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Quantifying Productivity Gains from Foreign Investment

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Abstract

We quantify the causal effect of foreign investment on total factor productivity (TFP) using a new global firm-level database. Our identification strategy relies on exploiting the difference in the amount of foreign investment by financial and industrial investors and simultaneously controlling for unobservable firm and country-sector-year factors. Using our well identified firm level estimates for the direct effect of foreign ownership on acquired firms and for the spillover effects on domestic firms, we calculate the aggregate impact of foreign investment on country-level productivity growth and find it to be very small.

JEL: E32, F15, F36, O16.

Keywords: Multinationals, FDI, Knowledge Spillovers, Selection, Productivity.

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1 Introduction

A key feature of globalization is the increase in the flows of foreign direct investment (FDI) to both developed countries and emerging markets. What is the effect of such investment on aggregate productivity growth? Policy makers assume the effect on country growth will be significant due to expected spillovers from multinationals and their subsidiaries to domestic firms in the host country in the form of superior technology and organizational practices. As a result there has been an extensive policy push to increase FDI at the expense of debt as the major source of external financing in the last two decades, which makes the effect of FDI on aggregate productivity a first order question to investigate.

Macro-level studies generally document a positive correlation between country-level growth and FDI flows,[1] while micro-level studies document that multinationals outperform domestic firms.[2] Unfortunately, both literatures face severe identification problems. At the macro-level, changes in the volume of FDI almost always coincide with macroeconomic policy reforms, making it hard to identify the effect of those flows from the effect of the policy reforms. At the firm-level most FDI takes the form of acquisitions rather than greenfield investment, making it difficult to know if a positive correlation between FDI and productivity is due to foreign firms causing productivity increases or foreign firms spotting firms which have good growth prospects whether they receive FDI or not.[3] Since firms select themselves into becoming exporters and multinationals (see Melitz (2003), Helpman, Melitz, and Yeaple (2004)), multinationals that engage in FDI are likely to be highly productive and likely to buy local firms with relatively high productivity and high

[1] In general, the positive correlation found at the macro-level between FDI and economic growth is conditional on some threshold level of human capital and financial development in the country; see Alfaro, Chandra, Kalemli-Ozcan, and Sayek (2004), Borensztein, De Gregorio, and Lee (1998) and Villegas-Sanchez (2010).

[2] Caves (1996), Helpman, Melitz, and Yeaple (2004), Arnold and Javorcik (2009), Guadalupe, Kuzmina, and Thomas (2012).

[3] 90% of FDI is conducted through acquisitions according to Barba-Navaretti and Venables (2004), which provides an excellent survey of the literature.

future growth potential. Hence, the positive selection at the firm-level must be accounted for through controlling both unobserved firm-specific factors and firm's future growth potential.

Entry of multinationals may also affect the average productivity of domestic firms even in the absence of productivity effects on acquired firms: research has found a "business-stealing" effect leading to potential exit of domestic firms (negative selection) due to more intense competition for factors of production or market shares.[4] At the same time, it is also possible that domestic firms in sector which receive substantial amounts of FDI become more productive due to spillovers from foreign-owned firms. To pin down such potential effects, we have to account for exit, competition and knowledge spillover effects together with sector-level selection; that is, why FDI was more attracted to certain sectors in the first place.

Our unique world-wide panel of firm-level data allows us to get around these identification challenges and enables us to produce well-identified firm-level estimates for the productivity gains from FDI. Our approach is straightforward. To control for firm- and sector-specific selection, we use sector-time and firm fixed effects, which account for fixed firm factors and all time varying changes in a sector or country that attract multinationals, such as better location, policy reform, or broad technological innovation. To account for unobserved heterogeneity at the firm-sector-time level, we use our unique information on investors' identity to construct exogenous instruments. Our identification rests on the difference between foreign financial investors (banks, hedge-funds, mutual-funds) and foreign industrial investors (manufacturing firms) investing in the same domestic sector. Financial investors typically hold smaller stakes for earnings and diversification and do not actively manage their targets. Industrial investors typically attempt to improve the productivity and profitability of their investment targets by merging production units, marketing, research, etc. We call the former type of investment "financial FDI" and the latter

[4]See Aitken and Harrison (1999); Harrison, Martin, and Nataraj (2011); Bloom, Schankerman, and Van Reenen (2013).

type "industrial FDI." The observation that both industrial and financial FDI is attracted by growth prospects in a given sector but only industrial foreign ownership causes productivity growth allows us to construct an instrument which identifies the causal effect of foreign ownership on productivity. More precisely, our identifying assumption is that the amount of industrial FDI which is orthogonal to financial FDI is exogenous to TFP growth.

Our data comes from the ORBIS database (compiled by Bureau van Dijk Electronic Publishing, BvD) and covers 60 countries worldwide, developed and emerging. The data set has financial accounting information from detailed harmonized balance-sheets of target companies, their investors, and non-acquired companies. It also provides the amount of foreign investment together with the type and country of origin of the investor. The dataset is crucially different from the other data sets that are commonly-used in the literature such as COMPUSTAT for the United States, Compustat Global, and Worldscope databases in that 99 percent of the companies in ORBIS are private, whereas the former popular data sets mainly contain information on large listed companies. A fundamental advantage is the detailed ownership information provided encompassing over 30 million shareholder/subsidiary "links."

Foreign investment is not usually in the form of 100 percent ownership. We know the percentage of foreign ownership and therefore we can explore heterogeneity in foreign investment. Given the possibility that such heterogeneity may interact with heterogeneity in total factor productivity,[5] it is important to know the exact amount of investment. Due to data availability, the literature most often uses a dummy variable which indicates whether the firm is owned by an "overseas" entity in the amount of more than a certain percent; see, for example, Bloom, Sadun, and Van Reenen (2009), Keller and Yeaple (2009) and Haskel, Pereira, and Slaughter (2007). Other papers use 100 percent foreign-owned subsidiaries of multinationals; see, for example, Desai, Foley, and Forbes (2007) and Alfaro and Chen (2012).

[5]Syverson (2011) finds a very wide range of productivity levels across firms.

Neither case will give a full description of heterogeneity in multinational investment.[6]

We first ask whether foreign-owned firms become more productive with increased foreign ownership; that is, we estimate dynamic relations with foreign ownership growth and productivity growth (for brevity, "difference regressions"). The literature has only found a positive correlation between the *level* of productivity and *level* of foreign ownership and not between *changes* in productivity and *changes* in foreign ownership. To put it differently, upon inclusion of firm fixed effects (or, alternatively, estimating growth-on-growth), no relation between FDI and productivity has been uncovered (see Aitken and Harrison (1999); Javorcik (2004); Liu (2008)).[7] Allowing for firm fixed effects, we find that foreign owned firms/multinational affiliates are more productive both in developed and emerging countries; however, using Instrumental Variable (IV) estimation, we show that this effect is driven mainly by investors cherry-picking firms with high future growth potential.

Second, we ask whether domestic firms (with zero foreign ownership) operating in the same sector as foreign affiliates become more productive with increased foreign presence? The spillover literature aggregates firm-level FDI to the sectoral level and tests for potential productivity spillovers to domestic firms in the same or vertically-linked sectors. It finds negative horizontal spillovers in emerging countries and positive horizontal spillovers in developed countries, and positive vertical spillovers (between two-digit upstream and downstream sectors) in both sets of countries. The explanation has been that negative competition and business stealing

[6]Exceptions are Javorcik (2004), Aitken and Harrison (1999), and Arnold and Javorcik (2009), who use firm-level ownership shares. Their samples are limited to firms from single countries.

[7]Arnold and Javorcik (2009) and Guadalupe, Kuzmina, and Thomas (2012) did not use fixed-effects estimation, but instead employed propensity-score matching to deal with this "cherry-picking" behavior, and find a positive effect of foreign investment on productivity. We believe the differences in results are due to differences in estimation techniques and variables. Arnold and Javorcik (2009) investigate FDI effects on plants but, as shown by Lileeva and Trefler (2010), the average effect on a firm might be nil if some plants are affected and some are not. Our data is at the firm level and, therefore, our results are not directly comparable with Arnold and Javorcik (2009). Firm headquarters receive investments and allocate funds to certain plants. Guadalupe, Kuzmina, and Thomas (2012) investigate the effect on labor productivity, while we solely focus on total factor productivity.

effects in the same "horizontal" sectors are relatively more pronounced in emerging countries. The existing literature does not explicitly control for sector-time trends and shocks because it focuses on a single country at a time. To identify spillover effects, controlling for sector-year influences, is of a first-order importance for alleviating selection concerns because we try to trace the productivity impact of *sectoral* foreign presence on domestic firms. Typically, sectoral foreign presence is correlated with other sector-year events and, thus, potential alternative determinants of productivity, which can only be controlled for in the multi-country samples.

We find negative horizontal spillovers for both developed and emerging countries. To dig deeper, we take advantage of our relatively fine four-digit firm classification and investigate spillovers within two digit sectors. We interpret spillovers to closely related firms as competition effects and spillovers to less closely related firms as knowledge transmission. "Knowledge spillovers," in our sense, are different from vertical knowledge spillovers which are usually defined as spillovers between two-digit downstream sectors such as, for example, car manufacturers and electricity producers. Our knowledge spillovers are true "intra-industry" knowledge spillovers within the same two digit sector but different four digit sector, for example, between car manufacturers and car part producers.

We find evidence of positive spillovers from foreign activity only for developed countries when we look at domestic firms which are not direct competitors of the foreign firms (in the same two-digit, but different four-digit sector). We further demonstrate that these effects are concentrated among relatively more productive domestic firms. We do not find such effects for emerging markets.[8] In both set of countries, we find clear negative competition effects for domestic firms that are direct competitors (in the same four-digit sector). These effects are driven mainly by market share reallocation, rather than by entry and exit.

The final exercise is a back-of-the-envelope calculation, using our firm-level es-

[8]We find a negative knowledge spillover effect that might possibly be due to foreigner-owned firms sourcing from foreign firms, rather than from domestic firms.

timates to evaluate the aggregate (country-level) effect of FDI. In terms of magnitudes, our estimates imply that even a huge increase in FDI is not important for country-level productivity growth. For example, a doubling of FDI from its current levels at the country-level, implies, using our micro estimates an increase in total factor productivity (which roughly translates into an increase in GDP) of about 0.01 percentage in developed countries and a drop of 0.01 percent in emerging countries. These numbers incorporate both direct and spillover effects.

The rest of the paper is structured as follows. Section 2 presents a detailed description of our methodology for estimating direct and spillover effects. Section 3 details our identification strategy. Section 4 reviews the data. Section 5 shows the results and Section 6 concludes.

2 Direct and Spillover Effects: Methodology

Foreign Ownership and Productivity of the Acquired Firms

We start the empirical analysis by exploring the relationship between foreign ownership and firm productivity. We estimate the following equation:

$$\log\left(\text{TFP}_{i,s,c,t}\right) = \beta\, \text{FO}_{i,s,c,t} + \alpha_i + \mu_{c,s,t} + \epsilon_{i,s,c,t}\,, \tag{1}$$

where $\text{TFP}_{i,s,c,t}$ refers to total factor productivity of firm i, in sector s, in country c, at time t, and $\text{FO}_{i,s,c,t}$ is the percentage of firm i's capital owned by foreign investors at time t. α_i represents firm-specific dummies, $\mu_{c,s,t}$ represents country-sector-year (country×sector×year) dummies (fixed effects).

The parameter of interest is the "within" coefficient, β: a positive β implies that changes in foreign ownership are associated with increasing productivity relative to firms that stay domestically owned. Firms are quite heterogenous and while most existing literature estimates equations similar to equation (1) by Ordinary Least Squares (OLS), this is quite inefficient if the variance of the error terms differs

across firms. We therefore estimate equation (1) by two-step feasible GLS.[9]

Productivity Spillovers to Domestic Firms

Horizontal Spillovers. Traditionally, the literature on FDI spillover has estimated an equation of the following type for the sample of domestic firms:[10]

$$\log\left(\text{TFP}_{i,s,t}\right) = \beta \text{Spillover}_{s,t} + \alpha_i + \mu_t + \epsilon_{i,s,t} \tag{2}$$

where $\text{TFP}_{i,s,t}$ refers to total factor productivity of firm i, in sector s, at time t and $\text{Spillover}_{s,t}$ is a regressor, to be discussed, which captures the presence of foreign ownership in sector s. α_i represents firm-specific dummies and μ_t represents year dummies. The parameter of interest is β and a positive coefficient indicates positive productivity spillovers from foreign-owned companies to domestic firms. With firm-fixed effects included, β captures the correlation between the changes in the Spillover variable at the sector level and changes in firm TFP.

However, there are potential sources of endogeneity. For example, certain sectors may be expected to have high productivity growth (e.g.; telecommunications due to recent technological advances) and such sectors are likely to attract foreign investment. We can control for such patterns by including sector-year fixed effects, which is possible only in a multi-country data set when the spillover variable is at the sector level. Further, we control for the possibility that certain countries, such as the Baltics, are in a growth and investment phase by including country-year fixed effects. We estimate the following equation by GLS for the sample of domestic firms

[9]The first step estimates the equation by OLS and for each firm the square root of the mean squared residuals is calculated. In the second step, the regression is repeated, weighting each firm by the inverse of its estimated residual standard error. GLS, although less so than OLS, can be sensitive to the effects of outliers and therefore, we winsorize the lower tail of the weights distribution at 5%. Graphical inspection of a partial correlation plot of the regression revealed that there are no obvious outliers. In addition, similar results were found if weights were obtained with a parametric model of the error variance (i.e., estimating standard errors as a function of firm characteristics).

[10]Domestic firms are those that were never acquired by foreign-owned investors over the sample period.

only as:

$$\log\left(\text{TFP}_{i,s,c,t}\right) = \beta \text{Spillover}_{s,c,t} + \alpha_i + \mu_{c,t} + \phi_{s,t} + \epsilon_{i,s,c,t} \tag{3}$$

where $\text{TFP}_{i,s,c,t}$ refers to total factor productivity of firm i, in sector s, country c, at time t where the terms $\mu_{c,t}$ and $\phi_{s,t}$ represent country-year and sectoral-year fixed effects, respectively.

Studies of FDI spillovers (horizontal and vertical) typically rely on a two-digit industry classification. We argue that the two-digit classification is too aggregated to properly identify spillovers and may mask important heterogeneity at finer sector classifications. To make this point clearly, we define, in the same fashion as most previous work, for each country a variable intended to capture (horizontal) spillovers in the same industry at a *two-digit* level as $\text{Spillover}_{s2,t} = \frac{\sum_{i \in s2} \text{FO}_{i,t} \times \text{Y}_{i,t}}{\sum_{i \in s2} \text{Y}_{i,t}}$, where $s2$ refers to the two-digit sector classification and $\text{Y}_{i,t}$ output (operating revenue) of firm i. (Country subscripts are suppressed for better exposition.) Second, we define horizontal "Spillover_Competition" at the *four-digit* classification for each country as $\text{Spillover\_Competition}_{s4,t} = \frac{\sum_{i \in s4} \text{FO}_{i,t} \times \text{Y}_{i,t}}{\sum_{i \in s4} \text{Y}_{i,t}}$, where $s4$ indicates a *four-digit* sector classification. Finally, we define "Spillover_Knowledge:" as $\text{Spillover\_Knowledge}_{s4,t} = \text{Spillover}_{s2,t} - \frac{\sum_{i \in s4} \text{FO}_{i,t} \times \text{Y}_{i,t}}{\sum_{i \in s2} \text{Y}_{i,t}}$, where the notation is identical to that of the previous equations, specifically $\text{Spillover}_{s2,t}$ is defined before. The knowledge spillover variable captures foreign presence in the same two-digit sector, excluding output produced by foreign-owned companies in the same four-digit sector. For example, if a foreign-owned company is a car manufacturer (four-digit sector classification 2910), it is possible that manufactures of electrical and electronic equipment for motor vehicles (classification (2931)) would establish a business relationship with the company leading to knowledge transfers but not competition.

Vertical Spillovers. We round out the analysis of spillover effects by studying the role of vertical spillovers. The lack of positive horizontal spillover effects in emerging countries have lead researchers to search for spillovers along the supply chain. Contacts with foreign-owned customers and suppliers could affect productiv-

ity, in particular, because more advanced foreign owned firms may demand higher quality inputs from suppliers than required by domestic firms in the same sector. We follow Javorcik (2004) and define $\text{Spillover\_Backward}_{j,t}$ as a measure of foreign presence in industries that are being supplied by sector j as $\text{Spillover\_Backward}_{j,t} = \sum_{k \neq j} \alpha_{jk} \text{Spillover}_{k2,t}$ where α_{jk}: proportion of sector j output supplied to sector k where both j and k are two-digit sectors. The aim of this variable is to capture contacts between domestic suppliers and foreign-owned customers. The α coefficients are obtained from input-output matrices.

Similarly, we define $\text{Spillover\_Forward}_{j,t}$ as a measure of foreign presence in industries supplied by sector j. The aim of this variable is to capture contacts between foreign-owned suppliers and domestic customers as $\text{Spillover\_Forward}_{j,t} = \sum_{m \neq j} \sigma_{jm} \text{Spillover}_{m2,t}$, where σ_{jm} is the share of inputs purchased by industry j from industry m in total inputs sourced by sector j.[11] We obtain the input-output coefficients from the World Input-Output Database (WIOD at $http://www.wiod.org/$) which provides standardize input-output matrices during the period 1995–2009, for the following countries in our sample: Austria, Belgium, Bulgaria, Czec Republic, Germany, Spain, Estonia, Finland, France, Hungary, Italy, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden. We use input-output coefficient that vary year-by-year (most articles in the literature were limited to using input-output coefficients from a single year).[12]

Business Stealing

In order to shed some light on the spillover results and further investigate the possibility of competition effects, we explore whether foreign-owned companies tend to increase their market shares. Increasing market shares of foreign companies do

[11] In calculating α_{jk} and σ_{jm} output sold for final consumption was excluded. However, to have the most complete information we use output sold/bought from all sectors in the economy (35 sectors) rather than just manufacturing sectors (14 sectors).

[12] The input-output coefficients provided by WIOD correspond to the two-digit sector classification according to NACE Rev 1.1. We use sector correspondence tables to make the link to the two-digit NACE Rev. 2 classification available in our dataset.

not in themselves imply declining productivity of competitors but if competition effects are important, market shares of foreign owned firms should increase. We estimate the following equation:

$$\log\left(\text{MS}_{i,s,c,t}\right) = \beta \text{FO}_{i,s,c,t} + \alpha_i + \mu_{c,s,t} + \epsilon_{i,s,t} \tag{4}$$

where $\text{MS}_{i,s,c,t}$ refers to the market share of firm i, in sector s, country c, at time t.

3 Identification

In this section, we explain the intuition behind the construction of our instruments. A detailed discussion of their validity is relegated to the WEB-appendix. We use instruments with the structure $\text{Z}_{i,t} = \widehat{\text{FO}_i}\,\text{W}_{s,c,t}$, where $\widehat{\text{FO}_i}$ is a non-time varying measure of predicted foreign ownership of firm i and $\text{W}_{s,c,t}$ is a measure that captures the exogenous *growth* in foreign ownership that varies by country, sector, and time but not by firm (implicit in the notation is that c and s denote the country and sector, respectively, in which firm i operates). This instrument needs to be correlated with $\text{FO}_{i,t}$ in equation (TFP) ("relevance") and it needs to satisfy the exclusion restriction that it is uncorrelated with the structural innovation term $u_{i,t}$ (see Appendix). The relevance condition is intuitive: firms with more predicted foreign ownership increase foreign ownership faster. If this condition is not satisfied it will be revealed by insignificant empirical results—the relevance assumption will not lead to bias.

To construct our instrument, first, we choose $\widehat{\text{FO}_i}$ to be the initial level of foreign ownership FO_{i0}.[13] For this to be valid, it is essential that firm fixed effects are included in the regression.

Second, for a time-varying measure of growth in foreign ownership, $\text{W}_{s,c,t}$, (now

[13] We obtain very similar results by estimating a probit model, where the probability of having foreign owners is a function of $\beta_0 \text{FO}_{i,t-1} + \beta_1 \log\left(\text{K/L}\right)_{i,t-1} + \beta_2 \log\left(\text{VA/L}\right)_{i,t-1} + \beta_3 \log\left(\text{ASSETS}\right)_{i,t-1} + \beta_4 \log\left(\text{ASSETS}\right)^2_{i,t-1} + \beta_5 \text{AGE}_{i,t} + \beta_6 \text{AGE}^2_{i,t} + \mu_{ct} + \phi_{st} + \epsilon_{i,t}$, and use the predicted probability of foreign ownership, using for the first year values for variables involved for firm i.

making the country dependence explicit again), we construct

$$I^I_{s,c,t} = \frac{\sum_{i \in c,s} \text{FO}^I_{i,t} \text{Y}_{i,0}}{\sum_{i \in c,s} \text{Y}_{i,0}} \ ; \tag{5}$$

where $\text{FO}^I_{i,t}$ is industrial ownership by foreign companies. I.e., $I^I_{s,c,t}$ is sector-level foreign industrial ownership in country c at time t. We further construct

$$I^F_{s,c,t} = \frac{\sum_{i \in c,s} \text{FO}^F_{i,t} \text{Y}_{i,0}}{\sum_{i \in c,s} \text{Y}_{i,0}} \ ; \tag{6}$$

where $\text{FO}^F_{i,t}$ is ownership by foreign financial companies. I.e., $I^F_{s,c,t}$ is sector-level foreign financial ownership in country c at time t.

We assume that country-sector level financial ownership is a function of future profit opportunities in the relevant sector-country cell as they accrue to a passive financial investor. We further assume that industrial foreign ownership is determined by the same factors as financial foreign ownership plus a factor

$$I^I_{s,c,t} = b\, I^F_{s,c,t} + \delta \text{W}_{s,c,t} + e_{s,c,t} \ , \tag{7}$$

where $\text{W}_{s,c,t}$ is the investment driven by extra future income that industrial owners can obtain from *active* management (or from market power, in case of mergers—whatever is specific to industrial ownership). If we know b, we can use $I^I_{s,c,t} - b\, I^F_{s,c,t} = \delta \text{W}_{s,c,t} + e_{s,c,t}$ as an exogenous instrument because the component of country-sector foreign ownership which is due to predicted future profits from passive investment, and which is the source of potential reverse causality, has been subtracted.

We obtain an estimate of b by regressing I^I on I^F and take residuals, $\text{W}_{s,c,t}$, which is part of our instrument; i.e.,

$$\text{W}_{s,c,t} = I^I_{s,c,t} - \hat{b}\, I^F_{s,c,t} \tag{8}$$

Because firm fixed effects are included, we refer to this variable as sector-level *growth* in foreign ownership. We further hedge against endogeneity by including country-sector-year dummies in our regressions.

4 Data

We focus on a European subset of ORBIS where coverage is better because company reporting is regulatory. We start from 40 European countries and 1.42 million unique firms, for which detailed information is available, 1996–2008. After implementing some preliminary cleaning to eliminate outliers and data mistakes we are down to around 800 thousand firms in these countries (4.3 million firm-year observations).[14] After detailed data cleaning explained in Appendix: Data, we retain a subset of firms to have more than 15 employees (350 thousand firms) and data for TFP calculation (210 thousand firms). Focusing only on the manufacturing sector, we have 134 thousand firms from 12 developed and 13 emerging countries, 1999–2008.[15]

Variables and descriptive statistics

The main *financial variables* used are total assets, operating revenue, tangible fixed assets, and expenditure on materials. We convert financial variables to "PPP US dollars with 2005 base," using country GDP deflators (2005 base) and converting to dollars using the end-of-year 2005 exchange rate. The distribution of these (logged) variables does not change much over time and is very close to normal. Employment is in persons, and the distribution of employment is skewed with many firms having 15 employees (our chosen minimum).

Firm productivity. We construct TFP as the residual from a Cobb-Douglas produc-

[14] Appendix Table A-6 shows regressions using this largest sample.

[15] Panel A in Appendix Table A-2 shows the number of observations and firms after most of the cleaning. Panel B shows the lower number of observations with data available for calculating TFP numbers. Appendix Figure A-1 shows the average percentage of observations by sectoral categories in the samples of panel B of Table A-2. We focus on manufacturing, which contains roughly 40 percent of the observations, to be consistent with the literature. See Appendix Table A-3 for detailed sector classification.

tion function with capital and labor: $\log(\text{TFP}_{i,t}) = \log(\text{Y}_{i,t} - \text{M}_{i,t}) - \alpha_1 \log(\text{L}_{i,t}) - \alpha_2 \log(\text{K}_{i,t})$, where the coefficients are estimated by the method of Wooldridge, Levinsohn and Petrin (WLP), as explained in Appendix: Data.[16]

Explanatory variables. The ownership section of ORBIS contains detailed information on owners of both listed and private firms, including name, country of residence, and type (e.g., bank, industrial company, private equity, individual, and so on). The database refers to each record of ownership as an "ownership link." An ownership link indicating that an entity A owns a certain percentage of firm B is referred as a "direct" ownership link. BvD traces a direct link between two entities even when the ownership percentage is very small (sometimes less than 1 percent). For listed companies, very small stock holders are typically unknown.[17] In addition, ORBIS contains information on-so called "ultimate" owners (UO) of the company by tracing the ownership pyramid beyond the direct owners. To find UOs of a company, BvD focuses on identifying the owners, if any, who exercise the greater degree of control over the company. We prefer *direct ownership* to ultimate ownership because the former allows to reliably measure a continuous ownership variable over time as reported by the original sources (see Appendix: Data for comparison of the two measures). We compute the *Foreign Ownership* (FO) as the sum of all percentages of *direct* ownership by foreigners. Owners of unknown origin (typically small) are assigned to the home country. We define a firm to be "domestic" only if it never had

[16]We estimate TFP by country and sector and winsorize the resulting distribution at the 1 and 99 percentiles by country. However, similar results are obtained if TFP is estimated by country, or by Levinsohn and Petrin (2003), and regardless of the level of winsorizing chosen (we also tried winsorizing the total sample at the 1 and 99 percentiles, winsorizing by country at the 5 and 95 percentiles, and by sector at the 1 and 99, and 5 and 95, percentiles). See Appendix: Data for more details.

[17]Countries have different rules for when the identity of a minority owner needs to be disclosed; for example, France, Germany, the Netherlands, and Sweden demand that listed firms disclose all owners with more than a five percent stake, while disclosure is required at three percent in the UK, and at two percent in Italy. Information regarding US companies taken from the SEC Edgar Filings and the NASDAQ, however, stops at one percent. BvD collects its ownership data from the official registers (including SEC filings and stock exchanges), annual reports, private correspondence, telephone research, company websites, and news wires.

any type of foreign owner, including these other types, during the sample period.[18]

Descriptive statistics. Table 1 displays the fractions of firms with foreign ownership. From Panel A, FO is relatively high in the manufacturing and retail sectors and the share of output of firms with foreign financial owners is considerably smaller than that of firms with foreign industrial owners. Overall, foreign-owned firms contribute about 7 percent of output of all firms. Panel B in Table 1 explores the relative importance of foreign-owned companies across developed and emerging countries overall and by owner type. There is slightly more foreign-owned firms in emerging markets but the difference is small. Focusing on firms with positive industrial or financial FO in at least one year in the remainder of Panel B, we observe that industrial FO clearly dominates financial FO in both groups of countries but financial foreign owners "prefer" firms in developed countries slightly more.

The distribution of controlling ownership shares (i.e., more than 50 percent of company equity) follows the total ownership ranking for country groups and FO type, but the differences in industrial FO between country groups are more pronounced. 71 percent of emerging-country firms with foreign ownership have controlling industrial FO, while this share in developed countries is 60 percent. The distributions of FO in Panel C are drawn from the regression samples of firms in the manufacturing sector. The ownership patterns in this smaller sample closely follow the patterns observed in the "All Industries" sample of Panel B, which makes us confident in the representativeness of our regression sample (also apparent from Appendix Figures A-2 and A-3 showing the distribution of foreign ownership). In developed countries, the distributions of FO and Industrial FO is bi-modal whereas they are skewed towards full ownership in emerging markets. More than two thirds of the firms with non-negative FO, have foreign stakes of less than a 20 percent, in both

[18]For example, if a company has three foreign owners with stakes of 10, 15, and 35 percent, FO for this company is 60 percent. A financial owner is a bank, financial company, insurance company, mutual or pension fund, other financial institution, or private equity firm. $\text{FO}^{I}_{i,s,c,t}$ (*Industrial* FO) $\text{FO}^{F}_{i,s,c,t}$ (*Financial* FO) are the shares owned by foreign industria and financial investors, respectively.

groups of countries. There is a spike in the number of firms with an ownership share around 50 percent, likely reflecting a desire to control the firm.

Figure 1 plots non-parametric probability density estimates of the logarithm of firm-level WLP's TFP. The firm sample includes firms which never had foreign owners (domestic firms, black solid lines) and firms with positive foreign ownership (foreign-owned firms, red dashed line). In both samples, firms with some or controlling foreign ownership are more productive, and these differences are statistically significant.[19]

Appendix Table A-4 reports descriptive statistics and Appendix Table A-5 shows counts of observations and firms and average values of log TFP and FO (in percent) by year. There is considerable time variation in ownership shares and productivity in both subsamples. FO exhibits a clear upward trend as the world economy becomes more globalized by late 2000s.

Appendix Table A-6 shows correlations between labor productivity and foreign activity for firms in all industries or in manufacturing using a raw uncleaned sample. There is a clear positive correlation between foreign ownership and labor productivity, if firm fixed effects are not accounted for, a pattern that has inspired many recent trade and FDI models.[20] However, after the inclusion of firm fixed effects, the positive coefficient halves or completely disappears, depending on the productivity measure.[21] This highlights the importance of firm-level selection. When firm-fixed effects are included, correlations are calculated from *within*-firm changes over time, suggesting that foreign ownership does not lead to an increase in the productivity of acquired firms. While other factors could influence the simple correlations displayed, this *prima facie* evidence points to multinationals investing in *a priori* productive

[19]Results of the difference of means and medians tests are available upon request.

[20]See Helpman, Melitz, and Yeaple (2004) for similar results on labor productivity using data on US multinationals.

[21]This sample has 4 million observations overall and over 1 million observations in manufacturing. Our regression samples are much smaller because we need data on, e.g., materials. We use the full sample in Appendix Table A-6 in order to document that this pattern is not an artifact of data cleaning.

firms. Keeping in mind these issues, we turn to a comprehensive regression analysis.

5 Results

5.1 Are Foreign Firms More Productive?

Table 2 shows the relationship between foreign ownership and firm total factor productivity in the manufacturing sector. We present results for developed and emerging countries separately because of conflicting results for these groups of countries found in the literature.[22] The model described in equation (1) is estimated by Generalized Least Squares (GLS) which is more efficient than OLS due to the great heterogeneity in the sample.

As we have been emphasizing, accounting for firm selection is crucial and all specifications in Table 2 include firm fixed effects. An additional factor that we have stressed is the role of country and sector selection. Foreigners may invest in growing countries, sectors, or country-sectors resulting in reverse causality; consequently, all columns account for country-sector-year fixed effects. Columns (1) and (4) of Table 2 show that even after controlling for country-sector-year effects there is a positive and statistically significant relationship between foreign ownership and firm productivity. However, this effect is not of much economic importance in developed countries: a ten percent increase in foreign ownership will be associated with a 0.07 percent increase in firm productivity (see column (1)). The relatively small productivity gap between foreign-owned and domestic companies shown in column (1) is not particular to the sample of developed countries where the technology gap between foreign-owned companies and domestic companies is smaller (Girma (2005)). Column (4), for emerging countries, shows a 0.5 percent increase in productivity associated with a ten percent increase in foreign ownership. Only considerable increases in firm ownership (of the order of 100 percent change) would

[22] See, among others, Aitken and Harrison (1999), Javorcik (2004), Haskel, Pereira, and Slaughter (2007) and Keller and Yeaple (2009).

lead to a substantial increase in firms' productivity.

The results of Table 2 are obtained in regressions that include firm-fixed effects. Early studies (see Aitken and Harrison (1999) or Javorcik (2004)) find a positive and significant correlation between foreign ownership and firm productivity which turns insignificant once firm fixed effects are included. Therefore, these early studies find a positive correlation between foreign ownership and productivity levels but not between foreign ownership growth and productivity growth. Our set of control dummy variables guarantees that the results in Table 2 are not driven by foreign investors targeting growing countries, growing sectors, or firms with constant higher productivity. However, it is probable that firm productivity changes over time and, therefore, we still need to correct for foreign investors targeting firms with increasing productivity. We analyze this possibility in columns (2) and (5) of Table 2 following the instrumental variable methodology outlined in Section 3.

Panel A in columns (2) and (5) of Table 2 shows the second stage results while Panel B shows the first stage results. It is clear from Panel B that the instrument and the endogenous variable (i.e., foreign ownership) are highly correlated. In both sets of countries, the instrumented coefficients are larger than the GLS-coefficients, suggesting significant heterogeneity across firms. Our interpretation of this difference is, therefore, that we are estimating a Local Average Treatment Effect.[23] Investors know the growth prospects of firms and our identifying assumption is that the amount of investment of industrial owners which is orthogonal to that of financial owners is exogenous to firms' future growth prospect in the absence of foreign investment.[24]

[23]Some downward bias in GLS could be due to measurement error, but for this to change the coefficient as much as we observe the variance of the measurement error would have to dominate the variance of foreign ownership. We firmly believe that this is not the case after cleaning and winsorizing our data.

[24]The survey article by Card (2001) shows that IV estimates being larger than non-instrumented estimates is the typical finding in the context of the returns-to-schooling literature where the returns are highly likely to be heterogenous across agents. The theoretical explanation, given by Imbens and Angrist (1994), is that the IV-estimates measure local average treatment effects (LATE), where the treatment (schooling laws) affects some individuals more than others.

We outline our interpretation by considering the simplest possible case. Assume there are two, equally large, groups of firms which are differently impacted by foreign investment. For firms belonging to group j ($j = 1, 2$), foreign investment is $\Delta \text{FO}_{it}^j = d_j \Delta \text{Z}_{it}^j + v_{it}^j$. Firms in group 1, where d_1 is large, are firms which are more likely targets of industrial than of financial investors. Under regularity conditions in large samples, the first-stage WLS estimate from a regression using the combined sample is $\Delta \text{FO} = \frac{d_1+d_2}{2} \Delta \text{Z}$. Consider also the case where the impact of foreign investment differs between groups: $\Delta \text{TFP}_{it} = \beta_j \Delta \text{FO}_{it}^j + e_{it}$. An IV regression of ΔTFP on ΔFO , using our instrument Z, gives, in large samples, the coefficient $\frac{E\{\Delta \text{TFP Z}\}}{E\{\Delta \text{FO Z}\}}$, which equals $\frac{d_1\beta_1+d_2\beta_2}{d_1+d_2}$, that is, a weighted average of β_1 and β_2. Relatively larger coefficients d_1 and β_1 imply that the IV estimate is larger than the OLS estimate which gives equal weight to β_1 and β_2. If, as we will find, the IV-coefficient is significantly larger than the OLS estimate, we interpret this as reflecting heterogeneity where the group of firms for which foreign ownership growth correlates more with industrial ownership growth orthogonal to financial ownership growth (here labeled with subscript 1) displays larger productivity changes when foreign ownership changes. We find it intuitive that firms that are targeted by industrial owners are those for which foreign investment is associated with active management which brings about relatively large effects on productivity.

The estimated effect in column (2) of Table 2 is larger than the OLS estimate, but it is still very small. The effect is likely small because the high economic integration among developed countries results in very small gaps in "hard technology" between developed countries. While we do not did deeper on this issue in the present article, we interpret the difference in productivity shown in column (2) as more likely to correspond to "soft technology" transfers based on the results of Bloom, Sadun, and Van Reenen (2012).[25] In the case of emerging countries, there is little evidence

[25]Bloom, Sadun, and Van Reenen (2012) show that establishments taken over by US multinationals (but not by non-US multinationals) increased the productivity of their IT. They find that the US IT-related productivity advantage is primarily due to better people management practices.

of a causal impact of foreign ownership on firm productivity as the second stage coefficient in column (5) is not significant.[26]

For comparison to the literature, we also estimate equation (1) in two-year differences. We experimented with one-year differences but (unreported) results were not robust. The two-year differences captures impacts on total factor productivity which only materialize with some lag and the second-year differences also give lower weight to outliers. Columns (3) and (6) in Table 2 corroborate the small or non-existent average results reported in columns (2) and (5). In the case of emerging countries, the standard deviations are fairly large, reflecting the smaller sample.[27] In unreported results, the estimates are sensitive to the exact choice of instruments (with the coefficient (standard error) ranging from a low 0.096 (0.082) to a significant 0.259 (0.106)). We chose to report the coefficient obtained using both the lagged level and differences of the instrument because it appears to deliver the most robust point estimate, being similar to the coefficient in column (5), but clearly our results for developing countries have large confidence bands.[28] There are mixed results in the literature regarding the causal effect of foreign ownership on firm productivity (see Arnold and Javorcik (2009)). Overall, the results suggest that the motives behind foreign investment might not necessarily involve technology transfer: foreign-owned firms could target domestic firms in order to diversify and such investments do not involve transfer of technology and/or foreign-owned firms might seek to expand into foreign markets through acquisition of domestic firms resulting in higher market shares for the target, issue to which we will return later.

[26]The point estimate is larger, but the IV estimate is quite imprecise in the smaller emerging market sample, so we cannot rule out either that some firms in emerging countries experience a jump in productivity with foreign investment.

[27]Only firms with a change in foreign ownership provides identification and a very large number of degrees of freedom are used on fixed effects and dummies, which is why 30,000+ observations does not constitute a large sample. 4,840 firms (13,840 observations) in developed countries and 1,066 firms (2,606 observations) in emerging countries changed foreign ownership.

[28]The significant 0.259 coefficient in the two-year specification implies that in emerging countries a 50 percent increase in foreign ownership leads to a 12.5 percent increase in productivity over two years which is similar in magnitude to previous findings in the literature.

The aim of the paper is to provide an estimate of aggregate productivity gains caused by foreign investment at the country level. This total effect is decomposed into direct effects (i.e., productivity changes in domestic targets after acquisition) and indirect effects (i.e., spillover effects or productivity changes in fully domestic firms operating in sectors with growing foreign activity). After having shown evidence of limited direct effects, we turn to the study of potential spillover effects.

5.2 What are the Spillovers from FDI?

Traditionally, the empirical literature has found positive horizontal productivity spillovers in developed countries and negative productivity spillovers in developing countries. We explore this issue in Table 3 with a sample of domestic companies. Columns (1) to (4) refer to developed countries while columns (5) to (8) refer to emerging countries. Columns (1), (2), (5) and (6) define spillovers using two-digit sector classifications as it is common in the literature. Column (1) shows that foreign-owned companies have a significant positive impact on the productivity of the typical domestic firm in the same two-digit sector. Researchers who are skeptical about the role of foreign investment in transferring knowledge and technology argue that results, such as those of column (1), likely are the result of foreign-owned companies targeting more productive sectors. The previous empirical literature, focusing on the experience of individual countries, as well as lacking suitable instruments, was not able to properly address this issue.[29]

Column (2) includes sector-year fixed effects which control for effects that are common to firms in the same sector across countries, in particular technological innovations that all firms in a sector can benefit from. Compared to column (1), there is a considerable reduction in the size of the spillover coefficient and it is no longer statistically significant. This decrease in the coefficient can mean that foreigners target more productive sectors or that, if spillovers are present, they are

[29]One exception is Haskel, Pereira, and Slaughter (2007), who use an instrumental variable approach to tackle this concern in a sample of UK manufacturing firms.

partly (or mainly) global for typical firms operating in the same sector. While we cannot literally rule this out, spillovers are more likely to be local (and much of the policy relevance of this issue revolves around the issue of local spillovers). Contrary to our findings for developed countries, column (5) in Table 3 reveals a negative and significant effect of foreign-owned companies in the same two-digit sector—a finding in line with previous results of Aitken and Harrison (1999), who use firm-level panel data for Venezuela. They argue that positive knowledge spillovers may be counteracted by negative competition effects. Column (6) of Table 3 shows that the negative spillover effect prevails in emerging countries even after controlling for sector-year fixed effects. The negative effect, as expected from a direct competition explanation, is, therefore, predominantly local.

We expect competition effects to be dominant within the same four-digit sector classification, while potential technology and knowledge transfers might come from foreign presence in the same two-digit sector. Columns (3) and (4) in Table 3 present the main results for developed countries. Once we focus on effects within the thinner 4-digit sector classification, we find negative competition effects in developed countries and positive and significant knowledge spillovers. The positive knowledge spillovers are similar in magnitude to the negative competition spillovers when sector-year trends are included which explains the insignificant spillover results found in column (2) of Table 3. Including four-digit sector-year fixed effects addresses the possibility that foreign-owned companies target more productive sectors and has a direct economic interpretation. Competition is local, so we do not observe significant changes in the size of the spillover competition coefficient after including sector-year fixed effects, consistent with our interpretation of our results actually capturing competition; on the other hand, knowledge transfers are partly global and are universally available within the same sector.[30] Strictly speaking,

[30]If four-digit sector-year fixed effects are not included in developed countries, the coefficient (standard error) on Spillover_Competition is -0.021 (0.004) and on Spillover_Knowledge 0.037 (0.007).

"global" refers to other developed countries where it is reasonable that, say, all car manufactures benefit from large global investments in, say, fuel systems—we do not examine global spillovers from developed to emerging countries. For the difference specification in column (4), the knowledge spillover coefficient is twice as large as for the level specification while the competition effects are halved. The level regression is likely capturing more permanent effects so the interpretation would be that competition effects are more permanent while knowledge effects dilute over time. We think longer time-series are necessary to sort this out and prefer to take away that the qualitative results are robust to the exact specification.

The positive knowledge spillovers is a new result which previous research has overlooked due to a higher sectoral aggregation. In line with vertical linkages theories, we find that there is scope for positive productivity spillovers from foreign-owned companies to domestic companies that are not direct competitors.

Columns (7) and (8) in Table 3 repeat the analysis for the sample of emerging countries. Column (7) shows that there are negative productivity spillovers from foreign-owned companies operating in the same four-digit sector. Unexpectedly, we also find negative knowledge spillovers in emerging markets. We believe competition for resources may be the root of the negative "knowledge spillovers." If emerging markets have a limited pool of workers with appropriate training for modern firms, domestic firms will be hurt if those workers are hired away to firms with foreign ownership. The negative competition effect is also found in the difference specification of column (8). For emerging countries, the magnitudes of the estimates are very robust to the choice of specification.

Finally, Table A-7 in the Appendix considers a balanced (or "permanent") panel of firms—firms observed over the full 2000-2007 period. By focusing on a permanent sample of firms, we examine if the results are reflecting new highly productive firms entering the sample reflecting Schumpeterian creative-destruction. However, the results in columns (1) and (3) of Table A-7 show that the effects found in Table 3

are not solely, nor mainly, reflecting entry and exit.

5.3 Business Stealing Effects

In Table 4, we explore if foreign investment is indeed associated with increasing market shares of recipients of foreign investment. If our negative four-digit competition results are truly competition effects, we should observe that foreign-owned companies increase their market shares. We, therefore, examine if output market shares, defined as the share of firm i's output in total sectoral output at the four-digit sector classification, are explained by foreign ownership. Columns (1) and (2) consider developed countries while columns (3) and (4) consider emerging countries. According to columns (1) and (3), companies that receive investments from foreign investors experience an increase in market shares which indicate that foreign owned firms grow faster at the expense of other firms in the same narrow sector. However, similar to the argument made for productivity in the previous section, it could be that foreign investors target domestic firms which are already growing disproportionately fast. Columns (2) and (4) address this concern by reporting instrumental variable results. In both developed and emerging markets, the instrumented coefficient is higher and statistically significant. In terms of economic magnitudes, there is a significant difference between the effect in developed and in emerging markets. A 10 percent increase in foreign ownership in developed countries translates into a 0.4 percent increase in market shares while a similar increase in emerging countries results in a 2 percent increase in market share. These results, with stronger effect in emerging countries, lends strong credence to our interpretation that the negative spillovers uncovered indeed are due to competition effects.

5.4 Vertical Spillovers

Table 5 considers backward and forward spillovers to suppliers or customers, respectively, of foreign owned firms. For comparison with the literature, we control for

2-digit horizontal spillovers. In the first row, we see a positive and significant coefficient on the Backward variable in both developed and emerging countries. This indicates positive productivity spillovers between domestic firms and their foreign-owned customers in downstream sectors. While backward spillovers of similar magnitudes have been previously found in the literature (see for example Javorcik (2004), Liu (2008) and the references therein), findings of backward spillovers in developed countries are more scant. Barrios, Görg, and Strobl (2011) using firm-level data from Ireland find little support for backward spillovers when standard measures are employed. However, they find robust evidence for positive backward spillovers when constructing measures that consider the percentage of domestically produced inputs versus imported inputs.

There is no indication of vertical linkages through contacts with foreign-owned suppliers, as the forward variable is insignificant in developed countries and even negative in emerging markets.[31] The backward spillovers appear quite orthogonal to horizon spillovers within the two-digit sector as the coefficient to the horizontal spillover variable is of a similar magnitude to that estimated in Table 3. Overall, our results confirm those found in the literature. Even the magnitude of our estimated backward spillover coefficients are similar to the results of Javorcik (2004), so we do not further pursue this issue.[32]

5.5 The Role of Firm Heterogeneity

One of the main insights from the first wave of firm-level micro studies is that firms are heterogeneous, which has inspired the development of new theories emphasizing this fact (see Melitz (2003), Bernard, Eaton, Jensen, and Kortum (2003) and

[31] Javorcik (2004) also finds a negative coefficient on the forward spillover variable in the case of Lithuania.

[32] Javorcik (2004) uses a panel of Lithuanian firms from 1996-2000 and estimates regressions in first differences, including sector dummies which is equivalent to sector specific trends in levels. Given the short time dimension of her sample that approach is not very different from our approach of including sector-year fixed effects.

Helpman, Melitz, and Yeaple (2004) among others). According to the early research, only a small fraction of firms engage in export activities and an even smaller fraction of firms become multinational. The theoretical models developed to accommodate these empirical findings have implications for within and between sectoral allocation of resources: within-industry reallocation effects contribute to higher sectoral productivity as greater competition from exporting firms drive less productive firms out of the market. An implication is that not all domestic firms will be equally affected by the presence of foreign-owned firms in their same sector of activity or related sectors. A less explored aspect of firm heterogeneity is differences in firm productivity arising from varying degrees of foreign ownership.

We consider two dimensions of heterogeneity: the differences in the percentage of firm capital owned by foreign investors and differences in the initial productivity of domestic firms. First, Table 6 studies whether competition and knowledge spillovers varies across domestic firms. We consider firms' total factor productivity in the first year of the sample (our measure of ex-ante productivity) and we split the sample according to whether firms are in the first, second, third, or fourth quartile of the total factor productivity distribution in each country-sector cell. Once firms are categorized according to their ex-ante productivity, we replicate the results of Table 3 for different quantiles. The dependent variable is firm total factor productivity and we focus again on the sample of domestic firms.

Column (1) of Table 6 shows results for developed countries while column (2) shows results for emerging countries. In developed countries, the negative competition effect is present for *all* firms, although the effect is somewhat larger for firms in the lowest and highest quantiles. Positive knowledge spillovers are concentrated among firms with total factor productivity in the top quartile. This is consistent with the idea that only the better firms have enough absorptive capacities to benefit from the presence of foreign-owned firms. In emerging countries, the competition effects are similar, albeit larger, than found in developed countries. Knowledge

spillover effects are negative for all quantiles in emerging countries, although the effect is not significant for the lowest and the highest categories.

Second, regarding foreign ownership heterogeneity, Figure 1 shows the the the TFP distribution of foreign-owned companies is to the right of that of domestic companies, whether we define foreign ownership in terms of majority control or not. Do spillovers vary depending on majority/minority ownership in the sector? Table 7 shows that the negative competition effect derived from foreign presence in the same four-digit sector is not specific to majority owners. Domestic firms in developed and emerging countries are hurt by increasing investment of foreign investors in the same four-digit sector regardless of the extent of foreign control in companies. More interestingly, for developed countries, positive knowledge spillovers are driven by foreign majority owned companies, see column (1) of Table 7. This supports the notion suggesting that foreign minority ownership typically does not imply technology transfer but rather is undertaken for diversification of income. Majority control involves decision making of the foreign parent, as well as lower risk of information leakage, both aspects encouraging technology transfer to the target company and therefore, a higher potential for spillovers for non-direct competitors.[33]

5.6 Aggregate Effects

We evaluate the effect of a doubling of foreign ownership in percent of aggregate assets using our point estimates. A doubling of foreign ownership leads to a doubling of FO, which implies that we change the right hand side by the means giving in Table A-4, which for developed countries are FO = 0.05, Spillover_Competition = 0.10, Spillover_Knowledge = 0.10, Spillover_Forward = 0.09, and Spillover_Backward = 0.13. Using the estimated coefficients[34] of 0.031, –0.028, 0.020, 0.063, and 0.027; respectively, we find a total effect of 0.011 percent (0.009 percent if the insignificant

[33]Similar results, although somewhat weaker due to the smaller sample, are found when a permanent sample of firms (continually observed 2000-2007) is considered (see Table A-7 in the appendix).

[34]From Table 2 column 2, Table 3 column 3, Table 3 column 3, and Table 5 column 1.

coefficient to Spillover_Forward is set to 0).[35]

The corresponding statistics for emerging countries are FO = 0.07, Spillover_Competition = 0.11, Spillover_Knowledge = 0.09, Spillover_Forward = 0.09, and Spillover_Backward = 0.15 and using the estimated coefficients[36] of $0.125, -0.080, -0.078, 0.076$, and -0.089; respectively, we find a total effect of –0.004 (–0.012 percent if the insignificant coefficient to FO is set to 0).

Clearly, the impact of FDI on productivity is not of first-order importance for economic growth. Our paper stops short of evaluating other possible effects of FDI, for example, direct ownership may bring in capital to firms which are unable to obtain bank-financing due to borrowing constraints. FDI may also increase risk sharing between countries. We do not attempt to quantify any of such effects in the present paper, but all are important questions for further research.

6 Conclusion

The last two decades have witnessed an extensive policy push for more FDI from governments and international organizations. Structural policies have been designed to attract FDI, ranging from sectoral subsidies to lower taxes for multinationals—all under the assumption that more FDI will bring more growth. We show in this paper that there is no systematic evidence that supports the notion of substantial growth effects from FDI.

Using a multi-country firm level data set, we find that foreign-owned firms are hardly more productive than other firms and the positive correlation between foreign ownership and productivity mainly is driven by positive selection. There are positive knowledge spillovers from FDI to domestic firms in developed countries but

[35] The effects are additive, so the calculation is simply $0.05 * 0.031 + .10 * (-0.028) + .10 * 0.020 + 0.13 * 0.063 + 0.09 * 0.027 = 0.011$. The calculation, for simplicity, assigns spillovers to all firms, whether of not they have foreign owners—assigning spillovers to domestic firms only would not change the magnitudes noticeably.

[36] From Table 2 column 5, Table 3 column 7, Table 3 column 7, and Table 5 column 2.

these are almost one-to-one offset by negative competition spillovers. In emerging countries, both competition and knowledge spillovers are negative (which, of course, calls into question the label "knowledge spillovers"). We find positive effects of FDI on suppliers of foreign owned firms, but these are minor. Together, the various effects imply that even a doubling of FDI leads to about a one percentage point increase of output in developed countries and a one percentage point decrease of output in emerging countries.

Although, as we show, there are no total productivity effects from FDI, we do not rule out that FDI may generate employment, provide capital, and improve risk sharing and consumption smoothing. FDI may also generate healthy competition in the labor markets offering higher wages. FDI might even have growth-enhancing indirect benefits though its effect on structural policies. As shown by Rodrik (2013), manufacturing labor productivity has converged across the world; however, this type of convergence has not led to aggregate growth convergence because many governments obstruct structural transformation. FDI can help to speed up this process indirectly, even though it does not provide direct productivity benefits for the country.

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Tables

Table 1: Relative Importance of Foreign Ownership across Sectors and Samples

Panel A: Percentage of Observations by Ownership Category and Industry, Firms in All Industries

Sample	Developed			Emerging		
FO Measure	FO	Industrial FO	Financial FO	FO	Industrial FO	Financial FO
Industry						
Agric. and Mining	4.4	4.3	0.3	2.3	2.3	0.1
Construction	1.4	1.4	0.1	2.0	1.9	0.2
Manufacturing	8.4	8.1	0.5	9.7	9.5	0.5
Retail	9.0	8.8	0.4	7.5	7.4	0.3
Services	5.1	4.8	0.5	6.1	5.8	0.4
Total	6.9	6.6	0.4	7.1	6.9	0.4

Panel B: Percentage of Observations by Ownership Category, Firms in All Industries

Sample	All Firms			Foreign-owned Firms				
	FO	Industrial FO	Financial FO	Industrial FO	Financial FO	FO> 50%	Industrial FO > 50%	Financial FO > 50%
Emerging	7.1	6.9	0.4	97.2	5.2	72.5	71.1	1.2
Developed	6.8	6.6	0.4	96.2	6.0	62.9	61.5	1.4
Total	6.9	6.6	0.4	96.4	5.8	64.9	63.4	1.3

Panel C: Percentage of Observations by Ownership Category, Firms in Manufacturing

Sample	All Firms			Foreign-owned Firms				
	FO	Industrial FO	Financial FO	Industrial FO	Financial FO	FO> 50%	Industrial FO> 50%	Financial FO> 50%
Emerging	9.4	9.3	0.4	98.5	3.8	71.1	70.1	0.8
Developed	8.1	7.8	0.5	96.5	5.7	61.1	59.6	1.4
Total	8.3	8.0	0.5	96.9	5.4	62.9	61.5	1.3

Notes: The distributions in Panels A and B are drawn from the sample with available data for TFP construction (Panel B of Table A-2), while the distributions in Panel C are drawn from the regression samples of firms in the manufacturing sector with available data for the main regressions (see Data Appendix). Panel A reports the percentage of all firms in all available years (observations) in a given industry. Agric. and Mining refers to Agriculture and Mining and corresponds to NACE 2-digit sector classification: 01, 02, 03, 05, 06, 07, 08, 09. Manufacturing: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33. Construction: 41, 42, 43. Services: 49, 50, 51, 52, 53, 55, 56, 58, 59, 60, 61, 62, 63, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96. Retail: 45, 46, 47. See Table A-3 for the industry classification. The "total" sample shows the distribution for the entire sample of firms with available data for TFP construction. FO refers to industrial plus financial FO (marked FO), or either of these two types (marked Industrial FO and Financial FO; resp.). FO is the percentage share of firm's voting equity owned by foreign owners. Panels B and C report the percentage of observations by ownership category. "All firms" report on firms with available data for TFP construction (Panel B) or the regression samples of firms in the manufacturing sector (Panel C). The "foreign-owned" sample includes a subset of firms with industrial FO, or financial FO, or industrial plus financial FO positive in at least one year. "FO> 50%" refers to firms with controlling foreign ownership (FO higher than 50% of voting shares).

Table 2: Total Factor Productivity and Foreign Ownership: Are Foreign Firms more Productive?

Dependent Variable: Firm Productivity						
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: GLS and Second Stage Results						
		Developed			Emerging	
ESTIMATION METHOD	GLS	GLS&IV	GLS&IV	GLS	GLS&IV	GLS&IV
DEPENDENT VARIABLE	log TFP	log TFP	Δ_2 log TFP	log TFP	log TFP	Δ_2 log TFP
log FO	0.007**	0.031**		0.048***	0.125	
	(0.003)	(0.014)		(0.010)	(0.108)	
Δ_2 log FO			0.023			0.116
			(0.017)			(0.082)
Observations	402,137	402,137	235,529	72,349	72,349	36,479
Firms	59,306	59,306	46,313	12,758	12,758	9,450
Firm Fixed Effects	yes	yes	no	yes	yes	no
Sector4dig-Year Fixed Effects	N/A	N/A	N/A	N/A	N/A	N/A
Country-Sector4dig-Year Fixed Effects	yes	yes	yes	yes	yes	yes
Cluster	firm	.	.	firm	.	.
Panel B: First Stage Results						
		log FO	Δ_2 log FO		log FO	Δ_2 log FO
$\log(\widehat{\text{FO}}_0 \times \text{Growth FO}_{s,c,t})$		66.5***			24.91***	
		(2.34)			(3.78)	
$\log(\widehat{\text{FO}}_0 \times \text{Growth FO}_{s,c,t-2})$			-13.846***			-23.144***
			(1.98)			(2.68)
$\Delta_2 \log(\widehat{\text{FO}}_0 \times \text{Growth FO}_{s,c,t})$			56.62***			25.75***
			(3.48)			(6.24)
Observations		402,137	235,529		72,349	36,479
Firms		59,306	46,313		12,758	9,450
F-Test		770.24	237.23		43.37	53.65

Notes: The dependent variable is the log of total factor productivity, computed using the Wooldridge-Levinsohn-Petrin methodology (WLP). $\log \text{FO}_{i,t}$ is the log of one plus the percent share of foreign ownership in firm i capital structure; the instrument $\log(\widehat{\text{FO}}_0 \times \text{Growth FO}_{s,c,t})$ enters the first-stage regression in the same transformation. $\widehat{\text{FO}}_0$ is a non-time varying measure of predicted foreign ownership of firm i, equal to the initial level of foreign ownership of firm i. Growth $\text{FO}_{s,c,t}$ represents a measure correlated with *growth* in foreign ownership that varies by sector s, country c and year t where firm i operates, but not by firm. We obtain an estimate of Growth $\text{FO}_{s,c,t}$ as the residuals from the regression of sector-level foreign industrial ownership in country c at time t, $I^I_{s,c,t}$, on sector-level foreign financial ownership in country c at time t, $I^F_{s,c,t}$, (i.e., Growth $\text{FO}_{s,c,t} = I^I_{s,c,t} - \hat{b} I^F_{s,c,t}$). The GLS estimation use as weights re the square root of firm mean squared predicted residuals. In columns (1), (2), (4), and (5) the dependent variable and the regressands are measured at time t. Columns (3) and (6) are specifications in differences; Δ_2 indicates the difference between t and $t-2$. Columns (1) to (3) focus on the sample of developed countries while columns (4) to (6) repeat the analysis for the sample of Emerging countries. Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for details on variable construction.

Table 3: Are There Positive Spillover Effects from Foreign Ownership?

Dependent Variable: Firm Productivity
Sample: Domestic Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Developed				Emerging			
dependent variable	log TFP	log TFP	log TFP	Δ_2 log TFP	log TFP	log TFP	log TFP	Δ_2 log TFP
Spillover_{s2}	0.026**	0.008			-0.061***	-0.090***		
	(0.009)	(0.010)			(0.014)	(0.016)		
$\text{Spillover\_Competition}_{s4}$			-0.028***				-0.080***	
			(0.004)				(0.011)	
$\text{Spillover\_Knowledge}_{s4}$			0.020**				-0.078***	
			(0.008)				(0.018)	
$\Delta_2\text{Spillover\_Competition}_{s4}$				-0.015**				-0.087***
				(0.005)				(0.015)
$\Delta_2\text{Spillover\_Knowledge}_{s4}$				0.046***				-0.092***
				(0.010)				(0.024)
Observations	350,344	350,344	350,344	204,224	58,573	58,573	58,573	28,981
Firms	52,153	52,153	52,153		10,554	10,554	10,554	
Firm Fixed Effects	yes	yes	yes	no	yes	yes	yes	no
Country-Year Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Sector2dig-Year Fixed Effects	no	yes	N/A	N/A	no	yes	N/A	N/A
Sector4dig-Year Fixed Effects	no	no	yes	yes	no	no	yes	yes
Cluster	country-2dig-year	country-2dig-year	country-4dig-year	country-4dig-year	country-2dig-year	country-2dig-year	country-4dig-year	country-4dig-year

Notes: The dependent variable is the log of total factor productivity, computed using the Wooldridge-Levinsohn-Petrin methodology (WLP). The spillover variables measure the share of foreign output in total sectoral output at different sectoral aggregation levels in each country (country subscripts are suppressed for brevity). Regarding sector classification, s2 refers to two-digit sector classification and s4 refers to four-digit sector classification. In particular, $\text{Spillover}_{s2,t} = \sum_{i \in s2} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} / \sum_{i \in s2} \text{Y}_{i,s,t}$ where $\text{Y}_{i,s,t}$ refers to output of firm i, in two-digit sector s2, in country c at time t. $\text{FO}_{i,s,t}$ is the percentage of firm capital owned by foreign investors. $\text{Spillover\_Competition}_{s4,t} = \sum_{i \in s4} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} / \sum_{i \in s4} \text{Y}_{i,s,t}$ where $\text{FO}_{i,s,t}$ refers to the share of ownership by foreign companies in firm i, four-digit sector $s4$, in country c, at time t. $\text{Y}_{i,s,t}$ refers to output of firm i, in four-digit sector s, in country c, at time t. $\text{Spillover\_Knowledge}_{s4,t}$ refers to the output produced by foreign companies in the same two-digit sector as the domestic firm but excluding the corresponding output produced by foreign companies operating in the same four-digit sector. $\text{Spillover\_Knowledge}_{s4,t} = \text{Spillover}_{s2,t} - \sum_{i \in s4} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} / \sum_{i \in s2} \text{Y}_{i,s,t}$ where in the second term, the numerator refers to output produced in the four-digit sector by foreign-owned companies and the denominator is total two-digit sectoral output. The GLS estimation uses as weights the square root of firm mean squared predicted residuals. Results are obtained based on the sample of firms with no foreign ownership (i.e., firms that do not have positive FO in any year of the sample). In columns (1), (2), (3), (5), (6), and (7) the dependent variable and the regressands are measured at time t. Columns (4) and (8) are specifications in differences; Δ_2 indicates the difference between t and $t-2$. Columns (1) to (4) focus on the sample of developed countries while columns (5) to (8) repeat the analysis for the sample of emerging countries. Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for details on variable construction.

Table 4: Negative Competition Spillover Channel: Output Market Shares

Dependent Variable: Output Market Share Sample: Total Sample of Firms	(1)	(2)	(3)	(4)
Panel A: Second Stage Results				
	Developed		Emerging	
ESTIMATION METHOD	GLS	GLS&IV	GLS	GLS&IV
DEPENDENT VARIABLE	log MS4dig	log MS4dig	log MS4dig	log MS4dig
log FO	0.015*** (0.004)	0.042** (0.017)	0.116*** (0.011)	0.214* (0.125)
Observations	402,137	402,137	72,349	72,349
Firms	59,306	59,306	12,758	12,758
Firm Fixed Effects	yes	yes	yes	yes
Sector4dig-Year Fixed Effects	N/A	N/A	N/A	N/A
Country-Sector4dig-Year Fixed Effects	yes	yes	yes	yes
Cluster	firm	.	firm	.
Panel B: First Stage Results				
		log FO		log FO
$\log(\widehat{\text{FO}}_0 \times \text{Growth FO}_{s,c,t-2})$		66.5*** (2.34)		24.91*** (3.78)
Observations		402,137		72,349
Firms		59,306		12,758
F-Test		770.24		43.37

Notes: The dependent variable is the log of the share of firm i output in total four-digit sectoral output. $\log \text{FO}_{i,t}$ is the log of one plus the percent share of foreign ownership in firm i capital structure; the instrument $\log(\widehat{\text{FO}}_0 \times \text{Growth FO}_{s,c,t})$ enters the first-stage regression in the same transformation. $\widehat{\text{FO}}_0$ is a non-time varying measure of predicted foreign ownership of firm i, equal to the initial level of foreign ownership of firm i. Growth $\text{FO}_{s,c,t}$ represents a measure correlated with *growth* in foreign ownership that varies by sector s, country c and year t where firm i operates, but not by firm. We obtain an estimate of Growth $\text{FO}_{s,t}$ as the residuals from the regression of sector-level foreign industrial ownership in country c at time t, $I^I_{s,c,t}$, on sector-level foreign financial ownership in country c at time t, $I^F_{s,c,t}$, (i.e., Growth $\text{FO}_{s,c,t} = I^I_{s,c,t} - \hat{b} I^F_{s,c,t}$). GLS estimation with weights equal to the square root of firm mean squared predicted residuals. Columns (1) and (2) refer to developed countries, while columns (3) and (4) refer to emerging countries. Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for details on variable construction.

Table 5: Vertical Spillovers

Dependent Variable: Firm Productivity
Sample: Domestic Firms

	(1)	(2)
	Developed	Emerging
DEPENDENT VARIABLE	log TFP	log TFP
Spillover_Backward$_{s2}$	0.063**	0.076**
	(0.023)	(0.034)
Spillover_Forward$_{s2}$	0.027	-0.089**
	(0.030)	(0.038)
Spillover$_{s2}$	0.014*	-0.057***
	(0.009)	(0.013)
Observations	357,995	55,565
Firms	52,976	10,172
Firm Fixed Effects	yes	yes
Country-Year Fixed Effects	yes	yes
Sector2dig-Year Fixed Effects	yes	yes
Cluster	country-2dig-year	country-2dig-year

Notes: The dependent variable is the log of total factor productivity, computed using the Wooldridge-Levinsohn-Petrin methodology (WLP). The spillover variables account for the share of foreign output in total sectoral output at the two-digit sectoral aggregation level in each country (country subscripts are suppressed for brevity). Spillover$_{s2} = \sum_{i \in s} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} / \sum_{i \in s} \text{Y}_{i,s,t}$ where $\text{FO}_{i,s,t}$ refers to the share of ownership by foreign-owned companies in firm i two-digit sector s, in country c, at time t. $\text{Y}_{i,s,t}$ refers to output of firm i, in two-digit sector s, in country c, at time t. Spillover_Backward$_{j,t} = \sum_{kif k \neq j} \alpha_{jk}$Spillover$_{k,t}$. Spillover_Forward$_{j,t} = \sum_{mif m \neq j} \sigma_{jm}$Spillover$_{m,t}$. GLS estimation uses weights equal to the square root of firm mean squared predicted residuals. Results are obtained based on the sample of firms with no foreign ownership (i.e., firms that do not have positive FO in any year of the sample). Column (1) reports the results from the sample of developed countries while column (2) reports the results from the emerging countries sample. Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for details on variable construction.

Table 6: Spillovers and Domestic Firms' Heterogeneity

Dependent Variable: Firm Productivity
Sample: Domestic Firms

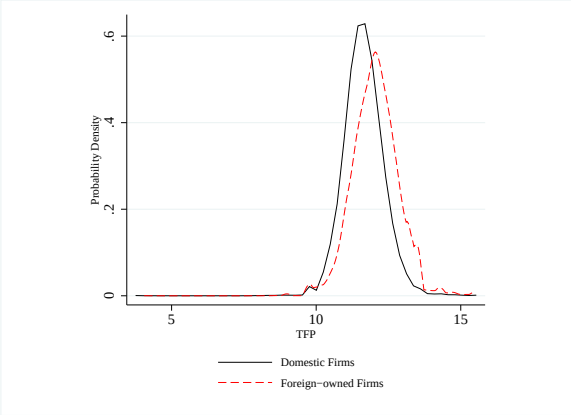
	(1)	(2)
	Developed	Emerging
dependent variable	log tfp	log tfp
Spillover_Competition$_{s4}$ × 1st Quartile of tfp distribution	-0.036**	-0.157***
	(0.014)	(0.030)
Spillover_Competition$_{s4}$ × 2nd Quartile of tfp distribution	-0.009	-0.094***
	(0.007)	(0.018)
Spillover_Competition$_{s4}$ × 3rd Quartile of tfp distribution	-0.021**	-0.060**
	(0.008)	(0.018)
Spillover_Competition$_{s4}$ × 4th Quartile of tfp distribution	-0.070***	0.008
	(0.016)	(0.039)
Spillover_Knowledge$_{s4}$ × 1st Quartile of tfp distribution	-0.008	0.064
	(0.028)	(0.046)
Spillover_Knowledge$_{s4}$ × 2nd Quartile of tfp distribution	0.011	-0.073**
	(0.013)	(0.029)
Spillover_Knowledge$_{s4}$ × 3rd Quartile of tfp distribution	0.011	-0.203***
	(0.014)	(0.031)
Spillover_Knowledge$_{s4}$ × 4th Quartile of tfp distribution	0.072**	-0.052
	(0.031)	(0.056)
Observations	350,344	58,573
Firms	52,153	10,554
Firm Fixed Effects	yes	yes
Country-Year Fixed Effects	yes	yes
Sector4dig-Year Fixed Effects	yes	yes
Cluster	country-4dig-year	country-4dig-year

Notes: The dependent variable is the log of total factor productivity, computed using the Wooldridge-Levinsohn-Petrin methodology (WLP). The spillover variables measures the share of foreign output in total sectoral output in each country (see Table 3 for a description of Spillover_Competition and Spillover_Knowledge). The 1st Quartile includes all domestic firms below the 25 percentile of the initial tfp distribution of domestic firms (idem definition for the rest of quartiles). GLS estimation uses as weights the square root of firm mean squared predicted residuals. Results are obtained based on the sample of firms with no foreign ownership (i.e., firms that do not have positive fo in any year of the sample). Column (1) reports the results from the sample of developed countries while column (2) reports the results from the emerging countries sample. Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for details on variable construction.

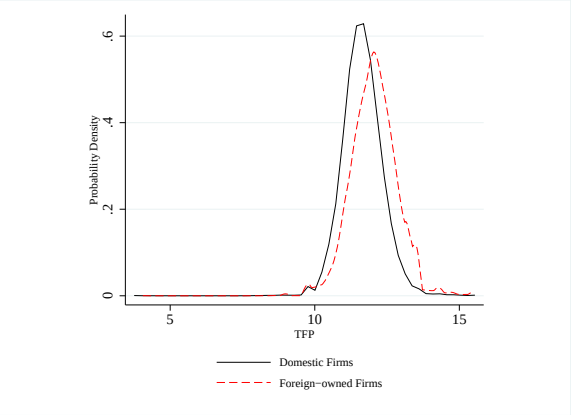
Table 7: Spillovers and Foreign Ownership Heterogeneity

Dependent Variable: Firm Productivity Sample: Domestic Firms	(1)	(2)
	Developed	Emerging
DEPENDENT VARIABLE	log TFP	log TFP
Spillover_Competition$_{s4}$ FO >50	-0.034*** (0.004)	-0.076*** (0.011)
Spillover_Competition$_{s4}$ FO <50	-0.024*** (0.004)	-0.056*** (0.014)
Spillover_Knowledge$_{s4}$ FO >50	0.014* (0.007)	-0.061*** (0.017)
Spillover_Knowledge$_{s4}$ FO <50	-0.008 (0.007)	-0.045** (0.017)
Observations	350,344	58,573
Firms	52,153	10,554
Firm Fixed Effects	yes	yes
Country-Year Fixed Effects	yes	yes
Sector4dig-Year Fixed Effects	yes	yes
Cluster	country-4dig-year	country-4dig-year

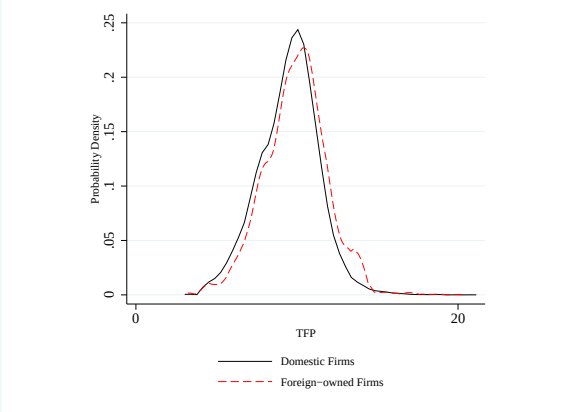
Notes: The dependent variable is the log of total factor productivity, computed using the Wooldridge-Levinsohn-Petrin methodology (WLP). The spillover variables measures the share of foreign output in total sectoral output in each country (see Table 3 for a description of Spillover_Competition and Spillover_Knowledge). The table differentiates between competition spillovers from FO >50 and FO <50 (idem for knowledge spillovers). Spillover_Competition FO $> 50 = \sum_{i\in s} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} \times I(\text{FO} > 50) / \sum_{i\in s} \text{Y}_{i,s,t}$ where $\text{FO}_{i,s,t}$ refers to the share of ownership by foreign companies in firm i, four-digit sector s, at time t and $I(\text{FO} > 50)$ is an indicator variable that takes the value of one if the percentage of firm foreign ownership is greater than 50 percent and zero otherwise. Spillover_Competition FO $< 50 = \sum_{i\in s} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} \times I(\text{FO} < 50) / \sum_{i\in s} \text{Y}_{i,s,t}$ where $\text{FO}_{i,s,t}$ refers to the share of ownership by foreign companies in firm i, four-digit sector s, in country c at time t and $I(\text{FO} < 50)$ is an indicator variable that takes the value of one if the percentage of firm foreign ownership is greater than 0 and less or equal than 50 percent and, zero otherwise. GLS estimation uses as weights the square root of firm mean squared predicted residuals. Results are obtained based on the sample of firms with no foreign ownership (i.e., firms that do not have positive FO in any year of the sample). Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for details on variable construction.



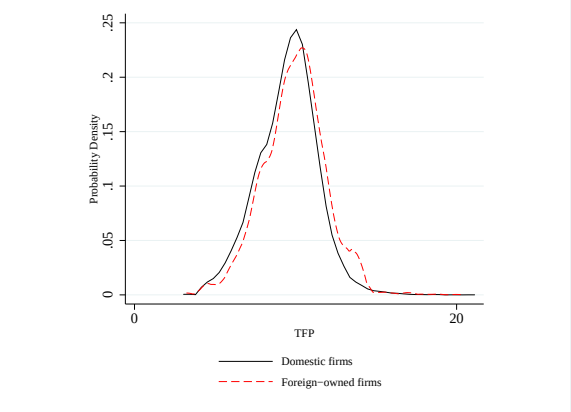
(a) Developed Countries: Foreign-owned>0. Mean (Median) TFP of foreign-owned firms = 12.07 (12.07); Mean (Median) TFP of domestic firms = 11.65 (11.63)



(b) Developed Countries: Foreign-owned>50. Mean (Median) TFP of foreign-owned firms = 12.05 (12.06); Mean (Median) TFP of domestic firms = 11.65 (11.63)



(c) Emerging Markets: Foreign-owned>0 Mean (Median) TFP of foreign-owned firms = 10.23 (10.30); Mean (Median) TFP of domestic firms = 9.50 (9.63)



(d) Emerging Markets: Foreign-owned>50. Mean (Median) TFP of foreign-owned firms = 10.26 (10.33); Mean (Median) TFP of domestic firms = = 9.50 (9.63)

Figure 1: TFP Density Distribution by Foreign Ownership, Firms in Manufacturing

This figure plots the probability density of the logarithm of firm-level TFP (in PPP dollars 2005 base), computed by the method of Wooldridge, Levinsohn, and Petrin. The figure shows the distribution of foreign ownership using all manufacturing firms in all available years. The firm sample includes firms which never had foreign owners (domestic firms) and firms with positive foreign ownership (foreign-owned firms) out of the regression samples of firms in the manufacturing sector with available data for the main regressions (see Data Appendix). The probability density of a given value of the log(TFP) is obtained using the non-parametric univariate kernel density estimation. See Sections 2 and 4 for the details on construction of variables.

NOT FOR PUBLICATION APPENDICES

Appendix: Instrument Validity and Exclusion

Consider the structural (causal) relation

$$(\text{TFP}) \quad \text{TFP}_{i,t} = \alpha_i + \mu_{c,t} + \phi_{s,t} + \beta\, \text{FO}_{i,t} + u_{i,t} \ ,$$

where all the notation is as before: FO is foreign ownership, TFP is total factor productivity, i denotes firm, and s and c are the sector and country in which firm i operates, respectively (suppressing s and c from firm-level variables).

We use instruments with the structure $\text{Z}_{i,t} = \widehat{\text{FO}}_i\, \text{W}_{s,c,t}$, where $\widehat{\text{FO}}_i$ is a non-time varying measure of predicted foreign ownership of firm i and $\text{W}_{s,c,t}$ is a measure that captures the exogenous *growth* in foreign ownership that varies by country, sector, and time but not by firm.

This instrument needs to be correlated with $\text{FO}_{i,t}$ in equation (TFP) ("relevance") and it needs to satisfy the exclusion restriction that it is uncorrelated with the structural innovation term $u_{i,t}$. The relevance condition is intuitive: firms with more predicted foreign ownership increase foreign ownership faster. We argue that the exclusion restriction is also satisfied. In the derivations that follow regarding the exclusion restriction, we suppress the c index and the country $\times$ year fixed effects for simpler notation. These dummies play a role parallel to that of sector $\times$ time, but the treatment is similar and we leave those out as they would complicate notation significantly.

We want the reduced form regression,

$$\text{TFP}_{i,t} = \mu_i + \nu_{s,t} + \delta \text{Z}_{i,t} + w_{i,t} \ ,$$

to give unbiased estimates of δ. For the purpose of estimating δ, this estimation

equation, by the Frisch-Waugh theorem, is equivalent to

$$\text{TFP}_{i,t}-\text{TFP}_{i.}-\text{TFP}_{s,t}+\text{TFP}_{s.} = \delta\left[\widehat{\text{FO}}_i\text{W}_{s,t}-\widehat{\text{FO}}_i\text{W}_{s.}-\widehat{\text{FO}}_s\text{W}_{s,t}+\widehat{\text{FO}}_s\,\text{W}_{s.}\right]+(w_{i,t}-w_{i.}-w_{s,t}+w_{s.})\,,$$

where $\text{X}_{i.} = \frac{1}{T}\Sigma_{t=1}^{T}\text{X}_{i,t}$, $\text{X}_{s,t} = \frac{1}{N_s}\Sigma_{i=1}^{N_s}\text{X}_{i,t}$, where the summation is over all firms i in sector s in year t, $\text{X}_{s.} = \frac{1}{N_s}\Sigma_{i=1}^{N_s}\frac{1}{T}\Sigma_{t=1}^{T}\text{X}_{i,t}$, etc. for any variable X.

The structural relation (TFP), demeaned, is

$$\text{TFP}_{i,t} - \text{TFP}_{i.} - \text{TFP}_{s,t} + \text{TFP}_{s.} = \alpha\left[\text{FO}_{i,t} - \text{FO}_{i.} - \text{FO}_{st} + \text{FO}_{s.}\right] + (u_{i,t} - u_{i.} - u_{s,t} + u_{s.})$$

and the reduced form regression on the instrument will be consistent if the covariance

$$Cov(u_{i,t} - u_{i.} - u_{s,t} + u_{s.}, \widehat{\text{FO}}_i\text{W}_{s,t} - \widehat{\text{FO}}_i\text{W}_{s.} - \widehat{\text{FO}}_s\text{W}_{s,t} + \widehat{\text{FO}}_s\,\text{W}_{s.}) = 0\ .$$

This will be the case if

$$E\{(u_{i,t} - u_{i.} - u_{s,t} + u_{s.})\widehat{\text{FO}}_i\text{W}_{s,t}\} = 0\ .$$

Our $i \times (s,t)$ instrument will be consistent as long as the off-diagonal variation $u_{i,t}-u_{i.}-u_{s,t}+u_{s.}$ is uncorrelated with $\widehat{\text{FO}}_i$. This is a reasonable assumption because the firm-average innovation $u_{i.}$—which most likely would correlate with firm specific ownership—is subtracted. We also need $u_{i,t}-u_{i.}-u_{s,t}+u_{s.}$ to be uncorrelated with $\text{W}_{s,t}$, which is again reasonable because sector averages are subtracted, and the product of $\widehat{\text{FO}}_i$ with $\text{W}_{s,t}$ is independent of TFP innovations.

To construct the instrument, first, we choose $\widehat{\text{FO}}_i$ to be the initial level of foreign ownership FO_{i0}. Second, for a time-varying measure of growth in foreign ownership, $\text{W}_{s,c,t}$, (now making the country dependence explicit again), we construct

$$I^{I}_{s,c,t} = \sum_{i\in c,t,s}{}^{\text{FO}^{I}_{i,t}\text{Y}_{i,0}}\Big/\sum_{i\in c,s}{}^{\text{Y}_{i,0}}\ ; \tag{9}$$

where $\text{FO}^I_{i,t}$ is industrial ownership by foreign companies. I.e., $I^I_{s,c,t}$ is sector-level foreign industrial ownership in country c at time t. We further construct

$$I^F_{s,c,t} = \sum_{i \in c,t,s} \text{FO}^F_{i,t} \text{Y}_{i,0} \Big/ \sum_{i \in c,s} \text{Y}_{i,0} \ ; \tag{10}$$

where $\text{FO}^F_{i,t}$ is ownership by foreign financial companies. I.e., $I^F_{s,c,t}$ is sector-level foreign financial ownership in country c at time t.

We assume that country-sector level financial ownership is a function of current profit opportunities in the relevant sector-country cell as they accrue to a passive financial investor. If there is reverse causality, such that foreign financial investment is determined by

$$\text{FO}^F_{i,t} = \gamma_0 + \gamma_1 \text{TFP}_{i,t} + e_{i,t} \ ,$$

where $e_{i,t}$ is a noise term which aggregate to 0 in I^F by the law of large numbers, and

$$\text{FO}^I_{i,t} = \xi_0 + \xi_1 \text{TFP}_{i,t} + v_{i,t} \ ,$$

where $v_{i,t}$ is an innovation which is partly based on industrial owner's return to active management and which aggregates to $\text{W}_{s,c,t}$, then

$$I^I_{s,c,t} = b\, I^F_{s,c,t} + \text{W}_{s,c,t} + e_{s,c,t} \ , \tag{11}$$

where $\text{W}_{s,c,t}$ is the investment driven by extra future income that industrial owners can obtain from *active* management (or from market power, in case of mergers—whatever is specific to industrial ownership). If we know b, we can use $I^I_{s,c,t} - b\, I^F_{s,c,t} = \text{W}_{s,c,t} + e_{s,c,t}$ as an exogenous instrument because the component of country-sector foreign ownership which is due to predicted future profits from passive investment, and which is the source of potential reverse causality, has been subtracted.

We obtain an estimate of b by regressing I^I on I^F and take residuals, $\text{W}_{s,c,t}$,

which is part of our instrument; i.e.,

$$\mathrm{W}_{s,c,t} = I^{I}_{s,c,t} - \hat{b}\, I^{F}_{s,c,t} \tag{12}$$

For the instrument to be valid, it is essential that firm and time dummies are included in the IV regressions because this implies that only changes relative to average values affect the results. For this reason, we refer to this variable as sector-level growth in foreign ownership.

$$E\{\, \widehat{\mathrm{FO}}_i \, \mathrm{W}_{s,c,t} \, (u_{i,t} - u_{i.} - u_{s,t} - u_{c,t} + u_{c,.} + u_{s,.}) \,\} = 0 \ ;$$

i.e., whether $\mathrm{FO}_{i0}\mathrm{W}_{s,c,t}$ is relatively high (low) when $(u_{i,t} - u_{i.} - u_{s,t} - u_{c,t} + u_{c,.} + u_{s,.})$ is relatively high (low). The endogenous component of FO_{i0} is u_{i0} so the assumption is that

$$E\{\mathrm{FO}_{i0} \, \mathrm{W}_{s,c,t} \, (u_{i,t} - u_{i.} - u_{s,t} - u_{c,t} + u_{c,.} + u_{s,.}) \,\} = 0 \ .$$

We have assumed that W is independent of u after controlling for country and sector fixed effects, so this simplifies to

$$E\{\mathrm{W}_{s,c,t}\} E\{\mathrm{FO}_{i0} \, (u_{i,t} - u_{i.} - u_{s,t} - u_{c,t} + u_{c,.} + u_{s,.}) \,\} = 0 \ .$$

Because FO_{i0} may be a function of initial productivity, this basically is the assumption that $E\{u_{i0} \, (u_{i,t} - u_{i.}) \,\} = 0$ so the main identifying assumption then is that the initial firm productivity *level* doesn't not predict firm-level *passive* productivity *growth*.

Appendix: Data

Sample Selection

We construct a unique data set of firm-level observations from the comprehensive database ORBIS, which covers around 100 million listed and private companies around the world. In this study, we focus on European companies (roughly a half of the entire ORBIS universe).[37] The European subset of ORBIS includes 40 countries with varying coverage. It totals some 50 million companies: public and private, large, medium, and small, with about 10 thousand listed companies. A company with subsidiaries is required to prepare consolidated accounts; however, we use only *unconsolidated* accounts to avoid double counting.[38]

The literature typically cleans the raw data. This appendix demonstrates the cleaning process in two major steps:

1. Cleaning which is necessary for any project linking firm ownership with firm outcomes (we refer to this as "general cleaning").

2. Further cleaning pertaining to this project (we refer to this as "project-specific cleaning").

[37] For marketing purposes, the BvD packages this data in a separate database, AMADEUS, which has a very similar structure to ORBIS.

[38] Even though the number of consolidated accounts is less than 1 percent of all accounts, it is important to use just the unconsolidated accounts. ORBIS categorizes all companies as subsidiaries regardless of the percentage of ownership: In standard accounting, a company A will be classified as a subsidiary of a company B if company B owns more than 50 percent of company A, while in ORBIS company A will be called a subsidiary even company B owns a 1 percent stake. There can be direct subsidiaries and also indirect subsidiaries. For example, BMW has 186 recorded subsidiaries, 54 of which are outside Europe (like BMW United States) and hence not in our data set. 77 out of the remaining 132 are direct subsidiaries while the remaining 55 companies are subsidiaries of these. Another example is LEGO, which has 38 subsidiaries of which 3 are directly owned—the remainder are subsidiaries of these. By using unconsolidated accounts, outcomes do not include the outcome of parents and subsidiaries. By looking at the consolidated accounts of the 3 direct subsidiaries, we verified that the sum of sales and employment of the indirect subsidiaries is less than the numbers reported in the consolidated accounts of the 3 direct subsidiaries. (It will not be an exact match because we do not have data for subsidiaries outside Europe).

General Cleaning

We focus on companies of a certain minimum size, discarding the companies defined by ORBIS as "small" (operating revenue less than EUR1 million; total assets less than EUR2 million, or number of employees less than 10). The data coverage is limited at the beginning of the period and for some countries; due to the limited coverage before mid-1990s and delays with reporting the data coverage for meaningful analysis, we focus on 1996–2008. We have information for 40 European countries and 1.8 million of unique firms for the period 1996–2008 of which many have missing outcomes and/or assets.

The main financial variables used in the analysis are total assets, operating revenue, tangible fixed assets, and expenditure on materials and employment. We convert all financial data into "2005 PPP dollars" using yearly GDP deflators with 2005 base from the World Bank and 2005 end-of-year US dollar exchange rates. The "$" sign will represent 2005 PPP dollars in the following. Employment is measured in number of persons.

We drop all firms with assets less than $1,000 in any year, employment negative or larger than 2 million (the employment of Walmart), negative sales, or negative operating revenue. As the result, we have 1.76 million firms. We drop firms that do not have ownership information and obtain a sample for 40 European countries and 1.42 million unique firms (See below for details of ownership variables calculation).

Our firms represent a wide range of industries. The classification of 2 digit NACE Revision 2, Level 2 industries is presented in Table A-3. We drop certain industries: electricity, gas, steam and air conditioning supply (NACE codes 35xx); water supply, sewerage, waste management and remediation activities (NACE codes 36xx–39xx); financial and insurance services (NACE codes 41xx–43xx); real estate (NACE codes 68xx); public administration and defense (NACE codes 84xx); and activities of extraterritorial organizations (NACE codes 99xx), leaving 1.23 million firms.

Next, we drop firms with gaps in the data. For example, if a firm reports data for 2001–2004, not in 2005, and then in 2006, the 2006 data is eliminated from analysis. After dropping 203,409 gaps we still have 1.23 million firms but fewer time series observations.

For the construction of our regression variables, we need non-missing data for certain financial variables. We drop firms with zero or missing employment, operating revenue, total assets, or negative "costs of materials" and are left with 907 thousand firms.

Visual inspection reveals errors in the data. For example, some numbers seem to be incorrectly coded in dollars rather than in millions of dollars, and to alleviate outliers due to typing mistakes, we eliminate firms below the 0.1th percentile and above the 99.9th percentile in the distribution of sales to assets, operating revenue to assets, operating revenue to sales, employment to assets, employment to sales, employment to operating revenue, operating revenue less material costs ("value added" computed by us) to operating revenue, and operating revenue less material costs to employment in any year. For the ratio of revenue to sales, we drop firms above the 95th percentile in order to eliminate firms with high financial income (included in operating revenue but not in sales numbers). Although we drop all firms classified as financial companies by ORBIS, many non-financial companies have significant investment income and our cleaning is intended to remove such firms. An extreme example is Warren Buffett's Berkshire Hathaway, which started as a textile firm and became an investment company over time. We also eliminate firms with sales larger than operating revenue. These filters also get rid of most phantom firms, tax-fronts, etc. The resulting sample covers 788 thousand unique firms from 38 European countries over 1996–2008.

Project-Specific Cleaning

Data coverage, in particular sectoral information, is limited at the beginning of the sample and for some countries. Therefore, we use a sample of 15 developed countries and 15 emerging countries over 1999–2008 with approximately 740 thousand firms.

We concentrate on the sample of firms with more than 15 employees and known sector information (at 2- and 4-digit level of the NACE industry classification Revision 2 in Table A-3). This step eliminates roughly half of the cleaned sample bringing it down to 15 developed countries and 15 emerging countries, over 1999–2008, with approximately 336 thousand firms. The data counts by country are presented in panel A of Appendix Table A-2.

In order to compute total factor productivity (TFP) at the firm level, we need data on output, employment, physical capital and cost of materials. Unfortunately, firms in some countries are not obliged to report expenditure on materials; furthermore, some firms do not report data on total fixed assets. This limits our sample to 208,400 firms from 12 developed and 13 emerging countries ("Firms with Available Data for TFP Construction"). The data counts by country in this sample are presented in panel B of Appendix Table A-2.

If we focus on the manufacturing sector only (to compare our findings to previous results in the literature). The comparison of descriptive statistics of the key variables shows that this manufacturing firms sample is representative of the larger sample of all sectors. Focusing on manufacturing, we are left with 134,000 firms.[39]

TFP Estimation

This appendix explains the details of the firm-level productivity estimation performed using the method of Wooldridge, Levinsohn and Petrin, as suggested by

[39]See Appendix for NACE 2 sector classification. Manufacturing sectors are sectors 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33. We drop sector 19 "Manufacture of coke and refined petroleum products" since there are not enough observations per country to estimate TFP.

Olley and Pakes. (1996) and Levinsohn and Petrin (2003) and further augmented by Wooldridge (2009). Olley and Pakes. (1996) (OP) and Levinsohn and Petrin (2003) (LP) propose to use proxy variables to control for unobserved productivity. The estimation in both methods is based on a two-step procedure to achieve consistency of the coefficient estimates for the inputs of the production function. Wooldridge (2009) suggests a generalized method of moments estimation of TFP to overcome some limitations of OP and LP, including correction for simultaneous determination of inputs and productivity, no need to maintain constant returns to scale, and robustness to the Ackerberg, Caves, and Frazer (2008) critique.[40] The following discussion is based on Wooldridge (2009), accommodated to the case of a production functions with two production inputs (see Wooldridge (2009) for a general discussion).

For firm i in time period t define:

$$y_{it} = \alpha + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + e_{it}\,, \tag{13}$$

where y_{it}, l_{it}, and k_{it} denote the natural logarithm of firm value added, labor (a variable input), and capital, respectively. The firm specific error can be decomposed into a term capturing firm specific productivity ω_{it} and an additional term that reflects measurement error or unexpected productivity shocks e_{it}. We are interested in estimating ω_{it}.

A key assumption of the OP and LP estimation methods is that for some function $g(.,.)$:

$$\omega_{it} = g(k_{it}, m_{it})\,, \tag{14}$$

where m_{it} is a proxy variable (for investment in OP, for intermediate inputs in LP).

[40] Ackerberg, Caves, and Frazer (2008) highlight that if the variable input (labor) is chosen prior to the time when production takes place, the coefficient on variable input is not identified.

Under the assumption,

$$E(e_{it}|l_{it}, k_{it}, m_{it}) = 0 \qquad t = 1, 2, ..., T\,, \tag{15}$$

substituting equation (14) into equation (13), we have the following regression function:

$$\begin{aligned} E(y_{it}|l_{it}, k_{it}, m_{it}) &= \alpha + \beta_l l_{it} + \beta_k k_{it} + g(k_{it}, m_{it}) \\ &\equiv \beta_l l_{it} + h(k_{it}, m_{it})\,, \end{aligned} \tag{16}$$

where $h(k_{it}, m_{it}) \equiv \alpha + \beta_k k_{it} + g(k_{it}, m_{it})$.

In order to identify β_l and β_k, we need some additional assumptions. First, rewrite equation (15) in a form allowing for more lags :

$$E(e_{it}|l_{it}, k_{it}, m_{it}, l_{i,t-1}, k_{i,t-1}, m_{i,t-1}, ..., l_{i1}, k_{i1}, m_{i1}) = 0 \qquad t = 1, 2, ..., T\,. \tag{17}$$

Second, assume productivity follows a first-order Markov process:

$$E(\omega_{it}|\omega_{i,t-1}, ..., \omega_{i1}) = E(\omega_{it}|\omega_{i,t-1}) \qquad t = 2, 3, ..., T, \tag{18}$$

and assume that the productivity innovation $a_{it} \equiv \omega_{it} - E(\omega_{it}|\omega_{i,t-1})$ is uncorrelated with current values of the state variable k_{it} as well as past values of the variable input l, the state k, and the proxy variables m:

$$\begin{aligned} &E(\omega_{it}|k_{it}, l_{i,t-1}, k_{i,t-1}, m_{i,t-1}, ..., l_{i1}, k_{i1}, m_{i1}) \\ &\quad = E(\omega_{it}|\omega_{i,t-1}) \equiv f[g(k_{i,t-1}, m_{i,t-1})]\,. \end{aligned} \tag{19}$$

Recall from equation(14) that $\omega_{i,t-1} = g(k_{i,t-1}, m_{i,t-1})$.

Plugging $\omega_{i,t} = f[g(k_{i,t-1}, m_{i,t-1})] + a_{it}$ into equation (13) gives:

$$y_{it} = \alpha + \beta_l l_{it} + \beta_k k_{it} + f[g(k_{i,t-1}, m_{i,t-1})] + a_{it} + e_{it}\,. \tag{20}$$

Now it is possible to specify two equations which identify (β_l, β_k):

$$y_{it} = \alpha + \beta_l l_{it} + \beta_k k_{it} + g(k_{i,t}, m_{i,t}) + e_{it} \tag{21}$$

and

$$y_{it} = \alpha + \beta_l l_{it} + \beta_k k_{it} + f[g(k_{i,t-1}, m_{i,t-1})] + u_{it}\,, \tag{22}$$

where $u_{it} \equiv a_{it} + e_{it}$.

Important for the GMM estimation strategy, the available orthogonality conditions differ across these two equations. The orthogonality conditions for equation (21) are those outlined in the equation(17), while the orthogonality conditions for equation (22) are

$$E(u_{it}|k_{it}, l_{i,t-1}, k_{i,t-1}, m_{i,t-1}, ..., l_{i1}, k_{i1}, m_{i1}) = 0 \qquad t = 2, ..., T\,. \tag{23}$$

To proceed with the estimation, we estimate these equations parametrically. In that, we follow Petrin, Reiter, and White (2011) and use a third-degree polynomial approximation using first order lags of variable input as instruments.[41]

Details of Foreign Ownership Calculations

To construct time and firm-specific foreign ownership variables we use two separate datasets available from the BvD: the Ownership section of ORBIS dataset with "static" ownership breakdown for a given firm at year-end, and the global Zephyr dataset containing information about *changes* in ownership due to M&A. The ORBIS-Ownership database contains detailed information on owners of both

[41] We use the Stata routine suggested in Petrin, Reiter, and White (2011).

listed and private firms including name, country of residence, and type (e.g., bank, industrial company, fund, individual, and so on). The global Zephyr database from the BvD which contains "deal records;" i.e., in each M&A, the target, the acquiring party or parties, the dates when the deal was announced and completed, and the type of the deal (e.g., Acquisition, Acquisition of 15%, Merger, Joint Venture, etc.).

Direct ownership and Ultimate ownership

A unit of observation in the Ownership section of ORBIS is the ownership link indicating that an entity A owns a certain percentage of firm B, which is referred as a "direct" ownership link. In addition, ORBIS contains information on-so called "ultimate" owners (UO) of the company by tracing the ownership pyramid beyond the direct owners. To find UOs of a company, BvD focuses on identifying the owners, if any, who exercise a greater degree of control over the company.

We prefer *direct ownership* because of the following considerations. First, most UO links are calculated by BvD but not reported by the original sources whereas the direct ownership links are taken from the direct sources and not altered by BvD. to identify UOs, BvD focuses on targets where at least one owner has more than 25 percent of direct ownership. For each such entity, BvD looks for the owner with the highest direct ownership stake. If this shareholder is "independent" (being owned less than 25 percent by any of its owners), it is defined as the UO of the company. If the shareholder with the largest ownership share is not independent, the process is repeated until BvD finds the UO. BvD admits that "even if the scope of the BvD ownership database is very wide, BvD cannot absolutely assert that all the existing links are recorded in the database. More importantly, because certain ownership structures can be very complex, trying to evaluate a controlling ultimate owner could be misleading" (Bureau van Dijk (2010)). Second, it is not possible to compute a satisfactory *continuous* ownership variable over time from the ultimate ownership links, exactly because of the uncertainty associated with construction of this variable. In contrast, large owners are almost always precisely identified

from our direct ownership variable. Finally, because the process of identifying the ultimate owner only uses the largest owners, foreign owners with stakes smaller than 25 percent are ignored, which leads to an incorrect classification of "foreign-owned" firms; we find that many foreign owners in our sample hold stakes that are smaller than 25 percent but not negligible.

Type-specific ownership.

The database refers to each record of ownership as an "ownership link" and BvD traces a link between two entities even when the ownership percentage is very small (sometimes less than 1 percent). For listed firms, very small stock holders are typically unknown.[42] An ownership link indicating that an entity A owns a certain percentage of firm B is referred to in ORBIS as a "direct" ownership link. We recode the the categorical variables indication direct ownership percentages into numeric format replacing special character values according to the usual GAAP practice as follows: replace special code "WO" (wholly owned) with 100%; replace special code "MO" (majority owned) with 51%; replace code "CQP1" (50% plus 1 share) with 50%.

The database contains a variable for country of residence of owners. If the owner's country is not the same as the country of the firm, the link is identified as foreign. Often the owner country is missing. In such cases, the researchers who work with BvD data typically assume that the owner is located in the same country as the given company. To improve on this procedure, we inspect the variable "owner name." When possible, we manually categorize the owner as foreign if the owner's name suggest so. The remaining (typically small) owners of unknown origin are

[42]Countries have different rules for when the identity of a minority owner needs to be disclosed; for example, France, Germany, the Netherlands, and Sweden demand that listed firms disclose all owners with more than a five percent stake, while disclosure is required at three percent in the UK, and at two percent in Italy. See Siems and Schouten (2009). Information regarding US companies taken from the SEC Edgar Filings and the NASDAQ, however, stops at 1 percent (Bureau van Dijk (2010)) BvD collects its ownership data from the official registers (including SEC filings and stock exchanges), annual reports, private correspondence, telephone research, company websites, and news wires.

assigned to the home country.

Next, we identify foreign links corresponding to a specific "owner type" using the available type of owner variable. The values of this variable is textual but sufficiently harmonized. Specifically, we identify *foreign ownership link of industrial type* if the foreign owner has the type "industrial company" or "corporate." We identify *foreign ownership link of financial type* if the foreign owner has the type "bank," "financial company," "insurance company," "mutual & pension fund/trust/nominee," "other financial institution," "pension/mutual fund," "private equity firms," or "Stichting."[43,44]

Having identified foreign ownership links of a given type, we compute *Foreign Ownership* (FO) variable as follows: For a firm i, $\text{FO}_{i,t}$ is the sum of all percentages of direct ownership by foreigners in year t; $\text{FO}^F_{i,t}$ ($\text{FO}^I_{i,t}$) is the sum of all percentages of direct ownership by foreigners of financial (industrial) type. For example, if a company A has three foreign owners with stakes 10 percent, 15 percent, and 35 percent; respectively, FO for this company is 60 percent. If the second owner is a bank, and the first and the third owner are industrial, the $\text{FO}^F_{i,t}$ is 15% and ($\text{FO}^I_{i,t}$) is 45%. The missing ownership percentage is set to zero, even though the link is preserved for other purposes (such as, for example, count of the number of owners).

Finally, we round FO values to a 100th of a percent and clean the resulting year and firm-specific ownership data for erroneous values due to obvious mistakes. We encountered relatively few cases of those. We drop a few firms where the computed total ownership (foreign and domestic) is larger than 102%. We replace $\text{FO} \subset [100, 102)$ by 100%.

[43]For observations before 2001, the only owner type values available are "corporate" and "individual." The finer division starts in 2002 but no "industrial company" value is available; both "corporate" and "industrial company" co-exist from 2004-on. We assign the "corporate" to be industrial type, because it is otherwise impossible to determine the type of a given owner.

[44]The other types of the owners could be "government," public (for listed companies), or "other" for non-classified owners such as autocontrol, self-owned, employees/managers, individual, individual(s) or family(ies), personnel, employees, private individuals/private shareholders, foundation, foundation/research institute, unnamed private shareholders aggregated, miscellaneous, undefined company, unknown, n.a., or simply missing.

Filling-in missing ownership information.

Kalemli-Ozcan, Sørensen, and Volosovych (2010) provide detailed examples demonstrating that for the years we observe the ownership data from the ORBIS-Ownership dataset includes all the information in the Zephyr database of Mergers and Acquisitions and adds to this because foreign ownership can change over time due to other reasons then M&As. The examples demonstrate that ownership information in Zephyr is clearly reflected in our FO variables, but there are companies that had changes in FO based on the ORBIS-Ownership dataset which do not appear in Zephyr.

We have access to the ORBIS-Ownership dataset only at a biannual frequency for the years 2000, 2002, 2004, 2006, 2008. We use the change in ownership information from Zephyr to fill-in the gaps in the time series and to extend it to the earlier years. The Zephyr data can easily be matched with the ORBIS-Ownership because a BvD company identifier is included in both databases. We keep Zephyr deals in which both the BvD ID of the target and the acquiror are non-missing. Each deal comes with information about the stake acquired during this transaction and we need to turn all possible information into numeric values. For the cases in which the acquired stake is codified as unknown, we infer this value from non-missing information of the initial and final stakes, if possible, and otherwise drop the observation.

In the next step, we clean the date variables. Zephyr includes a number of date variables showing when the deal took place (e.g., date announced, date completed, etc.). We drop observations for which no information on the date of the deal is provided. If there are multiple non-missing dates, we use the date when the deal was completed.

In the following step, we generate variables equivalent to the ones that had been created for ORBIS-Ownership. That is, we identify foreign links corresponding to a specific "owner type" using the available type of owner variable (e.g., industrial versus financial foreign ownership). There are cases in which a target company

has multiple ownership changes within the same year and the same acquiror. In this case, we keep the largest stake for a given acquiror and target in a given year. Therefore, after this step our Zephyr dataset is uniquely identified at the target-acquiror-year level. Finally, we collapse the data at the target-year level, thereby adding up all the foreign ownership stakes for each foreign nationality-type.

Once we have obtained the clean version of our Zephyr dataset for each target firm-year cell, we merge it with the ORBIS-Ownership database. In order to obtain the best match, in a sense of filling-in the missing gaps in the ORBIS-Ownership dataset without overwriting with potentially incorrect data from Zephyr, we adopt the following procedure. First, we generate a balanced panel for the ORBIS-Ownership database for the years 2000–2010. Next, we merge this balanced panel with our cleaned version of the Zephyr dataset using the unique BvD ID identifiers that are present in both datasets. Given that our primary ownership information is from the ORBIS-Ownership dataset, we give priority to this dataset. Among other things, we do not replace non-missing ORBIS-Ownership information with Zephyr information. In other words, we only add ownership from Zephyr when the corresponding ownership information is missing in ORBIS-Ownership. With respect to filling-in the missing gaps in the data, gaps can be present in initial years, final years, or years in between. For gaps in initial (final) years of ownership, we assume that the ownership is the same as in the first (last) observation with non-missing data. For missing observations in periods between the first and last non-missing periods, we replace the missing values with the non-missing observations of the earlier periods. The underlying assumption is that if a no transaction has been included in Zephyr, then there was no ownership change.

The resulting combined ownership dataset is merged with financial data.

Descriptive Statistics

Table A-4 reports descriptive statistics. The samples include firms in the manufacturing sector with available data for the regression analysis. "Domestic Firms" do not have foreign owners in any year.[45] On average, firms in developed countries are more productive than firms in emerging countries regardless of measure. With respect to output and employment market shares at the 2- and 4-digit level, we observe much higher concentration in emerging markets, especially at the 4-digit level, suggesting a less competitive market environment there. FO and industrial FO is somewhat larger for emerging-country firms. Financial FO shares are very small in both samples and their variation is lower. Sub-panels 2 and 3 of Table A-4 report features of the spillover variables in the sub-samples of purely domestic firms in developed and emerging countries. The general pattern is of somewhat larger values of all measures of spillovers in emerging markets.

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[45]The subsamples of domestic firms used in spillovers regressions are not the same in sub-panels A2 and A3 (B2 and B3) because we use somewhat different data. For example, we estimate backward/forward spillovers using 2-digit input-output tables—4-digit tables are not available. Our knowledge/competition spillovers are based on 4-digit sector classifications; we omit 4-digit sector-country cells with less than 7 firms. However, that are no systematic differences between the samples of domestic firms in panels A2 and A3 (B2 and B3) (descriptive statistics are available from authors).

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Table A-1: Firm Coverage in Manufacturing: 2002–2007.

		(1)	(2)	(3)	(4)
	Sample	Firms	Firms with GUO	Firms with FO	Firms with Financial Data in Every Year
			Our sample		
1	UA	39952	451	628	18931
2	SK	3376	79	508	301
3	SI	3457	36	129	1510
4	SE	21159	1421	452	15236
5	RU	57259	1934	1330	69
6	RS	16642	64	505	6820
7	RO	49597	105	3885	14084
8	PT	33242	237	202	77
9	PL	11393	291	1542	2706
10	NO	6696	52	163	28
11	NL	1919	143	298	434
12	LV	2276	26	118	329
13	LT	2393	11	170	471
14	IT	116	15	3	84
15	HU	13029	29	245	587
16	HR	7650	90	178	4334
17	GR	4682	66	38	3484
18	GB	12828	487	2046	5670
19	FR	88854	1158	1975	56140
20	FI	10150	323	318	2999
21	ES	82059	1183	1169	43639
22	EE	4262	14	534	1882
23	DK	1600	69	174	64
24	DE	14384	382	1193	568
25	CZ	13234	305	1763	3160
26	CH	163	56	15	95
27	BG	7574	80	611	1422
28	BE	8804	420	678	3193
29	BA	2677	26	100	1019
30	AT	1610	46	213	81
	Sum	523037	9599	21183	188620
			Additional Countries with Problematic TFP Coverage		
1	US	6230	1554	190	1566
2	KR	37446	153	215	8845
3	JP	27577	1527	128	10727
4	CN	181906	776	1952	60504
	Sum	253159	4010	2485	81642
			Additional Countries with Problematic Firm Coverage		
1	ZA	70	19	5	3
2	TW	1225	893	3	23
3	TR	78	3	5	.
4	TN	3	.	.	.
5	NZ	13	3	.	2
6	MY	919	144	139	54
7	MX	1278	44	277	.
8	MK	355	11	10	.
9	MA	6	.	.	.
10	KZ	12	2	3	2
11	IS	336	12	7	5
12	IN	213	15	13	3
13	IL	196	45	14	6
14	IE	586	89	174	15
15	ID	213	5	55	12
16	HK	55	12	13	7
17	EG	38	.	4	.
18	CO	409	13	10	17
19	CL	53	2	3	.
20	CA	10	3	3	.
21	BR	1926	65	366	.
22	BM	268	46	226	41
23	AU	593	239	165	19
24	AR	691	28	168	2
25	AE	11	4	.	.
	Sum	9557	1697	1663	393

Notes: The table presents number of firms from ORBIS with some financial data from selected countries. **Countries**: Algeria (DZ), Argentina (AR), Australia (AU), Austria (AT), Belarus (BY), Belgium (BE), Bermuda (BM), Bosnia and Herzegovina (BA)[a], Brazil (BR), Bulgaria (BG), Canada (CA), Chile (CL), China (CN), Colombia (CO), Croatia (HR), Czech Republic (CZ), Denmark (DK), Egypt (EG), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (GR), Hong Kong (HK), Hungary (HU), Iceland (IS), India (IN), Indonesia (ID), Ireland (IE), Israel (IL), Italy (IT), Japan (JP), Kazakhstan (KZ), Korea Republic of (KR), Latvia (LV), Lithuania (LT), Macedonia (MK), Malaysia (MY), Mexico (MX), Morocco (MA), Netherlands (NL), New Zealand (NZ), Norway (NO), Poland (PL), Portugal (PT), Romania (RO), Russian Federation (RU), Serbia (RS), Slovakia (SK), Slovenia (SI), South Africa (ZA), Spain (ES), Sweden (SE), Switzerland (CH), Taiwan (TW), Tunisia (TN), Turkey (TR), Ukraine (UA), United Arab Emirates (AE), United Kingdom (GB), United States of America (US). **Financial Data:** All companies with a known value of 1) Operating revenue; and 2) Total assets; and 3) Number of employees in *at least one* of the selected periods 2002–2007. **GUO is Global Ultimate Owner, FO is foreign owned in any amount larger than zero percent** .

Table A-2: Number of Observations per Country

Panel A: Total Number of Firms

Developed					Emerging				
Country	Obs.	Number Firms	Average Time	Firms per mill. Pop	Country	Obs.	Number Firms	Average Time	Firms per mill. Pop
AUSTRIA	2,140	1,142	1.87	140	BOSNIA AND HERZEGOVINA	1,536	228	6.74	61
BELGIUM	67,674	9,642	7.02	922	BULGARIA	22,236	3,564	6.24	457
DENMARK	11,403	2,997	3.80	554	CROATIA	19,628	2,169	9.05	489
FINLAND	37,219	5,019	7.42	958	CZECH REPUBLIC	60,444	10,322	5.86	1,004
FRANCE	357,607	56,600	6.32	935	ESTONIA	17,705	2,213	8.00	1,637
GERMANY	41,067	14,880	2.76	181	HUNGARY	4,997	2,128	2.35	210
GREECE	66,763	7,567	8.82	684	LATVIA	10,913	1,480	7.37	431
ITALY	230,802	34,447	6.70	592	LITHUANIA	10,996	1,872	5.87	809
NETHERLANDS	8,671	2,077	4.17	128	POLAND	83,085	12,669	6.56	331
NORWAY	54,058	7,155	7.56	1,552	ROMANIA	34,407	4,097	8.40	188
PORTUGAL	18,484	6,864	2.69	656	RUSSIAN FEDERATION	244,018	57,474	4.25	399
SPAIN	331,651	42,345	7.83	990	SERBIA	22,421	2,855	7.85	383
SWEDEN	80,424	9,185	8.76	1,019	SLOVAKIA	9,547	1,938	4.93	360
SWITZERLAND	1,712	255	6.71	34	SLOVENIA	10,516	1,797	5.85	898
UNITED KINGDOM	179,929	26,864	6.70	448	UKRAINE	27,207	3,709	7.34	78
TOTAL	1,489,604	227,039	6.56	–	TOTAL	579,656	108,515	5.34	–

Panel B: Number of Firms with Available Data for TFP Construction

Developed					Emerging				
Country	Obs.	Number Firms	Average Time	Firms per mill. Pop	Country	Obs.	Number Firms	Average Time	Firms per mill. Pop
AUSTRIA	1415	871	1.62	107	BOSNIA AND HERZEGOVINA	1521	226	6.73	60
BELGIUM	49093	6581	7.46	630	BULGARIA	21054	3432	6.13	440
DENMARK	–	–	–	–	CROATIA	19027	2123	8.96	479
FINLAND	34162	4673	7.31	892	CZECH REPUBLIC	36074	7660	4.71	745
FRANCE	325609	51953	6.27	858	ESTONIA	14766	2040	7.24	1509
GERMANY	38349	13985	2.74	170	HUNGARY	4855	2089	2.32	206
GREECE	–	–	–	–	LATVIA	301	53	5.68	15
ITALY	225524	33675	6.70	578	LITHUANIA	–	–	–	–
NETHERLANDS	419	75	5.59	5	POLAND	61647	11051	5.58	289
NORWAY	16374	2108	7.77	457	ROMANIA	33991	4029	8.44	185
PORTUGAL	12070	4787	2.52	458	RUSSIAN FEDERATION	–	–	–	–
SPAIN	315079	40346	7.81	943	SERBIA	22306	2836	7.87	381
SWEDEN	46666	6436	7.25	714	SLOVAKIA	7857	1841	4.27	342
SWITZERLAND	498	75	6.64	10	SLOVENIA	10350	1778	5.82	888
UNITED KINGDOM	–	–	–	–	UKRAINE	26720	3672	7.28	77
TOTAL	1065258	165565	6.43	–	TOTAL	260469	42830	6.08	–

Notes: Panel A reports on firms with reliable data for output, employment, ownership, with varying coverage over 1999–2008, as well as, sectoral information. We focus on firms with more than 15 employees and total assets over $1000, 2005 base. Firms in Panel B have data for computing TFP. See Data Appendix for more details on sample selection. Firms per mill. Pop reports the average number of firms per capita in millions (average population over bi-annual intervals from 2000 to 2008 from the World Bank.

Table A-3: (Appendix Table 2) NACE Revision 2, Level 2 Classification.

Code	Name of the Level 2 NACE sector
01	Crop and animal production, hunting and related service activities
02	Forestry and logging
03	Fishing and aquaculture
05	Mining of coal and lignite
06	Extraction of crude petroleum and natural gas
07	Mining of metal ores
08	Other mining and quarrying
09	Mining support service activities
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture, etc.
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing
33	Repair and installation of machinery and equipment
35	Electricity, gas, steam and air conditioning supply
36	Water collection, treatment and supply
37	Sewerage
38	Waste collection, treatment and disposal activities; materials recovery
39	Remediation activities and other waste management services
41	Construction of buildings
42	Civil engineering
43	Specialised construction activities
45	Wholesale and retail trade and repair of motor vehicles and motorcycles
46	Wholesale trade, except of motor vehicles and motorcycles
47	Retail trade, except of motor vehicles and motorcycles
49	Land transport and transport via pipelines
50	Water transport
51	Air transport
52	Warehousing and support activities for transportation
53	Postal and courier activities
55	Accommodation
56	Food and beverage service activities
58	Publishing activities
59	Motion picture, video and television programme production, sound recording and music publishing
60	Programming and broadcasting activities
61	Telecommunications
62	Computer programming, consultancy and related activities
63	Information service activities
64	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance and pension funding, except compulsory social security
66	Activities auxiliary to financial services and insurance activities
68	Real estate activities
69	Legal and accounting activities
70	Activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74	Other professional, scientific and technical activities
75	Veterinary activities
77	Rental and leasing activities
78	Employment activities
79	Travel agency, tour operator and other reservation service and related activities
80	Security and investigation activities
81	Services to buildings and landscape activities
82	Office administrative, office support and other business support activities
84	Public administration and defence; compulsory social security
85	Education
86	Human health activities
87	Residential care activities
88	Social work activities without accommodation
90	Creative, arts and entertainment activities
91	Libraries, archives, museums and other cultural activities
92	Gambling and betting activities
93	Sports activities and amusement and recreation activities
94	Activities of membership organizations
95	Repair of computers and personal and household goods
96	Other personal service activities
97	Activities of households as employers of domestic personnel
98	Undifferentiated goods- and services-producing activities of private households for own use
99	Activities of extraterritorial organizations and bodies

Table A-4: Summary Statistics, Firms in Manufacturing

Variable	Mean	Median	St. dev.	Min	Max
Panel A: Developed Countries					
A-1: All Firms (402,137 obs., 59,306 firms)					
log VA/L	11.42	11.43	0.53	7.26	12.91
log TFP	11.70	11.67	0.72	3.81	15.48
MS2dig_Output	0.00	0.00	0.01	0.00	0.84
MS2dig_Empl	0.00	0.00	0.01	0.00004	0.67
MS4dig_Output	0.02	0.00	0.05	0.00001	0.96
MS4dig_Empl	0.02	0.01	0.05	0.00005	0.93
FO	0.05	0.00	0.20	0.00	1.00
Industrial FO	0.05	0.00	0.20	0.00	1.00
Financial FO	0.00	0.00	0.03	0.00	1.00
A-2: Domestic Firms (350,344 obs., 52,153 firms)					
Spillover_{s2}	0.12	0.09	0.11	0.00	0.88
$\text{Spillover\_Competition}_{s4}$	0.10	0.05	0.13	0.00	0.98
$\text{Spillover\_Knowledge}_{s4}$	0.10	0.07	0.09	0.00	0.88
A-3: Domestic Firms (357,995 obs., 52,976 firms)					
Spillover_{s2}	0.12	0.09	0.11	0.00	0.88
$\text{Spillover\_Backward}_{s2}$	0.13	0.12	0.08	0.00	0.57
$\text{Spillover\_Forward}_{s2}$	0.09	0.07	0.05	0.007	0.33
Panel B: Emerging Countries					
B-1: All Firms (72,349 obs., 12,758 firms)					
log VA/L	9.68	9.70	0.98	7.19	12.89
log TFP	9.58	9.70	1.89	3.23	20.94
MS2dig_Output	0.01	0.00	0.03	0.00001	0.77
MS2dig_Empl	0.01	0.01	0.03	0.00008	0.73
MS4dig_Output	0.06	0.02	0.09	0.00010	0.92
MS4dig_Empl	0.06	0.03	0.08	0.0005	0.85
FO	0.07	0.00	0.24	0.00	1.00
Industrial FO	0.07	0.00	0.23	0.00	1.00
Financial FO	0.00	0.00	0.03	0.00	1.00
B-2: Domestic Firms (58,573 obs., 10,554 firms)					
Spillover_{s2}	0.14	0.10	0.15	0.00	0.94
$\text{Spillover\_Competition}_{s4}$	0.11	0.03	0.17	0.00	0.96
$\text{Spillover\_Knowledge}_{s4}$	0.09	0.05	0.12	0.00	0.82
B-3: Domestic Firms (55,565 obs., 10,172 firms)					
Spillover_{s2}	0.16	0.12	0.16	0.00	0.94
$\text{Spillover\_Backward}_{s2}$	0.15	0.13	0.10	0.00	0.64
$\text{Spillover\_Forward}_{s2}$	0.09	0.08	0.07	0.00	0.56

Notes: Statistics drawn from the regression samples of firms in the manufacturing sector with available data for the main regressions (see Data Appendix). Domestic firms refers to firms that did not have foreign owners in any year. log VA/L is firm value added, defined as the difference between operating revenue and expenditure on materials in PPP $ 2005 base, divided by firm employment. log TFP is the natural logarithm of total factor productivity, computed following Wooldridge-Levinsohn-Petrin (WLP). Industrial FO, Financial FO, and FO refer to the share of firm's voting equity owned by, correspondingly, industrial, financial, and all foreign owners. MS2dig_Output (MS2dig_Empl) is the firm's output (employment) market share in total output (employment) of the 2 (4)-digit sector of the firm, by country and year. The spillover variables measure the share of foreign output in total sectoral output in a country (country subscripts are suppressed for brevity). In particular, $\text{Spillover}_{s2,t} = \sum_{i \in s2} \text{FO}_{i,s,t} \times \text{Y}_{i,t} / \sum_{i \in s2} \text{Y}_{i,s,t}$ where $s2$ refers to the 2-digit sector classification and $\text{FO}_{i,s,t}$ indicates the share of foreign ownership of firm i (country subscripts are suppressed for brevity throughout). $\text{Spillover\_Competition}_{s4,t} = \sum_{i \in s4} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} / \sum_{i \in s4} \text{Y}_{i,s,t}$, where $s4$ refers to the *four-digit* sector classification. $\text{Spillover\_Knowledge}_{s4,t} = \text{Spillover}_{s2,t} - \sum_{i \in s4} \text{FO}_{i,s,t} \times \text{Y}_{i,s,t} / \sum_{i \in s2} \text{Y}_{i,s,t}$. The knowledge spillover variable captures foreign presence in the same 2-digit sector, excluding output produced by foreign-owned companies in the same 4-digit sector. $\text{Spillover\_Backward}_{j,t}$ is a measure of foreign presence in industries being supplied by sector j and equals $\sum_{k \neq j} \alpha_{jk} \text{Spillover}_{k2,t}$, where α_{sk} is the proportion of sector j output supplied to sector k. $\text{Spillover\_Forward}_{j,t}$ is a measure of foreign presence in upstream sectors and it equals $\sum_{m \neq j} \sigma_{jm} \text{Spillover}_{m2,t}$, where σ_{jm} is the share of inputs purchased by industry j from industry m in total inputs sourced by sector j. See Table A-3 for industry classifications and Sections 2 and 4 for details on construction of variables.

Table A-5: Summary Statistics: Time Variation in Foreign Ownership and Productivity, Firms in Manufacturing

	Developed Countries				Emerging Countries			
year	Obs.	Firms	Average FO	Average log TFP	Obs.	Firms	Average FO	Average log TFP
1998	170,476	197,591	3.43	11.80	14,343	1,617	2.47	9.37
1999	296,939	347,943	3.77	11.72	30,505	4,105	3.42	9.45
2000	328,047	390,350	3.67	11.71	37,782	5,144	3.22	9.41
2001	338,490	398,481	3.85	11.69	50,246	7,071	3.95	9.33
2002	349,600	417,012	4.09	11.67	55,184	7,557	6.13	9.45
2003	340,860	404,638	4.37	11.66	59,600	8,430	6.36	9.55
2004	334,435	400,838	5.53	11.71	61,844	9,073	7.66	9.63
2005	337,994	415,462	5.84	11.72	61,882	9,341	7.79	9.66
2006	348,517	471,152	5.73	11.71	63,947	10,128	8.85	9.74
2007	338,385	448,919	5.87	11.73	57,012	8,787	8.66	9.76
2008	93,282	129,025	5.95	11.63	7,486	1,096	10.93	9.69

Notes: Counts of observations and averages over firms by year for the variables indicated in the column headings. Observations are from the regression samples of firms in the manufacturing sector with available data for the regressors (see Data Appendix). log TFP is the natural logarithm of total factor productivity, computed following Wooldridge-Levinsohn-Petrin. FO refers to the percentage share of firm's voting equity owned by industrial and financial foreign owners. See Table A-3 for industry classifications and Sections 2 and 4 for details on data construction.

Table A-6: Foreign Activity and Labor Productivity, Preliminary Explorations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firms	All	All	Manuf.	Manuf.	All	All	Manuf.	Manuf.
DEPENDENT VARIABLE	log(Y/L)	log(Y/L)	log(Y/L)	log(Y/L)	log(VA/L)	log(VA/L)	log(VA/L)	log(VA/L)
FO	0.518***	0.027***	0.622***	0.037***	0.552***	-0.018***	0.494***	0.002
	(0.008)	(0.005)	(0.012)	(0.008)	(0.007)	(0.005)	(0.011)	(0.008)
Firm Fixed Effects	no	yes	no	yes	no	yes	no	yes
Sector Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Country-Year Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4,288,260	4,288,260	1,104,777	1,104,777	3,091,452	3,091,452	872,039	872,039

Note: All refers to the full sample while Manuf. refers to the manufacturing sample. Y refers to operating revenue, L is the number of employees, VA is value-added computed as the difference between operating revenue and cost of materials. FO is the log of one plus the percent share of foreign ownership in firm i capital structure.

Table A-7: Spillovers and Selection through Entry/Exit

DEPENDENT VARIABLE: FIRM PRODUCTIVITY
SAMPLE: DOMESTIC FIRMS
PANEL: BALANCED

	(1)	(2)	(3)	(4)
	Developed		Emerging	
DEPENDENT VARIABLE	log TFP	log TFP	log TFP	log TFP
Spillover_Competition$_{s4}$	-0.029***		-0.080**	
	(0.006)		(0.027)	
Spillover_Knowledge$_{s4}$	0.023**		-0.020	
	(0.011)		(0.042)	
Spillover_Competition$_{s4}$ FO> 50		-0.035***		-0.081**
		(0.006)		(0.026)
Spillover_Competition$_{s4}$ FO< 50		-0.025***		-0.016
		(0.006)		(0.037)
Spillover_Knowledge$_{s4}$ FO> 50		0.017		-0.011
		(0.011)		(0.040)
Spillover_Knowledge$_{s4}$ FO< 50		-0.008		-0.085
		(0.010)		(0.056)
Observations	160,040	160,040	17,360	17,360
Firm Fixed Effects	yes	yes	yes	yes
Country-Year Fixed Effects	yes	yes	yes	yes
Sector4dig-Year Fixed Effects	yes	yes	yes	yes
Cluster	country-4dig-year	country-4dig-year	country-4dig-year	country-4dig-year

Notes: The dependent variable is the log of total factor productivity which is computed following Wooldridge-Levinsohn-Petrin methodology (WLP). The spillover variables distinguish between Competition and Knowledge constructed at the four-digit sector in each country. See Table 3 for a description of Spillover_Competition$_{s4}$ and Spillover_Knowledge$_{s4}$. See Table 7 for a description of Spillover_Competition$_{s4}$ FO $>$ 50 and Spillover_Knowledge$_{s4}$ FO $>$ 50. Estimation performed by Generalized Least Squares (GLS) where weights are the square root of the firm mean squared predicted residuals. Results are obtained based on the sample of firms with no foreign ownership (i.e., firms that were never acquired (in any percentage) by a foreign-owned investor over the period of analysis). Results are based on a permanent sample of firms (i.e., firms that we observe from 2000 to 2007 in our sample).Standard errors clustered at the corresponding level specified in the table are reported in parentheses. *** , **, *, denote significance at 1%, 5%, 10% levels. See Sections 2 and 4 for the details on construction of variables.

Appendix Figures

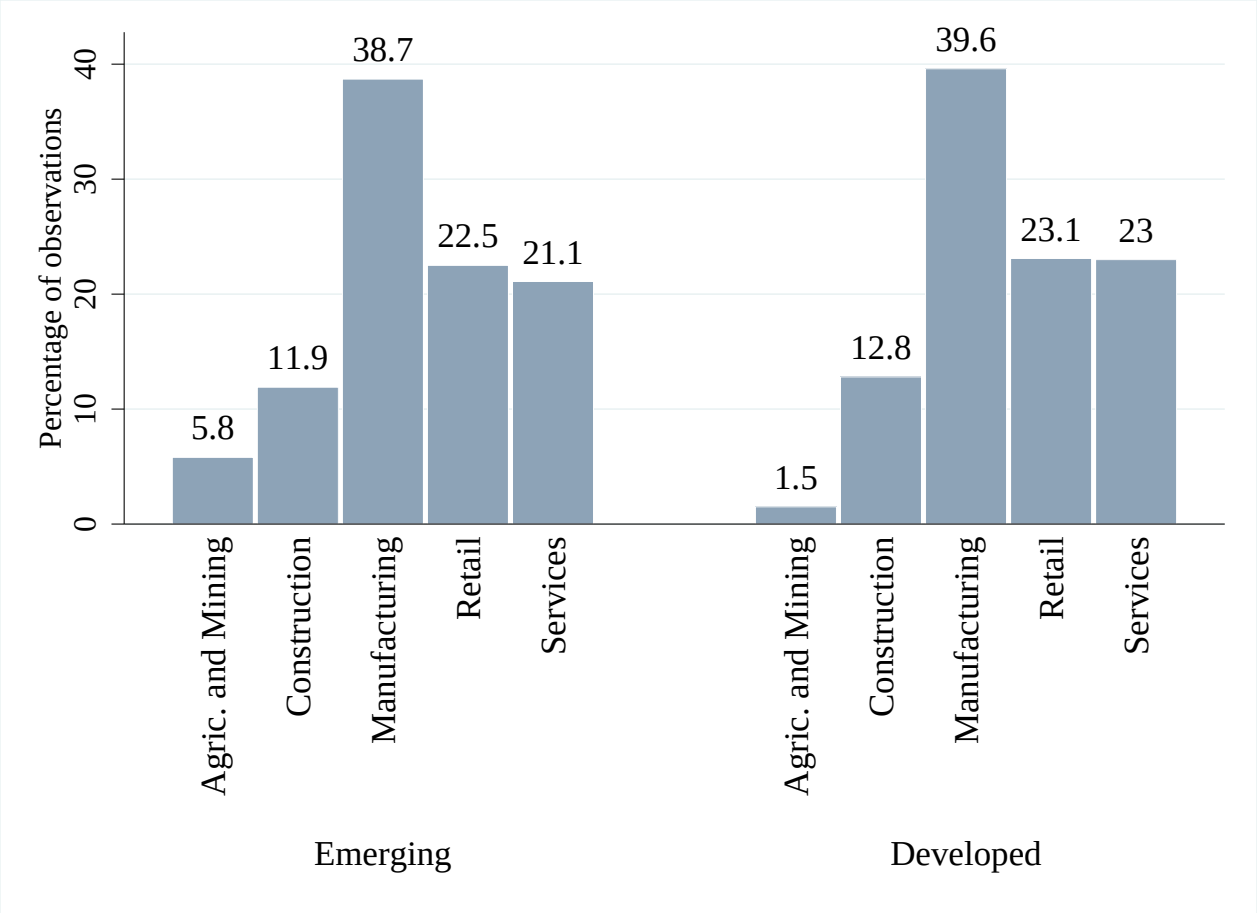

Figure A-1: Sectoral Distribution of Firms

Notes: The figure shows the percentage of all firms in all available years in a given industry. Agric-Mining refers to Agriculture and Mining and corresponds to NACE 2 digit sector classification: 01, 02, 03, 05, 06, 07, 08, 09. Manufacturing: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33. Construction: 41, 42, 43. Services: 49, 50, 51, 52, 53, 55, 56, 58, 59, 60, 61, 62, 63, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96. Retail: 45, 46, 47. See Table A-3 for the industry classification and Sections 2 and 4 for the details on construction of variables. Firms are drawn from the sample with available data for TFP construction (panel B of Table A-2).

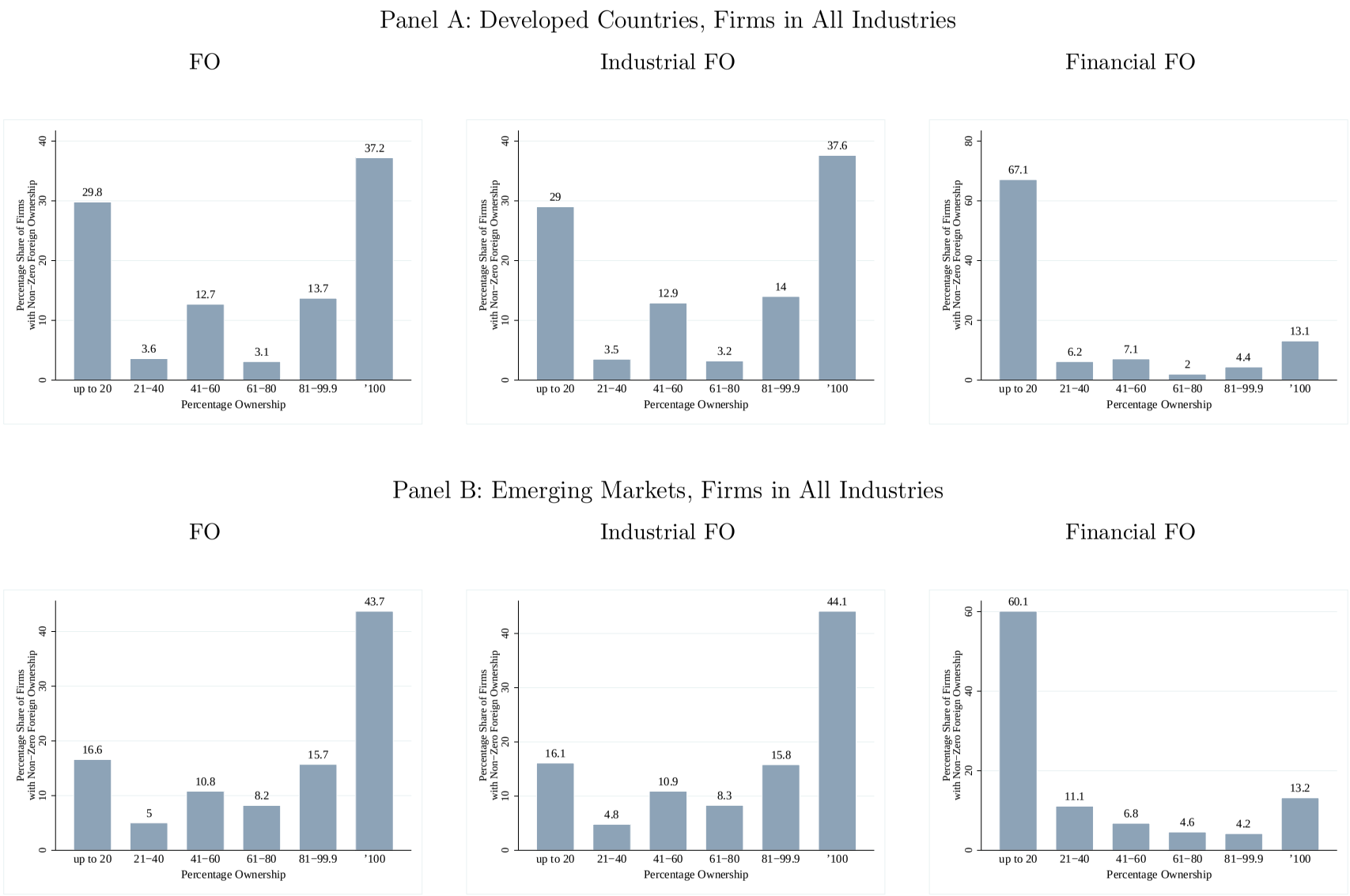

Figure A-2: Distribution of Industry-FO and Financial-FO Among Foreign Owned Firms: Developed and Emerging Market Countries

Notes: The figure shows the distribution of foreign ownership using all firms in all available years. Firms are drawn from the sample with available data for TFP construction (panel B of Table A-2). Each graph defines foreign-owned firm as a firm with foreign ownership of a *given type* (industrial, financial, or both) positive in at least one year. The percentage of observations in each ownership bin are computed relative to the total number of foreign-owned firms in a given country group. See Sections 2 and 4 for the details on construction of variables.

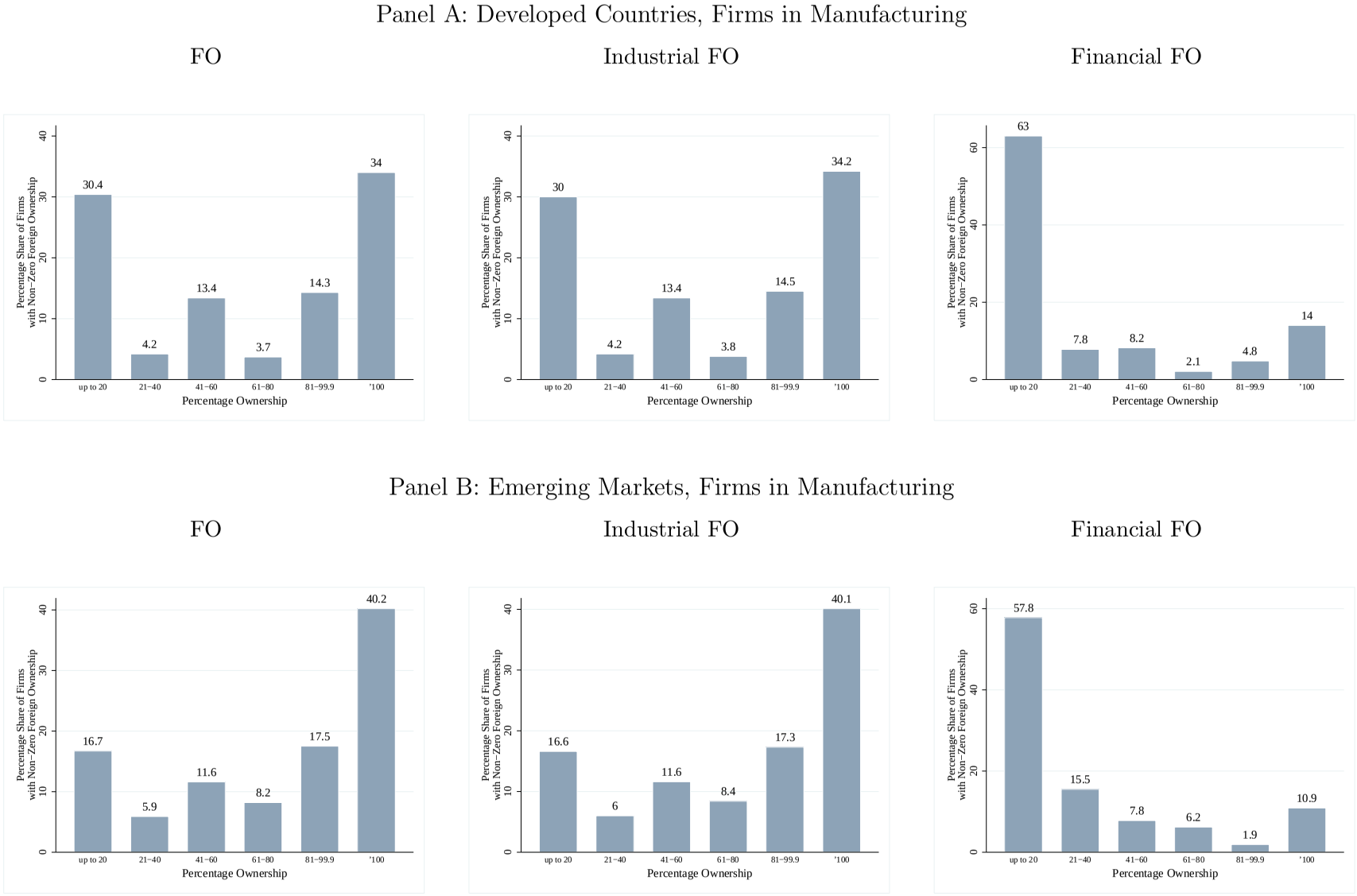

Figure A-3: Distribution of Industry-FO and Financial-FO Among Foreign Owned Firms in Manufacturing: Developed and Emerging Market Countries

Notes: The figure shows the distribution of foreign ownership using all manufacturing firms in all available years. Firms are drawn from the regression samples of firms in the manufacturing sector with available data for the main regressions (see Data Appendix). Each graph defines foreign-owned firm as a firm with foreign ownership of a *given type* (industrial, financial, or both) positive in at least one year. The percentage of observations in each ownership bin are computed relative to the total number of foreign-owned firms in a given country group. See Sections 2 and 4 for the details on construction of variables.