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Foreign Ownership and Productivity

Abstract

This study examines the impact of foreign ownership on firm productivity in private firms, employing the World Bank Enterprise Survey (WBES) dataset, which includes over 120, 000 firms from 139 countries. We find strong and robust evidence that foreign ownership is positively related to firm productivity. We then explore possible channels through which foreign ownership could impact firm productivity. Firms with foreign ownership are more likely to engage in innovation, telecommunication, and labor cost reduction, and less likely to face financial constraints. Moreover, the foreign-productivity relationship is more pronounced in medium/large firms than in small firms. Countries with medium institutional development or collectivistic countries stand to benefit more from foreign investment than countries with either low or high institutional development or individualistic countries do.

Keywords: Foreign ownership; Productivity; Private firms; Institution; Culture

JEL Classification: (G21, G30, O16, K40)

1. Introduction

The importance of foreign direct investment (FDI) in energizing a country's economy has been well established in many macro-level studies (Alfaro, 2017). Some micro-level studies have documented that FDI, or foreign ownership, is positively related with host firms' productivity (e.g., Javorcik, 2004; Kapri, 2016; Keller and Yeaple, 2009; Yasar et al., 2007). However, most of the micro-level studies have focused on the impacts of foreign ownership in public firms from developed countries (Kang and Stulz, 1997; Dahlquist and Robertsson, 2001; Aggarwal et al., 2011). The impacts of foreign ownership on the productivity of private firms from developing, especially those least developed countries, remain unexplored.

Moreover, the possible channels through which foreign ownership affects firm productivity are a less-tapped area. Two possible channels discussed by previous literature are innovation and finance (Beck et al., 2006; Ayyagari et al.,2011; Luong et al., 2017). Foreign ownership is linked with higher innovation activities and lower financial constraints in host firms, while both innovation and access to finance lead to higher firm performance and productivity (Beck et al., 2005; Eberhart et al., 2004). However, foreign ownership may also affect firm productivity through other channels, as Boubakri et al. (2013) have argued: "Foreign owners seeking to improve performance might be… introducing new production technologies, cutting costs, and reducing expenses, or tightening controls on production."

We also do not know much about when and where foreign ownership benefits firm productivity the most. Would foreign ownership benefit small firms more than it benefits medium/large firms? Would the positive foreign-productivity relationship become stronger in countries with weak institutions, or vice versa? Would culture affect the foreign-productivity relationship? The limited existing literature provides divergent results to the above questions.

This study tries to deepen our understanding of the foreign ownership-productivity relationship by examining a large sample from World Bank Enterprise Survey (WBES) dataset. This dataset contains over 120,000 private firms from 139 countries over the 2006 - 2017 period. Private firms in this study are defined as firms without publicly traded shares. Firms with foreign ownership are our main variable of interest. We use the terms "firms with foreign ownership" or "foreign-owned firms"

(FOF) interchangeably in this study. Specifically, we ask and try to answer the following questions.

1. To what extent does foreign ownership affect firm productivity in private firms from developing countries? We find statistically and economically significant evidence that foreign ownership is positively related to firm productivity. We alleviate endogeneity issues related to the foreign-productivity relationship through the two-stage least square, the propensity score matching, and the Heckman selection models. The main results continue to hold in these endogeneity tests. Moreover, our findings remain robust when we use alternative measures of foreign ownership and alternative measures of TFP.

2. What are the possible channels through which foreign ownership affects firm productivity? Does the impact of foreign ownership on firm productivity vary by firm size? Regarding the possible channels, we find that firms with foreign ownership are more likely to engage in innovation, telecommunication, and labor cost reduction, and less likely to face financial constraints. In terms of firm size, we find that although the foreign-productivity relationship remains positive in small, medium, and large firms, the effect of foreign ownership is more pronounced in medium/large firms than in small firms.

3. Does the impact of foreign ownership on firm productivity vary by institutional development or culture? We first document that institutional development has a nonlinear (inverted-U shaped) impact on the foreign-productivity relationship. The advantages of foreign ownership strengthen in countries with medium institutional development, weakens in countries with low institutional development, and almost diminishes in countries with high institutional development. Next, we find that national culture also affects the foreign-productivity relationship. The positive foreign-productivity relationship turns stronger in collectivistic countries and weaker in individualistic countries.

Our analysis adds to the literature in three ways. First, this study deepens our understanding of the foreign ownership-productivity relationship by focusing on private firms in (mostly) developing economies, and the majority of these private firms fall into the category of small and medium-sized enterprises. Existing literature has generally

focused on developed countries (Griffith, 1999; Benfratello and Sembenelli, 2006; Halkos and Tzeremes, 2010) or a few developing countries (Wang and Wang, 2015; Huang and Yang, 2016; Le et al., 2019). Few studies have employed a world-level dataset to portray a broader picture between foreign ownership and productivity.

Second, we examine four possible channels through which foreign ownership affects firm productivity. Some studies have emphasized the impacts of foreign ownership on firm innovation and financial constraints. Few studies have explored the impacts of foreign ownership on telecommunication usage and labor cost management. Our findings specify that firms with foreign ownership tend to engage in a higher level of innovation and telecommunication, a stronger level of labor cost reduction, and tend to worry less about financial constraints.

Third, we investigate the environment where the benefits of foreign ownership are likely to be higher. The foreign-productivity relationship is more pronounced in medium/large firms than in small firms. Countries with medium institutional development or collectivistic countries stand to benefit more from foreign investment than countries with either low or high institutional development or individualistic countries do.

The remainder of this study is organized as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 describes the sample and variables used in this study. Section 4 presents and discusses the main results, the related endogeneity and robustness tests. Section 5 explores the mechanisms through which foreign ownership affects firm productivity. Section 6 discusses the influence of firm size on the foreign-productivity relationship. Section 7 analyzes the influence of institutional development and culture on the foreign-productivity relationship. Section 8 concludes the study.

2. Literature Review

2.1. Foreign Ownership and Productivity

Dunning (1977, 1980, 1988) proposes a framework about the multinational enterprises (MNEs), which argues that MNEs have valuable intangible assets, e.g., technological know-how, superior management practices, coordination with suppliers

and customers, and overseas contacts. According to this framework, MNEs are likely to be more competitive and productive than domestic firms. Consistent with the theory, some literature empirically documents that foreign-owned enterprises are more productive than domestic enterprises (Arnold et al., 2008; Beltrán, 2019; Benfratello and Sembenelli, 2006; Griffith, 1999; Harris and Robinson, 2002; Le et al., 2019; Takii, 2004; Ullah et al., 2014).

Previous literature has focused on developed countries (Benfratello and Sembenelli, 2006; Griffith, 1999; Halkos and Tzeremes, 2010) or a few developing countries, e.g., China and Vietnam (Huang and Yang, 2016; Le et al., 2019; Wang and Wang, 2015). Few studies have investigated the association between foreign ownership and productivity worldwide.

We review the relevant literature and propose four possible channels through which foreign ownership could affect firm productivity. One possible channel is innovation. Ayyagari et al. (2011) and Luong et al. (2017) document a positive relationship between foreign ownership and firm innovation. Boubakri et al. (2013) show that firms with higher foreign ownership tend to have higher R&D investments. It has been well established in the literature that R&D/innovation is associated with higher productivity.

Another possible channel we propose is the usage of telecommunication. Firms with foreign ownership need to use communication technology more frequently than their pure domestic peers (Correa et al., 2010). Since the applications of telecommunications have a positive effect on firm productivity (Arnold et al., 2008; Paunov and Rollo, 2016), firms with foreign ownership may have higher productivity through their broader usage of telecommunication.

The third possible channel, labor cost management, is relatively less explored in previous literature. Firms with foreign stakes tend to have superior management practices (Dunning, 1988). They may therefore be more efficient at human resources management. Ullah and Wei (2017) have mentioned that firms with foreign ownership are less likely than other ownership types to increase employment and are more likely to hire temporary staff. We expect that firms with foreign ownership would have a better control at their labor cost and hence increase their productivity.

The fourth channel we propose is financing support. Foreign investors could improve firm productivity through relaxing financial constraints. Several papers document that foreign ownership is related to lower financial obstacles (Beck et al., 2006; Dong and Men, 2014; D'Souza et al., 2017; Knack and Xu, 2017). Financing obstacles has been linked to lower firm performance and lower productivity (Beck et al., 2005). Firms with foreign ownership may have higher productivity through their foreign parents' financial support. Based on the discussion above, we hypothesize that:

H1: Foreign ownership positively affects firm productivity in private firms.

2.2 Foreign Ownership, Productivity, and Firm Size

Firm size has a significant impact on firm performance and productivity (Allison et al., 2021; Arnold et al., 2008; Beck et al., 2005; Beltrán, 2019; D'Souza et al., 2017; Ullah et al., 2014; Ullah and Wei, 2017; Yang and Tsou, 2020). In this section, we discuss whether the foreign ownership-productivity relationship varies with firm size. Beck et al. (2005) find that small firms face higher financing and corruption constraints than larger firms. They further argue that as financial/institutional development lowers firm growth obstacles, small firms benefit the most compared with medium and large firms. Along the same vein, Beck et al. (2008) find small firms have less access to external financing, especially bank financing, and rely more on informal funding compared with large firms. However, foreign ownership can alleviate firms' financial constraints (Beck and Demirguc-Kunt, 2006; Beck et al., 2006; Bergbrant et al., 2018; Clarke et al., 2006; Dong and Men, 2014; D'Souza et al., 2017; Knack and Xu, 2017; Mertzanis, 2019; Ullah, 2020). We hence expect that small firms benefit more from foreign ownership than medium/large firms do through lowered financial constraints.

On the other hand, foreign investors avoid investing in firms that suffer information asymmetry problems (Doidge et al., 2009; Leuz et al., 2009). Since small firms are more likely to face information asymmetry problem than medium/large firms do (Bharath et al., 2009; Chang et al., 2006), foreign investors prefer to invest in medium/large firms (Bena et al., 2017; Chakravarty and Xiang, 2013; Dahlquist and Robertsson, 2001). Foreign investors may also prefer to invest in medium/large firms since these firms have a higher probability to possess political connections and/or built-

up supplier chains (Bliss and Gul, 2012; Faccio, 2006). The foreign owner and the domestic owner would then complement each other's weaknesses and maximize the joint venture's productivity. We hence expect that medium/large firms benefit more from foreign ownership than small firms do through better information and complement resources. According to the above discussion, we make two competing hypotheses:

H2a: The foreign ownership-productivity relationship is stronger in smaller private firms.

H2b: The foreign ownership-productivity relationship is stronger in medium/larger private firms.

2.3. Foreign Ownership, Productivity, and Institutional Development

A country's institutional development is an important determinant of firm performance (e.g., Beck et al., 2005; D'Souza et al., 2005; Yasar et al., 2011), risk-taking and R&D investment (Boubakri et al., 2013; John et al., 2008; Xiao, 2013), and investment efficiency (Chen et al. 2017). In this section, we investigate whether a country's institutional development, as external corporate governance, substitutes or complements the roles of foreign ownership, as internal corporate governance, in terms of affecting firm productivity. Foreign investors export good corporate governance all over the world, and the governance exporting is especially effective from strong institution countries to weak institution countries (Aggarwal et al., 2011). Moreover, institutional development is related with greater investment efficiency (McLean et al., 2012), and the improvement of firm investment efficiency brought by foreign ownership is greater in countries with worse institutions (Chen et al., 2017). Hence, we expect the positive foreign ownership-productivity relationship to be stronger in countries with a lower level of institutional development.

However, expropriation risks are usually high in countries with weak legal institutions (Ben-Nasr et al., 2015; Boubakri et al., 2013). Foreign investors may be reluctant to invest in these countries to avoid the risk of rent-seeking and expropriation. John et al. (2008) document that in countries with weak institutions, the stakeholders may pursue their self-interests by reducing firms' risk-taking activities. Durnev and Fauver (2009) show that if the government is predatory, firms usually lack the

motivation to implement good governance. Boubakri et al. (2013) argue that foreign investors' incentives to take risks or improve productivity in joint ventures are relatively low since the additional benefits may be confiscated by the government in countries with weak institutions. Hence, we expect the positive foreign ownership-productivity relationship is weaker in countries with a lower level of institutional development. Following the discussion above, we make the following two hypotheses:

H3a: The foreign-productivity relationship is stronger in countries with weaker institution.

H3b: The foreign-productivity relationship is stronger in countries with stronger institution.

2.4. Foreign Ownership, Productivity and Culture

Culture is "the collective programming of the mind that distinguishes the members of one group or category of people from another" (Hofstede, 2001). Culture also represents internal values that are persistent over an extended period of time, and it shapes the incentives of human actors (Williamson, 2000). A rich literature has shown that national culture affects corporate policies, such as disclosure policies (Hope, 2003), corporate governance (Doidge et al., 2007), capital structure and debt maturity (Chui et al., 2002; Li et al., 2011; Zheng et al., 2012), dividend policy (Shao et al., 2010), earnings management (Han et al., 2010), corporate risk-taking and innovation (Li et al., 2013), corporate investment strategies (Shao et al., 2013), and CEO power (Urban, 2019).

In this study, we focus on the collectivism versus individualism dimension since this dimension is the fundamental driving force of national differences (Markus and Kitayama, 1991; Triandis, 2001). Collectivism is usually related with conservative behaviors, such as more cash holding, fewer capital expenditures, fewer acquisitions (Chen et al., 2015), less risk-taking (Li et al., 2013), less overconfidence and self-attribution bias (Chui et al., 2010), less investment in risky assets and R&D (Shao et al., 2013), and more accounting conservatism (Kanagaretnam et al., 2014). Considering that firms in collectivistic countries tend to take less risks and underinvest, while foreign ownership is positively related with corporate risk-taking (Boubakri et al., 2013), we

expect that the foreign-productivity relationship is more pronounced in collectivistic countries. Following the discussion above, we hypothesize the following:

H4: The foreign-productivity relationship is stronger in collectivistic countries.

3. Data

3.1. The Sample

We obtain our data from the World Bank Enterprise Survey (WBES) (http://www.enterprisesurveys.org/). This dataset was collected between 2006 and 2017 through surveys of more than 120,000 firms in 139 countries. WBES data has been widely examined in corporate finance and international business areas (e.g., Akins et al., 2017; Ayyagari et al., 2011, 2014; Barth et al., 2009; Beck et al., 2005; Beck et al., 2006; Beck et al., 2008; Cheng et al. 2020; Houston et al., 2011; Jensen et al., 2010; Pierce and Snyder, 2018). A small percent of the firms surveyed are public firms. We drop public firms in this study since the behavior patterns between public and private firms are fundamentally different. Previous studies have focused on public firms in developed economies and a few developing economies (such as China, India, and Vietnam). We choose to focus on private firms worldwide.

The WBES dataset we employ in this study is a pooled cross-sectional data in general. Although a specific country may be surveyed once, twice or three times during the sample period, the majority of the firms are only surveyed once. A minority of the firms, approximately 18% of sample firms, are surveyed twice or more. We therefore use the general pooled cross-sectional data in our major regressions, and use the much smaller panel data in robustness tests.

Sections 3.2 to 3.6 discuss the key independent variable (foreign ownership), dependent variables (productivity measures, and productivity channel measures for innovation, telecommunication, labor costs, and finance), control variables, and institution/culture variables, respectively. To avoid the effect of outliers, we winsorize all continuous variables on both sides of the distribution at the 1% level.

3.2. Foreign Ownership

The key independent variable in this study is foreign ownership. We measure foreign ownership by *Foreign*, which is a dummy variable that equals one if foreign individuals, companies, or organizations have ownership stakes in a firm, and zero otherwise (Akins et al., 2017; Beck et al., 2005; Beck et al., 2006; Beck et al., 2008; D'Souza et al., 2017; Lee et al., 2020; Ullah and Wei, 2017). An alternative measure of foreign ownership is *Foreign_Pct*, which is the percent of a firm owned by foreign individuals, companies, or organizations. In our sample, foreign ownership exists in 10% of the firms, and it accounts for 8% of firms' total ownership on average (Table 1, Panel A). The summary statistics are consistent with prior privatization research (e.g., Allison et al., 2021; Cheng et al., 2020; Knack and Xu, 2017).

Figure 1 shows the percentage of FOF by firm size. World Bank defines small, medium, and large firms as firms with less than 20, 21 to 99, and more than 99 full-time employees, respectively. 21.3% of large firms are FOF, while only 6.0% of small firms are FOF. Figure 2 exhibits the percentage of FOF by city size. We see that there is a nonlinear relationship between the percent of FOF and city size. Firms in cities with over 50,000 to 250,000 population have the highest percentage of FOF (10.1%) among the four categories. Figure 3 displays the percentage of FOF by region. Sub-Saharan Africa has the highest percent of FOF (15.6%), followed by the East Asia & Pacific (12.3%), Latin America & Caribbean (10.8%), Europe & Central Asia (8.4%), Middle East & North Africa (7.08%), and South Asia (1.7%).

[Figure 1, Figure 2, and Figure 3 here]

3.3. Productivity Measures

Three productivity measures are used in this study. Our first productivity proxy is *Labor_Productivity*, which is defined as the natural logarithm of sales minus the natural logarithm of employee number (D'Souza et al., 2017; Ullah et al., 2014). Our second and third productivity measures, *TFP_3 Factor* and *TFP_4 Factor*, are defined according to the Cobb-Douglas production function. Within the Cobb-Douglas function $Y = AK^{\alpha}L^{\beta}M^{\gamma}$, firm output is measured by Y, capital, labor and intermediate inputs are measured by K, L and M, respectively (Douglas, 1976). TFP is calculated as the residuals from Cobb-Douglas production function, with the natural logarithm of firm

output as the dependent variable, and the natural logarithm of capital, labor, intermediate inputs as independent variables. Following Douglas (1976) and Arnold et al. (2008), which also employ the WBES dataset, we use sales, measured as a firm's total annual sales, to proxy firm output. Labor input is measured as a firm's total labor costs, capital input is measured as a firm's cost to re-purchase all of its machinery, intermediate input is measured as a firm's costs of raw materials and intermediate goods used in production process, and energy input is measured as a firm's costs of electricity and fuel. All these variables are transformed from local currencies to U.S. dollars via the corresponding exchange rates, then transformed to constant 2010 U.S. dollars via U.S. consumer pricing index.

Using the variables described above, *TFP_3 Factor* is calculated as residuals from regressing the natural logarithm of sales on the natural logarithm of labor costs, capital costs, and intermediate costs. *TFP_4 Factor* is calculated as residuals from regressing the natural logarithm of sales on the natural logarithm of labor costs, capital costs, intermediate costs, and energy costs. The summary statistics in Table 1, Panel B show that the means of *Labor_Productivity, TFP_3 Factor*, and *TFP_4 Factor* are 9.91, -0.01, and -0.01, respectively.

We then check how productivity measures would vary with country size and country income. Our sample includes large countries such as China and India, and small countries such as Tonga and Micronesia. A detailed checking in country statistics indicates that larger countries tend to have higher *Labor_Productivity, TFP_3 Factor*, and *TFP_4 Factor* on average. Our sample also ranges from high-income countries (e.g., Sweden and Israel) to low-income countries (e.g., Central African Republic and Burundi). A subsample statistic indicates that *Labor_Productivity* maximizes in high medium quartile income countries, while *TFP_3 Factor*, and *TFP_4 Factor* maximize in low medium quartile income countries. For a detailed country-level statistics of productivity measures, please see our Online Appendix.

[Appendix 1 here]

3.4. Channel Measures

We then explore the mechanisms through which foreign ownership affects firm productivity. The first possible channel is innovation. We employ the following three

dummy variables to measure a firm's technology development and innovation activities. *New_Product* equals one if the firm introduced new products/services over the last three years, and zero otherwise. *Improved_Process* equals one if the firm introduced a new/significantly improved process during the last three years, and zero otherwise. *R&D* equals one if the establishment incurred any R&D expense during the last fiscal year, and zero otherwise.

The second possible channel is telecommunication. We use the following three dummy variables to gauge a firm's telecommunication usage. *Email* equals one if the firm has currently communicated with clients and suppliers by e-mail, and zero otherwise. *Website* equals one if the firm has its own website, and zero otherwise. *Internet* equals one if the firm has a high-speed, broadband internet connection on its premises, and zero otherwise.

The third channel is labor cost. *Employee_Growth* is calculated as one half of the difference between the natural logarithm of employee number and the natural logarithm of employee number two years ago (D'Souza et al., 2017; Ullah and Wei, 2017). *Temporary_Pct* is defined as the number of temporary employees divided by the number of total employees. *Labor_Cost* is calculated as the total labor cost (including wages, salaries, and bonuses) divided by the sales.

The fourth possible channel is finance. In WBES, business owners or managers were asked: *"Over fiscal year, please estimate the proportion of this establishment's purchase of fixed assets that was financed from each of the following sources?"* The finance of fixed assets purchase includes internal funds/retained earnings (*Fixed_Internal*), funds borrowed from banks (*Fixed_Bank*), funds borrowed from other non-bank financial institutions (*Fixed_NonBank*), owners' funding or new equity shares (*Fixed_NewEquity*), funds from suppliers and advances from customers (*Fixed_Suppliers*), and other funding sources, e.g., moneylenders, friends, relatives, etc. (*Fixed_Other*). These proportions add up to 100%. *Fixed_External* is further defined as 100% minus *Fixed_Internal.* In addition to the variables mentioned above, several other variables are related to the firm's investment and its usage of bank service. *Fixed* is the dummy variable that equals one if the firm has purchased any fixed asset, zero otherwise. *Finance_Obstacle* is the categorical variable used to measure *"how much of*

an obstacle: access to finance?" with 0 indicates no obstacle and 4 indicates severe obstacle.

The summary statistics in Table 1, Panel C show that 40%, 43%, and 22% of firms introduced new products/services, launched new/significantly improved processes, or spent on R&D, respectively. As to telecommunication, 70% of the firms have currently communicated with clients and suppliers using e-mail, 45% of firms have their own websites, and 73% of firms have a high-speed internet connection. For labor-related measures, the means of *Employee_Growth*, *Temporary_Pct*, and *Labor_Cost* are 5%, 10%, and 22%, respectively. As to finance measures, the median of *Finance_Obstacle* is 1, which means more than half of the respondents rated the obstacle as none or minor. 44% of the firms have purchased fixed assets. 33.93% of the purchase of fixed assets was financed from external findings, among which 18.11% from banks, 1.82% from other financial institutions, 5.05% from suppliers, 4.11% from new equity issues, and 2.46% from other sources.

3.5. Control Variables

Following the literature (Beck et al., 2005; Beck et al., 2008; Cheng et al., 2020; Liu et al., 2020; Ullah and Wei, 2017), our multivariate regressions include a set of firm-level control variables. We first include the top manager's working experience in this sector (*Experience*). Second, we control for firm size using the natural logarithm of the number of permanent full-time employees (*Ln_FirmSize*). Third, we include firm age (*Ln_FirmAge*), the natural logarithm of the survey year minus the founding year plus one. Fourth, we include ownership concentration, which equals the percentage of the firm owned by its largest shareholder (*Top_Owner_Pct*). Lastly, we measure whether a firm export using a dummy variable *Exporter*. In some robustness tests, we also use some county-level macro variables. Following Beck et al. (2005) and Zheng et al. (2013), we control *Ln_GDP* (the natural logarithm of a country's GDP, in constant 2010 U.S. dollars), *GDP_Growth* (the growth rate of GDP), *GDP_per_Capita* (GDP per capita, in constant 2010 U.S. dollars), and *Inflation* (inflation rate).

Panel D of Table 1 provides summary statistics of the control variables. The mean of the firms' top manager's working experience in this sector is 17.29 years. The medians of *Ln_FirmSize* and *Ln_FirmAge* are 2.94 and 2.71, respectively, indicating

50% of firms have less than 19 employees and are less than 15 years old. The percent of an average firm owned by its largest blockholder is 79.96%. In addition, 21% of firms are exporting. With respect to macro variables, the means of the natural logarithm of GDP and GDP per capita are 25.26 and 7.99, respectively. An average country's GDP growth rate is 4.66%, and its inflation rate is 7.31%.

3.6. Institution and Culture Variables

We also examine the role of institutional development and culture in the relationship between foreign ownership and firm productivity. Following Bitar and Tarazi (2019), Gugler et al. (2013), Hearn et al. (2017), Pinkowitz et al. (2016), and Xiao (2013), we use the aggregate Worldwide Governance Indicators (WGI) as the institutional development proxy. *WGI* represents a country's overall governance quality, which is defined as the sum of government effectiveness, regulatory quality, control of corruption, political stability, rule of law, and voice and accountability scores. Each of the six governance indexes ranges from -2.5 (weak) to 2.5 (strong). With respect to culture measures, *Individualism* is defined accordingly to Hofstede's (2001) individualism index, which reflects the degree of people focusing on their internal attributes to distinguish themselves from others. In our sample, a country's is overall governance quality ranges from -11.41 to 10.44, with a median of -2.51. The mean and median of *Individualism* are 29.07 and 27, respectively. See Table 1, Panel D for details.

[Table 1 here]

Table 2 reports Pearson correlation coefficients among all dependent and independent variables used in the baseline regression analysis. We do not observe any correlation coefficients that have an absolute value of 0.5 or higher for any pair of independent variables, suggesting that multicollinearity is unlikely to be an issue. We find our variable of interest, *Foreign,* is positively and significantly related to *Labor_Productivity, TFP_3 Factor* and *TFP_4 Factor*.

[Table 2 here]

4. Foreign Ownership and Productivity

4.1. Method

To examine the effect of foreign ownership on productivity, we estimate the following baseline regression model:

$$Productivity_{i,j,c,t} = \alpha + \beta_1 Foreign_{i,j,c,t} + \beta_2 Firm\ Level\ Controls_{i,j,c,t} + \beta_3 Year\ FE_t + \beta_4 Country \times Industry\ FE_{j,c} + \varepsilon_{i,j,c,t} \quad (1)$$

where i, j, c, t refers to firm, industry, country, and survey year[1], respectively. *Productivity* is proxied by *Labor_Productivity, TFP_3 Factor* or *TFP_4 Factor*. *Foreign* is the key variable in this study. Our main interest is the coefficient β_1, which captures the sensitivity of firm productivity to foreign ownership.

Experience, Ln_FirmSize, Ln_FirmAge, Top_Owner_Pct, Exporter are firm-level control variables that may affect firm productivity. We include country×industry fixed effects to absorb other unobserved variables that may affect firm productivity at the country-industry level. We also include year fixed effects to control for unobserved time-specific effects. To control for the firms' correlation within each country-industry category, we cluster standard errors at the country-industry level. Meanwhile, we winsorize all the continuous variables at the 1st and 99th percentiles to mitigate the effect of outliers.

4.2. Results Discussion

Table 3 presents the ordinary least squares (OLS) regression results of Equation (1). As shown in Columns (1), (2), and (3), the coefficients on *Foreign* are all significantly positive (in Column (1), β_1 =0.409, t-value=13.84; in Column (2), β_1=0.129, t-value =5.10; and in Column (3), β_1=0.126, t-value=4.82), suggesting that firms with foreign ownership tend to have a higher labor productively and a higher total factor productivity. The coefficients are also economically significant. The marginal effects suggest that FOF, on average, are 40.9%, 12.9%, and 12.6% more efficient in terms of *Labor_Productivity, TFP_3 Factor* or *TFP_4 Factor*. These results are

[1]Within the WBES dataset, a firm surveyed in year t reported its financial data in year t-1. The default time subscript of all variables used in this study, unless specified individually, is the survey year.

consistent with Hypothesis H1 and previous literature (Arnold et al., 2008; Beltrán, 2019; Le et al., 2019; Ullah et al., 2014).

Table 3 also displays that several other firm characteristics are related to firm productivity. Larger, older, and exporting firms exhibit higher productivity (Beltrán, 2019; D'Souza et al., 2017; Ullah et al., 2014). *Top_Owner_Pct* is negatively related with firm productivity. However, the top manager's experience has no significant effect on *Labor_Productivity*, and even a negative effect on *TFP_3 Factor* and *TFP_4 Factor*.

[Table 3 here]

4.3. Endogeneity Tests

Although our baseline results in Section 4.2 present a strong positive relationship between foreign ownership and firm productivity, the relationship between the two may not be causal due to omitted variables, selection bias and reverse causality. Limited by the data we employed, some firm-level productivity determinants are likely omitted in Equation (1). Selection bias may also affect β_1 in Equation (1) since foreign investors are not randomly assigned to firms. Instead, foreign investors have a clear preference for firms with better corporate governance and financial reporting (Barth et al., 1999; Guedhami et al., 2009), or firms located in better institutional environments (Boubakri et al., 2005; Guedhami et al., 2009). Reverse causality may also affect β_1 in Equation (1), as a firm's historical productivity should affect its current ability to attract foreign investors. We try to address these endogeneity issues with three methods: instrumental variable (IV) regression, propensity score matching (PSM), and Heckman selection.

4.3.1. Instrumental Variable Regression

An appropriate IV in this study should be a determinant of foreign ownership, but not directly related to firm productivity. Following Liu et al. (2014), we use *Foreign_Expected*, which is calculated as the average percentage of firms with foreign ownership who locate in the same country, industry, and year as the target firm, as our IV for foreign ownership.

Table 4, panel A reports the results of the IV regression. In the first-state regression, we regress *Foreign* on *Foreign_Expected* along with the full set of control variables, country×industry fixed effects, and year fixed effects. *Foreign_Expected* loads positively and significantly on *Foreign* at the 1% level, indicating that a firm's choice of accepting foreign investors is positively affected by its neighbors' choices. In the second stage, *Foreign* predicted by the first stage's fitted values remains significantly and positively related with *Labor_Productivity*, *TFP_3 Factor*, and *TFP_4 Factor*.

4.3.2. Propensity Score Matching (PSM)

PSM is a popular method used to deal with endogeneity in empirical studies (Dehejia and Wahba, 2002; Smith and Todd, 2001). We hence match firms with foreign ownership to firms without foreign ownership using several observable firm characteristics. Specifically, we use the same set of firm control variables as in Equation (1) and country-industry, year fixed effects to estimate the probability of a firm having any foreign stake. We then match, without replacement, firms with foreign ownership to firms without foreign ownership, based on the closest propensity score. In the second stage (Columns 1, 2 and 3 of Table 4, Panel B), we re-estimate the baseline regression using the matched sample. Consistent with our main regression results (as shown in Table 3), we continue to find that *Foreign* is positively and significantly associated with *Labor_Productivity*, *TFP_3 Factor*, and *TFP_4 Factor*.

4.3.3. Heckman Two-Stage Analysis

Sample selection bias can arise from several perspectives, such as the desire of foreign investors to participate in well-governed firms with less information asymmetry (Doidge et al., 2009; Leuz et al., 2009). In our context, foreign investors may be attracted by firms with historically higher productivity. Following Boubakri and Saffar (2019), Chen et al. (2017), and Chen et al. (2018), we employ the Heckman (1979) two-stage model to control for the sample selection effects. In the first stage, we use a Probit model to predict the presence of foreign ownership. We regress *Foreign* on its instrument *(Foreign_Expected*) as an additional independent variable in Equation (1) to estimate the inverse Mills (1926) ratio (LAMBDA). As shown in Column (4) of

Table 4, Panel B, the first stage results indicate *Foreign_Expected* is positively and significantly related with the foreign ownership dummy. The results in Columns (5), (6), and (7) of Table 4, Panel B show that the coefficients of foreign ownership are both positive and statistically significant at the 1% level, which is consistent with the main regression and the IV regression. Besides, LAMBDA loads negatively and significantly at the 5% level on *Labor_Productivity*, *TFP_3 Factor*, and *TFP_4 Factor*.

[Table 4 here]

4.4. Robustness Tests

Baseline results in Table 3 may be sensitive to the way we define foreign ownership. In Table 5, Panel A we replace *Foreign* with an alternative measure of foreign ownership, *Foreign_Pct* and re-run baseline regressions. We find that the coefficient of foreign ownership remains positive and significant at the 1% level, suggesting our earlier results are not affected by the choice of foreign ownership measurement.

In Panel B of Table 5, we report the findings using a panel data. A minority of sample firms within the whole sample (18%) are surveyed twice or more. We identify these firms according to their firm ID and establish a relatively small panel dataset (Cheng et al. 2020; Liu et al. 2021). We further include firm fixed effects in the main regressions and find that foreign ownership positively affects firm productivity whether the productivity is measured by *Labor_Productivity*, *TFP_3 Factor*, or *TFP_4 Factor*.

In Panel C, Table 5, we employ the Stochastic Frontier Analysis (SFA) method and the Olley and Pakes (OP, 1996) method to generate alternative measures of TFP.[2] The SFA approach is first introduced by Aigner et al. (1977) and Meeusen and van den Broeck (1977), then extended by Löthgren (1997) to incorporate cases with multiple inputs. This approach uses firm efficiency as a function of several explanatory variables and helps explain the differences between firm efficiencies. The OP approach uses investment or other intermediate inputs to measure unobserved productivity variables. This method is a structural approach of production function which reduces the endogeneity problem.

[2] We thank two anonymous referees for suggesting the SFA and OP methods.

Using the SFA method, we generate two alternative TFP measures, *SFA_3 Factor*, which controls for labor, capital, and intermediate costs, and *SFA_4 Factor*, which controls for labor, capital, intermediate and energy costs. Using the OP method, we generate another two alternative TFP measures, *OP_3 Factor* and *OP_4 Factor*, which includes the similar three and four cost factors as mentioned above. The SFA results are reported in Columns (1) and (2) of Table 5, Panel C, while the OP results are reported in Columns (3) and (4) of Table 5, Panel C. For both methods, we find that *Foreign* is significantly and positively related with all four different TFP measures. Hence, we conclude that the positive foreign-productivity relationship is robust under different TFP measures and regression methods.

[Table 5 here]

5. The Channels between Foreign Ownership and Productivity

In Section 4.2, we find that foreign ownership has an overall positive impact on firm productivity. In this section, we investigate four possible channels through which foreign ownership could affect productivity. In Sections 5.1 to 5.4, we test the effects of foreign ownership on innovation, telecommunication, labor cost and finance pattern, respectively. Comparing to Equation (1), the regressions we run in this section include different dependent variables, but similar independent variables. Standard errors are also clustered at the country-industry level.

5.1. Innovation

The first channel through which foreign ownership may affect firm productivity is through its effect on innovation. Boubakri et al. (2013) show that firms with higher foreign ownership tend to have higher R&D inputs. Ayyagari et al. (2011) and Luong et al. (2017) document a positive relationship between foreign ownership and firm innovation output. Guadalupe et al. (2012) prove that foreign owners transfer innovation related knowledge to their subsidies. Along the same line, Wellalage and Locke (2020) indicate that foreign ownership increases the probability of product innovation and process innovation.

We examine whether *Foreign* affect a firm's innovation, which is proxied by *New_Product*, *Improved_Process*, and *R&D*, with results reported in Table 6, Panel A. We find that foreign ownership increases the probabilities of firms introducing new products/services, new/significantly improved processes, and spending on R&D activities. The results are consistent with the literature (Ayyagari et al., 2011; Boubakri et al., 2013; Luong et al., 2017), indicating that foreign ownership is positively related to innovation.

5.2. Telecommunication

Telecommunication facilitates knowledge transfer and speeds up a firm's buying and selling process. We use *Email, Website*, and *Internet* to describe a firm's usage of telecommunication services and examine whether *Foreign* has a positive impact on the three variables. Results of this section are reported in Table 6, Panel B, which indicate that firms with foreign ownership are more likely to use emails to communicate with clients and suppliers, to create business websites and to connect to the internet. These results are in line with Correa et al. (2010), which also emphasizes the importance of web use. Given that the usage of internet and telecommunication has a positive impact on a firm's productivity, investment, and innovation (Arnold et al. 2008; Paunov and Rollo, 2016), the adoption of telecommunications facilities may (at least partially) explain the better performance of FOF.

5.3. Labor Costs

In this part, we examine how foreign ownership affects labor costs. *Employee_Growth*, *Temporary_Pct* and *Labor_Cost* are selected to measure a firm's labor cost management. The results are reported in Table 6, Panel C. Compared to firms without foreign ownership, firms with foreign ownership are less likely to increase employment and more likely to hire temporary employees. We further find that having foreign ownership is linked to a lower percent of labor cost. These findings seem to suggest that firms with foreign stakes are more efficient at controlling their labor costs.

5.4. Finance

In this section, we explore whether firms with foreign stake face different levels of finance obstacles and have different financing patterns, compared to firms without foreign ownership. The variables examined in this section include: one finance obstacle variable (*Finance_Obstacle*), one fixed assets investment dummy variable (*Fixed*), six financing pattern variables (*Fixed_External, Fixed_Bank, Fixed_NonBank, Fixed_Suppliers, Fixed_Other*, and *Fixed_NewEquity*).

In Table 6, Panel D, we find that firms with foreign ownership face lower finance obstacles. The coefficient of *Foreign* is negatively significant on *Fixed_External* and *Fixed_Bank*, positively significant on *Fixed_NewEquity*. The coefficients are also economically significant. These results are consistent with previous literature, which indicates that foreign owned firms are associated with lower financial obstacles (e.g., Beck et al., 2006; Dong and Men, 2014; D'Souza et al., 2017; and Knack and Xu, 2017), less external finance and bank finance (Dong and Men, 2014; Knack and Xu, 2017; Liu et al., 2020), and more equity finance (Beck et al., 2008).

[Table 6 here]

6. Foreign Ownership, Productivity and Firm Size

Firm size has an important effect on firm performance and productivity (e.g., Beck et al., 2005; D'Souza et al., 2017; Ullah and Wei, 2017). How does firm size moderate the relationship between foreign ownership and firm productivity? We separate the dataset into three subsamples (small firms, medium firms, and large firms, see their definitions in Section 3.2), and re-estimate Equation (1) for each subsample. Firm-level controls are included, though not reported, to save space.

The results are presented in Table 7. Panels A, B and C show the subsample regression results of small, medium, and large firms, respectively. We find that in three subsamples, *Foreign* loads positively and significantly on all productivity measures. It is worth noting that the effect of *Foreign* is more pronounced in medium firms when *Labor_Productivity* is the dependent variable, and more pronounced in large firms when *TFP_3 Factor* and *TFP_4 Factor* are the dependent variables. In sum, the results in Table 7 provide some support to Hypothesis H2b.

[Table 7 here]

7. Foreign Ownership, Productivity, and Institution Development/Culture

7.1. Foreign ownership, Productivity, and Institution Development

Country institution also plays an essential role in firm performance (e.g., Beck et al., 2005; D'Souza et al., 2005; Yasar et al., 2011). How does institution affect the relationship between foreign ownership and firm productivity? Following prior literature (Bitar and Tarazi, 2019; Gugler et al., 2013; Hearn et al., 2017; Pinkowitz et al.,2016; Xiao, 2013), we use the aggregate Worldwide Governance Indicators (WGI), derived from World Bank, as our institutional development proxy. We separate the whole sample into four subsamples based on the 1st quartile, Median, and 3rd quartile of *WGI* and then re-run Equation (1) in each subsample. The coefficients of firm-level control variables are not reported for the sake of brevity.

The effects of *Foreign* are positively significant on *Labor_Productivity* in all four subsamples, while the coefficients of *Foreign* are relatively small in countries with either low or high institutional development. The effects of *Foreign* are positively significant on *TFP_3 Factor* and *TFP_4 Factor* in countries with low, lower medium and higher medium institutional development. The coefficients of *Foreign* are maximized at higher medium countries (*TFP_3 Factor* and *TFP_4 Factor*). However, the coefficients of *Foreign* are insignificant on *TFP_4 Factor* in countries with high institutional development. The results indicate that *Foreign* has no or less advantage in promoting firm productivity in countries with high institutional development, while the advantage of *Foreign* is likely maximized in countries with lower medium or higher medium institutional development. In sum, our results provide no direct support to either Hypothesis 3a or Hypothesis 3b. The reality is probably more complicated.

As we have discussed in Section 2.3, if foreign ownership and institutional development substitute each other, the foreign-productivity relationship should be stronger in low institutional countries. If foreign ownership and institutional development complement each other, the foreign-productivity relationship should be stronger in high institutional countries. Our results indicate that both substitution and complementary effects are at work. Countries with lower medium or higher medium institutional development are likely to be the best place to absorb foreign investment.

On one side of the spectrum, advantages associated with foreign owners may not be appliable in countries with poor institutions. On the other side of the spectrum, advantages associated with foreign owners may no longer be advantages in countries with strong institutions.

[Table 8 here]

7.2. Foreign ownership, Productivity, and Culture

In this section, we examine whether a country's national culture influences the relationship between foreign ownership and firm productivity. Government in collectivist countries tend to intervene market more than government in individualistic countries do (Boubakri et al., 2016). According to Hofstede's (2001) individualism index, we divide countries into two subsamples. Collectivistic countries have an individualism index below the sample median, while individualistic countries have an individualism index above the sample median. The subsample results of culture are presented in Table 9. Firms with foreign ownership tend to have higher productivity advantages in collectivistic countries, using all three productivity measures. The results support Hypothesis H4.

[Table 9 here]

8. Conclusion

This study focuses on the relationship between foreign ownership and firm productivity. Using a large sample of 128,776 *private* firms from 139 countries for the 2006-2017 period, we document a positive effect of foreign ownership on firm productivity. We have adopted two-stage least squares, propensity score matching, and Heckman selection model to address endogeneity concerns related to the above specified relationship. The positive foreign ownership-productivity relationship remains stable in all of our endogeneity and robustness tests.

We further investigate four possible mechanisms through which foreign ownership promotes productivity. Foreign ownership likely increases firm productivity by promoting innovation, using telecommunication facilities, cutting labor costs, and relaxing financial constraints. Moreover, we find that the positive association between

foreign ownership and firm productivity becomes stronger in larger firms and collectivistic countries. Furthermore, we document an inverted U-shaped effect of institutional development on the foreign ownership-productivity relationship. In other words, the impact of foreign ownership on firm productivity maximizes in countries with medium developed institutions.

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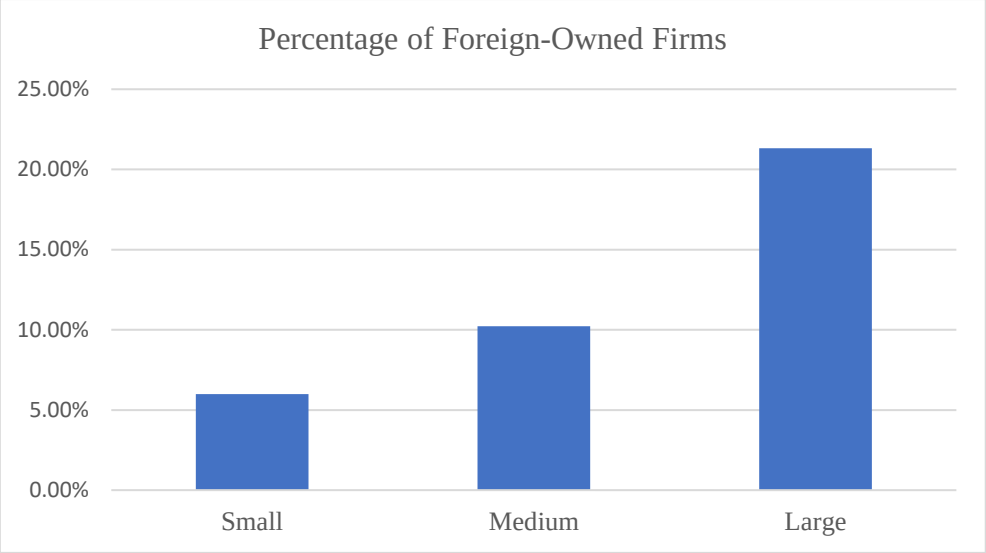

Figure 1. Percentage of Foreign-Owned Firms by firm size.

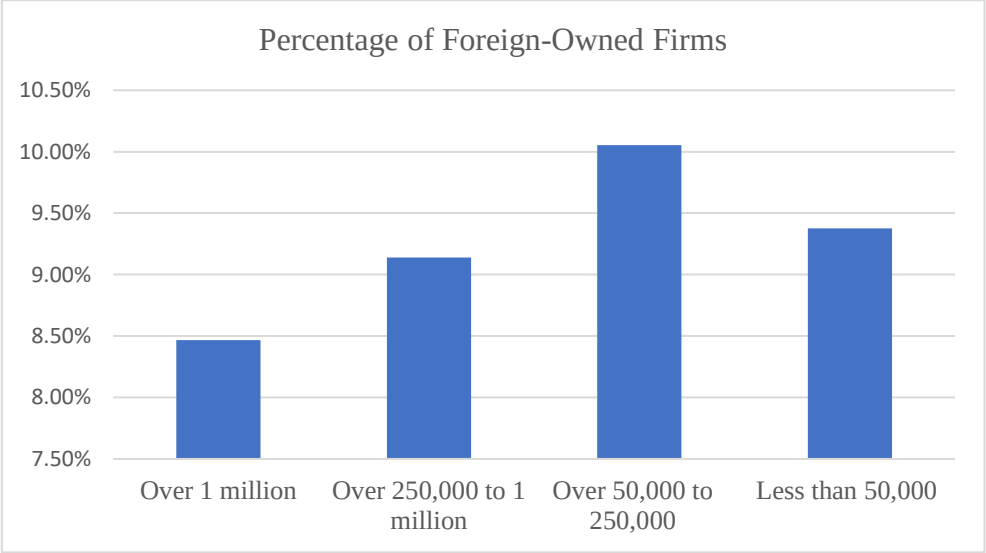

Figure 2. Percentage of Foreign-Owned Firms by city size.

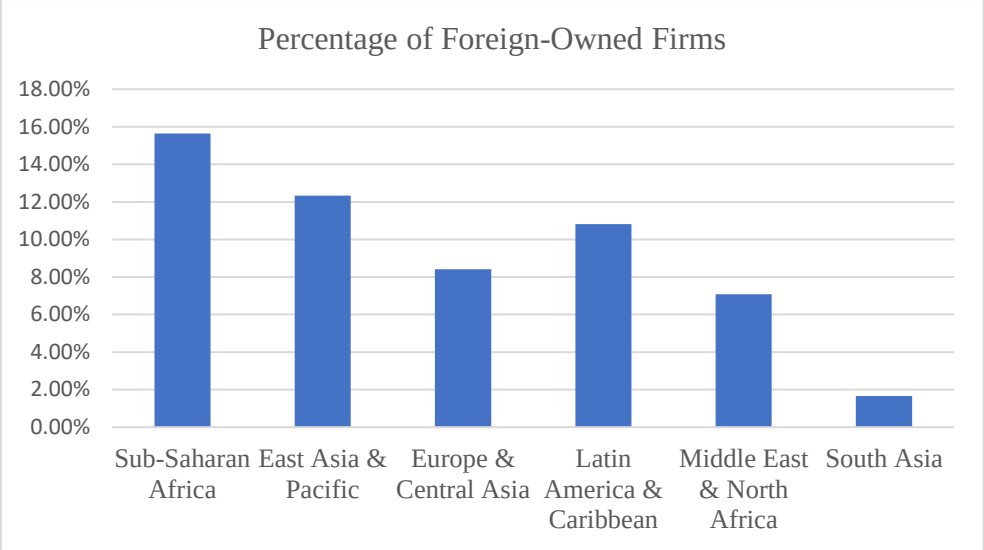

Figure 3. Percentage of Foreign-Owned Firms by region.

Table 1. Summary of Descriptive Statistics.

	N	Mean	Std	Median	Min	Max
			A. Foreign Ownership			
Foreign	127414	0.10	0.30	0	0	1
Foreign_Pct	127414	0.08	0.25	0	0	1
			B. Productivity			
Labor_Productivity	109040	9.91	1.99	9.90	4.61	17.40
TFP_3 Factor	40130	-0.01	0.77	-1.40	-0.19	3.28
TFP_4 Factor	35728	-0.01	0.74	-0.17	-1.46	3.21
			C. Channels			
New_Product	80896	0.40	0.49	0	0	1
Improved_Process	79305	0.43	0.50	0	0	1
R&D	79617	0.22	0.41	0	0	1
Email	127911	0.70	0.46	1	0	1
Website	128218	0.45	0.50	0	0	1
Internet	41200	0.73	0.45	1	0	1
Employee_Growth	115873	0.05	0.18	0	-0.48	0.75
Temporary_Pct	123998	0.10	0.18	0	0	1.00
Labor_Cost	104140	0.22	0.19	0.16	0.00	0.94
Finance_Obstacle	124348	1.50	1.33	1	0	4
Fixed	127449	0.44	0.50	0	0	1
Fixed_External	55256	32.93	40.45	0	0	100
Fixed_Bank	54703	18.11	32.92	0	0	100
Fixed_NonBank	49359	1.82	11.29	0	0	100
Fixed_Suppliers	54828	5.05	17.69	0	0	100
Fixed_Other	41831	2.46	12.86	0	0	100
Fixed_NewEquity	54963	4.11	16.42	0	0	100
			D. Firm-level Control and Macro Variables			
Experience	125298	17.29	11.09	15	0	90
Ln_Employee	127902	3.19	1.33	2.94	1.10	7.17
Ln_FirmAge	126983	2.67	0.74	2.71	0	5.83
Top_Owner_Pct	123147	79.96	26.15	100	0.2	100
Exporter	127460	0.21	0.40	0	0	1
Ln_GDP	127497	25.26	2.01	25.24	19.48	29.53
GDP_Growth	128206	4.66	4.21	5.25	-26.05	29.32
GDP_per_Capita	127497	7.99	1.06	7.94	5.39	10.87
Inflation	126607	7.31	5.87	7.10	-35.84	59.22
WGI	123493	-2.44	3.66	-2.51	-11.41	10.44
Individualism	90143	29.07	15.83	27	2	80

Table 2. Pearson Correlation Matrix.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Labor_Productivity	(1)									
TFP_3 Factor	(2)	0.32***								
TFP_4 Factor	(3)	0.38***	0.95***							
Foreign	(4)	0.09***	0.09***	0.10***						
Foreign_Pct	(5)	0.10***	0.08***	0.08***	0.92***					
Experience	(6)	0.10***	-0.03***	0.00	-0.02***	-0.03***				
Ln_FirmSize	(7)	0.12***	0.13***	0.16***	0.19***	0.18***	0.13***			
Ln_FirmAge	(8)	0.09***	0.01*	0.03***	-0.01***	-0.02***	0.46***	0.27***		
Top_Owner_Pct	(9)	-0.14***	-0.02***	-0.04***	-0.09***	-0.03***	-0.14***	-0.25***	-0.14***	
Exporter	(10)	0.09***	0.08***	0.10***	0.19***	0.17***	0.10***	0.34***	0.13***	-0.13***

Table 3. Foreign Ownership and Productivity.

Table 3 reports impacts of foreign ownership on firm productivity. The dependent variable in Columns 1, 2, and 3 are *Labor_Productivity*, *TFP_3 Factor*, and *TFP_4 Factor*, respectively. The main independent variable in all regressions is *Foreign*, which is a dummy variable that equals 1 if the firm is at least partially owned by private foreign individuals, companies, or organizations, 0 otherwise. Year and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics based on standard errors clustered at the country-industry level are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)
Foreign	0.409***	0.129***	0.126***
	(13.84)	(5.10)	(4.82)
Experience	0.000	-0.002***	-0.001**
	(0.39)	(-3.23)	(-2.05)
Ln_FirmSize	0.094***	0.062***	0.070***
	(7.84)	(9.33)	(10.51)
Ln_FirmAge	0.090***	0.003	0.002
	(5.27)	(0.31)	(0.26)
Top_Owner_Pct	-0.004***	-0.000	-0.000
	(-9.74)	(-0.81)	(-0.59)
Exporter	0.219***	0.063***	0.077***
	(8.75)	(4.81)	(5.53)
Observations	93514	38504	34317
Adj. R-squared	0.48	0.09	0.08

Table 4 Panel A. Endogeneity Test of Foreign Ownership (IV).

Table 4 Panel A reports impacts of foreign ownership on firm productivity when an instrumental variable (IV) is used to address the endogeneity issue. Columns 1, 2 and 3 report the first-stage IV regression results. The instrument for *Foreign* is *Foreign_Expected*, which is calculated as the average percentage of firms with foreign ownership who locate in the same country, industry, and year as the target firm. Columns 4, 5, and 6 reports the second-stage IV regression results, when *Labor_Productivity*, *TFP_3 Factor*, or *TFP_4 Factor* serves as the dependent variable, respectively. Year and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics based on standard errors clustered at the country-industry level are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Variables	IV 1st			IV 2nd		
	Foreign	Foreign	Foreign	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign				2.664**	0.521***	0.497***
				(2.53)	(2.75)	(3.03)
Foreign_Expected	0.832***	0.792***	0.809***			
	(45.82)	(29.52)	(29.39)			
Experience	-0.001***	-0.001***	-0.001***	0.004***	-0.001***	-0.000
	(-7.01)	(-6.23)	(-5.84)	(3.45)	(-2.67)	(-0.84)
Ln_FirmSize	0.038***	0.045***	0.045***	0.025	0.040***	0.049***
	(12.35)	(12.36)	(12.38)	(0.49)	(3.62)	(4.80)
Ln_FirmAge	-0.014***	-0.016***	-0.015***	0.140***	0.003	0.002
	(-5.17)	(-4.48)	(-4.48)	(4.71)	(0.28)	(0.18)
Top_Owner_Pct	-0.000***	-0.000**	-0.000**	-0.004***	0.000	0.000
	(-4.05)	(-2.13)	(-2.28)	(-4.70)	(0.43)	(0.12)
Exporter	0.093***	0.092***	0.090***	-0.047	0.033	0.047**
	(12.34)	(12.18)	(11.40)	(-0.40)	(1.44)	(2.12)
Observations	91745	38336	34325	91745	38336	34325
Adj. R-squared	0.15	0.16	0.16	0.03	0.01	0.01
First stage F test statistics				2099.78	871.45	863.99
First stage F test p value				0.00	0.00	0.00

Table 4 Panel B. Endogeneity Test of Foreign Ownership (PSM and Heckman).

Table 4 Panel B reports impacts of foreign ownership on firm productivity when propensity score matching (PSM) model and Heckman 2-stage selection model are used to address the endogeneity issue. PSM results are reported in Columns 1, 2 and 3. The first-stage results of Heckman selection model is reported in Column 4, with *Foreign_Expected* served as the IV. The second-stage results of Heckman selection model are reported in Columns 5, 6 and 7 with the inverse Mills ratio (LAMBDA) controlled. Year and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics based on standard errors clustered at the country-industry level are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Variables	PSM			Heckman 1st	Heckman 2nd		
	Labor_Productivity	TFP_3 Factor	TFP_4 Factor	Foreign	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Foreign	0.424***	0.127***	0.103***		0.414***	0.135***	0.132***
	(14.16)	(5.66)	(4.11)		(11.25)	(5.22)	(5.01)
Foreign_Expected				4.044***			
				(27.45)			
Experience	-0.000	-0.002*	-0.002*	-0.006***	0.005***	-0.001***	-0.000
	(-0.07)	(-1.78)	(-1.83)	(-5.76)	(3.71)	(-2.65)	(-0.76)
Ln_FirmSize	0.057***	0.072***	0.066***	0.244***	-0.015	0.038***	0.046***
	(4.05)	(6.57)	(6.23)	(21.49)	(-0.22)	(3.06)	(4.04)
Ln_FirmAge	0.193***	0.008	0.010	-0.122***	0.172***	0.007	0.006
	(8.82)	(0.48)	(0.61)	(-8.33)	(4.53)	(0.61)	(0.59)
Top_Owner_Pct	-0.001	0.000	0.000	-0.004***	-0.003**	0.000	0.000
	(-1.57)	(0.94)	(0.71)	(-7.65)	(-2.32)	(1.11)	(0.88)
Exporter	0.193***	0.044**	0.069**	0.527***	-0.105	0.026	0.038
	(5.68)	(1.98)	(2.22)	(18.14)	(-0.75)	(1.02)	(1.50)
LAMBDA					-0.610**	-0.097**	-0.096**
					(-2.17)	(-2.00)	(-2.21)
Observations	16910	7500	6738	105835	91745	38336	34325
Adj. R-squared	0.50	0.13	0.10	0.21	0.17	0.05	0.05

Table 5. Robustness Tests.

Panel A tests the foreign-productivity relationship by replacing *Foreign* with *Foreign_Pct*. Panel B tests the foreign-productivity relationship using a smaller panel dataset, with firm fixed effects controlled. Panel C tests the foreign-productivity relationship using Stochastic Frontier Analysis (SFA) and Olley and Pakes (OP, 1996) methods. Year and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Alternative independent variable			
	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)
Foreign_Pct	0.545***	0.137***	0.134***
	(17.87)	(6.71)	(6.54)
Experience	0.000	-0.002***	-0.001**
	(0.41)	(-3.23)	(-2.06)
Ln_FirmSize	0.092***	0.063***	0.070***
	(7.50)	(9.04)	(10.10)
Ln_FirmAge	0.092***	0.003	0.002
	(5.34)	(0.34)	(0.27)
Top_Owner_Pct	-0.004***	-0.000	-0.000
	(-10.99)	(-1.26)	(-1.03)
Exporter	0.222***	0.066***	0.080***
	(8.79)	(4.76)	(5.43)
Observations	93514	38504	34317
Adj. R-squared	0.48	0.09	0.08

Panel B. Panel regression			
	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)
Foreign	0.207***	0.186**	0.178*
	(2.85)	(2.27)	(1.93)
Experience	0.002	-0.002	-0.002
	(1.10)	(-1.41)	(-1.13)
Ln_Employee	-0.212***	0.013	-0.002
	(-8.04)	(0.42)	(-0.06)
Ln_FirmAge	0.058*	0.034	0.019
	(1.69)	(0.88)	(0.44)
Top_Owner_Pct	-0.002**	-0.000	0.001
	(-2.26)	(-0.23)	(0.60)
Exporter	0.127**	-0.003	-0.055
	(2.53)	(-0.05)	(-0.88)
Observations	16761	4830	3490
Adj. R-squared	0.61	0.14	0.15

Panel C. Alternative dependent variables and regression methods				
	SFA_3 Factor	SFA_4 Factor	OP_3 Factor	OP_4 Factor
	(1)	(2)	(3)	(4)
Foreign	0.002**	0.002**	0.205***	0.203***
	(2.58)	(2.14)	(6.62)	(6.53)
Experience	-0.000	-0.000	-0.002***	-0.001*
	(-1.08)	(-0.80)	(-2.84)	(-1.93)
Ln_FirmSize	0.001***	0.001***	0.512***	0.498***
	(3.31)	(2.62)	(45.47)	(45.57)
Ln_FirmAge	0.000	0.000	0.040***	0.040**
	(0.65)	(0.75)	(2.62)	(2.55)
Top_Owner_Pct	-0.000	-0.000	-0.002***	-0.001***
	(-0.89)	(-0.54)	(-5.80)	(-4.82)
Exporter	0.000	0.000	0.124***	0.131***
	(0.88)	(1.00)	(6.10)	(5.98)
Observations	38504	34317	39548	34904
Adj. R-squared	0.53	0.47	0.49	0.49

Table 6. Foreign Ownership and Productivity-Channel Analysis.

Table 6 reports impacts of foreign ownership on innovation, communication, labor costs, and finance. Innovation is measured by *New_Product*, *Improved_Process*, and *R&D*; Communication is measured by *Email*, *Website*, and *Internet*; Labor costs is measured by *Employee_Growth*, *Temporary_Pct*, and *Labor_Cost*; while Finance is measured by *Finance_Obstacle*, *Fixed*, *Fixed_External*, *Fixed_Bank*, *Fixed_NonBank*, *Fixed_Suppliers*, *Fixed_Other*, and *Fixed_NewEquity*. For the sake of brevity, only coefficients of *Foreign* are reported. Firm level controls, year, and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Innovation				
	New_Product	Improved_Process	R&D	
	(1)	(2)	(3)	
Foreign	0.024***	0.015**	0.014**	
	(3.09)	(2.03)	(2.01)	
Observations	73271	71972	72183	
Adj. R-squared	0.17	0.21	0.18	
Panel B: Communication				
	Email	Website	Internet	
	(1)	(2)	(3)	
Foreign	0.041***	0.050***	0.046***	
	(5.66)	(6.66)	(5.26)	
Observations	108015	108352	34049	
Adj. R-squared	0.36	0.30	0.34	
Panel C: Labor Costs				
	Employee_Growth	Temporary_Pct	Labor_Cost	
	(1)	(2)	(3)	
Foreign	-0.014***	0.012***	-0.018***	
	(-6.04)	(4.38)	(-6.35)	
Observations	99991	105833	89883	
Adj. R-squared	0.10	0.13	0.09	
Panel D: Finance				
	Finance_Obstacle	Fixed	Fixed_External	Fixed_Bank
	(1)	(2)	(3)	(4)
Foreign	-0.194***	0.005	-5.777***	-6.276***
	(-12.12)	(0.85)	(-7.23)	(-9.28)
Observations	106028	108045	46823	46302
Adj. R-squared	0.14	0.15	0.13	0.13
	Fixed_NonBank	Fixed_Suppliers	Fixed_Other	Fixed_NewEquity
	(5)	(6)	(7)	(8)
Foreign	-0.121	0.363	-0.270	0.539*
	(-0.58)	(1.13)	(-1.31)	(1.86)
Observations	41443	46546	38325	46549
Adj. R-squared	0.04	0.04	0.03	0.04

Table 7. Foreign Ownership and Productivity Subsample Analysis by Firm Size.

Table 7 reports impacts of foreign ownership on firm productivity when the whole sample is split by firm size. Panels A, B and C present results of small, medium and large firms, respectively. For the sake of brevity, only coefficients of *Foreign* are reported. Firm level controls, year, and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Small Firms			
	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)
Foreign	0.307***	0.087***	0.077**
	(6.49)	(2.83)	(2.47)
Observations	43584	16019	14103
Adj. R-squared	0.52	0.09	0.07
Panel B: Medium Firms			
	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)
Foreign	0.453***	0.080***	0.089***
	(12.51)	(2.86)	(3.05)
Observations	32414	14273	12876
Adj. R-squared	0.45	0.08	0.06
Panel C: Large Firms			
	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
	(1)	(2)	(3)
Foreign	0.390***	0.164***	0.166***
	(9.14)	(4.10)	(4.02)
Observations	17307	8080	7208
Adj. R-squared	0.43	0.09	0.08

Table 8. Institutions, Foreign Ownership and Productivity.

Table 8 reports impacts of foreign ownership on firm productivity when the whole sample is split by world governance index (WGI). The sample is split into four subsamples, which are low WGI, lower medium WGI, higher medium WGI and high WGI countries. For the sake of brevity, only coefficients of *Foreign* are reported. Firm level controls, year, and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Dependent variable is Labor_Productivity				
	Low	Lower Medium	Higher Medium	High
	(1)	(2)	(3)	(4)
Foreign	0.345***	0.476***	0.458***	0.326***
	(4.10)	(10.32)	(7.57)	(8.22)
Observations	21995	21512	23669	22176
Adj. R-squared	0.46	0.30	0.53	0.42
Panel B: Dependent variable is TFP_3 Factor				
	Low	Lower Medium	Higher Medium	High
	(1)	(2)	(3)	(4)
Foreign	0.165***	0.146***	0.215***	0.049*
	(3.61)	(4.99)	(2.83)	(1.67)
Observations	9351	9317	9563	9039
Adj. R-squared	0.13	0.08	0.11	0.09
Panel C: Dependent variable is TFP_4 Factor				
	Low	Lower Medium	Higher Medium	High
	(1)	(2)	(3)	(4)
Foreign	0.125***	0.143***	0.211***	0.041
	(3.01)	(4.73)	(2.83)	(1.43)
Observations	8799	8366	8658	8544
Adj. R-squared	0.10	0.07	0.11	0.09

Table 9. Culture, Foreign Ownership and Productivity.

Table 9 reports impacts of foreign ownership on firm productivity when the whole sample is split into individualist countries and collectivist countries. For the sake of brevity, only coefficients of *Foreign* are reported. Firm level controls, year, and country×industry fixed effects are included in all regressions. Variable definitions are provided in Section 3. *t*-statistics are presented in parentheses beneath each coefficient estimate. The superscripts ∗, ∗∗, and ∗∗∗ refer to significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Dependent variable is Labor_Productivity		
	Collectivism Countries	Individualism Countries
	(1)	(2)
Foreign	0.621***	0.388***
	(7.63)	(6.69)
Observations	19494	15462
Adj. R-squared	0.25	0.33
Panel B: Dependent variable is TFP_3 Factor		
	Collectivism Countries	Individualism Countries
	(1)	(2)
Foreign	0.291**	0.078*
	(2.73)	(1.87)
Observations	9071	8044
Adj. R-squared	0.09	0.11
Panel C: Dependent variable is TFP_4 Factor		
	Collectivism Countries	Individualism Countries
	(1)	(2)
Foreign	0.306***	0.081**
	(2.80)	(2.10)
Observations	7598	7256
Adj. R-squared	0.09	0.07

Appendix 1. Productivity Summary by Country Size and Income.

Country Size	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
Top Quartile (largest)	10.22	0.08	0.08
High Medium Quartile	10.25	0.01	0.01
Low Medium Quartile	9.66	0.01	-0.06
Low Quartile (smallest)	9.76	-0.15	-0.25

Country Income	Labor_Productivity	TFP_3 Factor	TFP_4 Factor
Top Quartile (highest)	10.73	-0.11	-0.11
High Medium Quartile	10.37	-0.07	-0.08
Low Medium Quartile	9.92	0.14	0.12
Low Quartile (lowest)	8.82	0.03	-0.06