In: *Economic Journal*, 111 (475), pp. 723-739.

- Görg, H. /Strobl, E. (2005): Spillovers from Foreign Firms through Worker Mobility: An Empirical Investigation. In: *Scandinavian Journal of Economics*, 107 (4), pp. 693-709.
- Greenaway, D. /Sousa, N. /Wakelin, K. (2004): Do Domestic Firms Learn to Export from Multinationals? In: *European Journal of Political Economy*, 20 (4), pp. 1027-1043.
- Griliches, Z. /Mairesse, J. (1995): *Production Functions: The Search for Identification*. NBER Working Paper Series, No. 5067. National Bureau of Economic Research.
- Haddad, M. /Harrison, A. E. (1993): Are there Positive Spillovers from Direct Foreign Investment? In: *Journal of Development Economics*, 42 (1), pp. 51-74.
- Helpman, E. /Melitz, M. J. /Yeaple, S. R. (2004): Export Versus FDI with Heterogeneous Firms. In: *American Economic Review*, 94 (1), pp. 300-316.
- Javorcik, B. S. (2004): Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In *Search of Spillovers through Backward Linkages*. In: *American Economic Review*, 94 (3), pp. 605-627.
- Javorcik, B. S. (2008): Can Survey Evidence Shed Light on Spillovers from Foreign Direct Investment. In: *World Bank Research Observer*, 23 (2), pp. 139-159.
- Javorcik, B. S. /Spatareanu, M. (2008): To Share or not to Share: Does Local Participation Matter for Spillovers from Foreign Direct Investment? In: *Journal of Development Economics*, 85 (1-2), pp. 194-217.
- Kokko, A. /Zejan, M. /Tansini, R. (2001): Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay. In: *Weltwirtschaftliches Archiv*, 137 (1), pp. 124-149.
- Konings, J. (2001): The Effects of Foreign Direct Investment on Domestic Firms. In: *Economics of Transition*, 9 (3), pp. 619-633.
- Kugler, M. (2006): Spillovers from Foreign Direct Investment: Within or Between Industries? In: *Journal of Development Economics*, 80 (2), pp. 444-477.
- Levinsohn, J. /Petrin, A. (2003): Estimating Production Functions Using Inputs to Control for Unobservables. In: *Review of Economic Studies*, 70 (2), pp. 317-342.
- Müller, T. /Schnitzer, M. (2006): Technology Transfer and Spillovers in International Joint Ventures. In: *Journal of International Economics*, 68 (2), pp. 456-468.
- Olley, S. /Pakes, A. (1996): The Dynamics of Productivity in the Telecommunications Equipment Industry. In: *Econometrica*, 64 (6), pp. 1263-1297.
- Saliola, F. /Seker, M. (2011): Total Factor Productivity across the Developing World. *Enterprise Note Series*, No. 23. The World Bank.
- Smeets, R. (2008): Collecting the Pieces of the FDI Knowledge Spillovers Puzzle. In: *World Bank Research Observer*, 23 (2), pp. 107-138.
- Solow, R. M. (1957): Technical Change and the Aggregate Production Function. In: *Review of Economics and Statistics*, 39 (3), pp. 312-320.
- Tondl, G. /Fornero, J. A. (2010): Sectoral Productivity and Spillover Effects in Latin America. *FIW Working Paper Series*, No. 53. Austrian Institute for International Economics.

- Van Beveren, I. (2012): Total Factor Productivity Estimation: A Practical Review. In: Journal of Economic Surveys, 26 (1), pp. 98-128.
- Waldkirch, A. /Ofosu, A. (2010): Foreign Presence, Spillovers, and Productivity: Evidence from Ghana. In: World Development, 38 (8), pp. 1114-1126.
- Wang, J-Y. /Blomström, M. (1992): Foreign Investment and Technology Transfer: A Simple Model. In: European Economic Review, 36 (1), pp. 137-155.
- World Bank (2011): Enterprise Surveys (<http://www.enterprisesurveys.org>).
- Yasar, M. /Morrison Paul, C. J. (2007): Firm Performance and Foreign Direct Investment: Evidence from Transition Economies. In: Economics Bulletin, 15 (21), pp. 1-11.

APPENDIX

Tab. 9: Official Exchange Rate (LCU/USD; Annual Average)

Country	2006	2010
Argentina	3.05	3.90
Bolivia	8.01	7.02
Chile	530.28	510.25
Colombia	2361.14	1898.57
Ecuador	LCU = USD since 2000	LCU = USD since 2000
Guatemala	7.60	8.06
Panama	1.00	1.00
Paraguay	5635.46	4735.46
Peru	3.27	2.83
Uruguay	24.07	20.06
<p><i>Note:</i> Definition given by the World Bank: “The official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).”</p> <p><i>Source:</i> World Development Indicators, The World Bank.</p>		

Tab. 10: Definition of Firm-Level Variables

Variable	Definition
<i>Y</i>	Output: Total sales in last fiscal year in USD
<i>MAT</i>	Costs of raw materials and intermediate goods used in production in last fiscal year in USD
<i>LAB</i>	Total labor costs (incl. wages, salaries, etc.) in last fiscal year in USD
<i>CAP</i>	Costs to re-purchase all of its machinery, vehicles, equipment, land, and buildings in USD
<i>FDI</i>	Percent owned by private foreign individuals, companies or organizations
<i>EMP</i>	Total employment: Number of permanent and temporary, full-time employees at the end of the last fiscal year
<i>LP</i>	Labor productivity: Which is calculated as total sales divided by total employment ($LP = Y / EMP$)
<i>SL</i>	Skilled labor share: Share of skilled, permanent, full-time production workers in all workers
<i>CapEMP</i>	Capital labor ratio: <i>CAP</i> divided by <i>EMP</i>

Tab. II: Regions within the Countries

Country	Number of Regions	Regions
Argentina	4	Buenos Aires, Rosario, Mendoza, Cordoba
Bolivia	3	La Paz, Santa Cruz, Cochabamba
Chile	4	Antofagasta, Los Lagos, Santiago, Valparaíso
Colombia	4	Bogota, Cali, Medellin, Barranquilla
Ecuador	3	Pichincha, Guayas, Azuay
Guatemala	2	Guatemala City, Rest of the country
Panama	2	Panama City, Rest of the country
Paraguay	2	Asuncion, Central
Peru	3	Lima, Arequipa, Chiclayo
Uruguay	2	Montevideo, Canelones

Tab. 12: Summary Statistics of Various Variables

Variable	obs.	mean	Median	SD	min	max	Within SD
EMP	1,862	147	35	489.1	2	9,150	177.1
lnEMP	1,862	3.76	3.56	1.36	0.69	9.12	0.22
lnY	1,862	13.91	13.72	1.95	6.28	20.88	0.34
lnLAB	1,862	12.16	12	1.84	0	18.33	0.41
lnMAT	1,862	12.85	12.70	2.21	0	19.29	0.67
lnCAP	1,862	13.16	13.16	2.52	0	20.67	0.97
lnTFP	1,862	-0.01	-0.13	1.08	-3.15	4.99	0.24
SL	1,862	0.58	0.6	0.35	0	1	0.17
FDI	1,862	7.37	0	24.73	0	100	8.19
lnLP	1,862	10.16	10.14	1.05	2.72	15.33	0.33
lnCapEMP	1,862	9.44	9.66	1.77	0	15.10	0.80

Tab. 13: Country-Specific TFP Regressions

	(1) ARGENTINA	(2) BOLIVIA	(3) CHILE	(4) COLOMBIA	(5) ECUADOR	(6) GUATEMALA	(7) PARAGUAY	(8) PANAMA	(9) PERU	(10) URUGUAY
SL	0.0984	1.118	-0.115	0.0867	0.162	-0.359	0.349	-0.00980	0.247	-0.305
	(0.803)	(0.638)	(-1.121)	(0.818)	(0.597)	(-0.836)	(0.476)	(-0.0520)	(1.523)	(-0.900)
lnEMP	0.204**	-0.223	0.480***	0.350***	0.711***	0.793**	-1.034**	0.0349	0.232**	0.323
	(2.485)	(-0.376)	(5.470)	(4.252)	(3.325)	(2.468)	(-2.104)	(0.190)	(2.113)	(1.310)
FDIsector	-0.00651	0.00666	-0.000493	0.00338	-0.00510	-0.00611	0.0503	-0.0106	-0.0310*	-0.0310*
	(-1.136)	(0.276)	(-0.138)	(1.115)	(-1.061)	(-1.083)	(1.017)	(-0.803)	(-1.932)	(-1.905)
FDIregion	0.0105*	-0.649	0.00629	0.0833*	-0.0102	-0.00187	0.0558	0.0263*	0.0306	-0.0266
	(1.800)	(-0.832)	(0.725)	(1.702)	(-0.775)	(-0.237)	(1.276)	(1.788)	(0.817)	(-0.778)
Constant	-0.809**	10.25	-1.703***	-2.124***	-2.691***	-2.821**	1.965	-0.762	-0.904	0.159
	(-2.294)	(0.878)	(-4.425)	(-4.161)	(-3.092)	(-2.603)	(1.445)	(-0.840)	(-1.233)	(0.127)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	295	46	286	182	57	40	31	47	169	109
Observations	434	56	456	277	93	61	40	63	238	144
Within R ²	0.091	0.272	0.168	0.143	0.318	0.397	0.561	0.546	0.197	0.134
F	3.219	1.364	7.326	4.152	3.426	9.257	10.70	6.202	3.007	1.293
Notes: FE estimation technique. Dependent variable is the natural logarithm of TFP. <i>t</i> -values obtained from robust standard errors in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.										

Tab. 14: Country-Specific LP Regressions

	(1) ARGENTINA	(2) BOLIVIA	(3) CHILE	(4) COLOMBIA	(5) ECUADOR	(6) GUATEMALA	(7) PARAGUAY	(8) PANAMA	(9) PERU	(10) URUGUAY
SL	0.122	1.456	-0.0428	0.0445	0.300	-0.556	0.360	-1.947	0.310*	-0.476
	(0.887)	(0.975)	(-0.371)	(0.363)	(1.182)	(-0.923)	(0.233)	(-1.275)	(1.703)	(-1.121)
lnCAP	-0.449***	-0.0284	-0.139	-0.192**	0.121	0.632***	-0.411	-1.397	-0.406***	-0.435**
	(-3.515)	(-0.0256)	(-1.552)	(-2.146)	(0.450)	(2.769)	(-0.553)	(-1.663)	(-3.212)	(-2.277)
lnCAPperEMP	0.475***	-0.391	0.217**	0.290***	0.0186	-0.853**	0.693	1.366*	0.507***	0.586***
	(4.203)	(-0.269)	(2.052)	(3.057)	(0.0705)	(-2.326)	(0.633)	(1.716)	(3.165)	(3.173)
FDIsector	-0.0100	-0.0191	0.00369	0.00201	0.00311	-0.0105	0.0820	-0.0679	-0.0233	-0.0302*
	(-1.486)	(-0.711)	(0.934)	(0.533)	(0.639)	(-1.140)	(0.545)	(-1.273)	(-1.239)	(-1.790)
FDIregion	0.00813	-0.145	0.00586	0.0477	-0.0119	-0.0147	0.0216	-0.0551	0.0211	0.00432
	(1.544)	(-0.140)	(0.691)	(0.950)	(-0.725)	(-0.646)	(0.216)	(-0.673)	(0.679)	(0.168)
Constant	11.82***	14.97	10.18***	9.179***	8.036***	9.921***	6.962	17.55***	10.53***	10.97***
	(14.76)	(0.937)	(24.19)	(13.96)	(5.908)	(10.37)	(1.583)	(2.888)	(17.70)	(9.028)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	295	46	286	182	57	40	31	47	169	109
Observations	434	56	456	277	93	61	40	63	238	144
Within R ²	0.302	0.516	0.054	0.153	0.161	0.454	0.138	0.440	0.332	0.346
F	12.71	2.200	1.196	3.339	1.663	5.557	0.738	2.037	3.984	6.477
<i>Notes:</i> FE estimation technique. Dependent variable is the natural logarithm of labor productivity. <i>t</i> -values obtained from robust standard errors in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.										