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International trade, FDI and agency problems

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Abstract

This dissertation comprises three papers that separately study product quality in international trade, the governance' effect on FDI and the agency problems in firms' exporting decisions.

The first chapter quantifies the contribution of differences in quality preferences to the differences in gains from trade across countries. The quantification demonstrates that variations in the strength of quality preferences across countries add to heterogeneities across countries in market competitiveness. If the quality channel is shut down, countries with stronger preferences for quality have larger degrees of underestimations in their losses from the trade barrier. Finally, gains from a universal rise in quality preference are unequal among countries, with larger economies generally gaining more than smaller economies.

The second chapter proposes a theoretical model to micro-found firms' optimal choice of FDI location, and sourcing and production, allowing for many countries, industries, and heterogeneous firms. We arrive at the main hypothesis that predicts an institutional complementarity pattern across countries in bilateral FDI flows at both the firm and country levels. We conduct an extensive test of the theory using worldwide bilateral FDI data at the firm level and at the country level. The results indicate a statistically significant assortative matching pattern in the institutional qualities of FDI origins and destinations.

The third chapter incorporates financial constraints into agency problems of firms. We show that under the same conditions, managers of potential exporting firms around the export threshold exert more efforts in financially under-developed countries to induce their owners to export. This finding has very positive policy implications, as firms in financially under-developed countries can compete with their peers in financially developed countries by exerting more managerial efforts. We find clear empirical evidence for this theoretical prediction using World Management Survey data for more than ten thousands firms from around 20 countries during 1999 – 2010.

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1. Heterogeneous Firms in Trade: Quality Matters

1.1. Introduction

Trade economists have paid particular attention to the role played by product quality in international trade. Under quality sorting, more efficient firms produce higher-quality goods, enter more competitive markets and charge higher prices,[1] which enriches conventional efficiency-based trade theories.[2] Additionally, quality differentiations across firms and markets can explain price variations in exports and imports.[3] Finally, the product quality is related to welfare gains from trade.[4]

This paper analyzes differences in quality preferences and technologies among countries and investigates the impact of these differences on gains from trade. Despite the growing literature linking quality, price and welfare, little has considered the contribution of quality either to cross-country differences in market competitiveness or to unequal gains from trade. In addition, this paper is the first to quantify the countries' heterogeneities in quality preferences and costs from both demand and supply sides. In this paper, I investigate this problem using a combination of empirical, theoretical and structural analyses. Two findings emerge from this analysis: first, differences in quality preferences among countries enlarge the inequality in gains from trade; second, a universal rise in quality preferences brings higher gains to larger economies.

To provide micro-foundations, I use a recent Chinese firm-level export transaction dataset to explore firm-level evidence. Evidence from this dataset shows that firms charging higher prices sell to larger countries, earn higher revenues and enter more markets. The positive relationship between price, revenue, and market entry is strengthened in sectors of high research and development (R&D) intensity. Typically, R&D intensity can be viewed as a proxy for scope of quality differentiation in Manova and Zhang (2012). Additionally, I choose two sectors with different levels of R&D intensity - tobacco (R&D intensity approximately zero) and pharmaceutical (R&D intensity approximately 50%). In the pharmaceutical sector, the positive relationship between price, revenue and market entry still holds. However, in tobacco sector, price is negatively correlated to revenue and the destination market size. The evidence reveals that the price is positively correlated destination market size, firm revenues

[1] See, for example, Baldwin and Harrigan (2011), Baller (2015), Crozet et al. (2012), Demir (2011) and Eckel et al. (2015).

[2] Conventional heterogeneous firm trade theories include Melitz (2003) and Melitz and Ottaviano (2008).

[3] See, for example, Mandel (2010).

[4] See, for example, Fan et al. (2018)

and market entry in a subset of sectors only. This implies that price reveals quality only in selected industries and that some sectors are homogeneous with limited quality differentiation space.

Motivated by these stylized facts, I extend the framework of Antoniades (2015) into the multi-country and multi-sector setting. The framework introduces quality differentiation into Melitz and Ottaviano (2008) (MO, thereafter). According to Antoniades (2015), firms compete along the quality dimension as well as cost dimension so that more productive firms charge higher prices because they can produce higher-quality products. I also extend Antoniades (2015) so that a firm can produce multiple products. The extension suggests that more productive firms produce more products with higher average qualities. On the demand side, quality preferences are homogeneous within a country and sector. On the supply side, the cost of improving quality is embedded in both variable and sunk costs that firms have to pay.

In the multi-country setting in this paper, it is possible to assess spillover effects of the bilateral trade liberalization and the preference shock. The spillover effect is unique to this multi-country model. A bilateral trade liberalization between two countries can generate negative effect on competitiveness of other countries. The effect on the third country is higher, the larger the trade-liberalizing economies. Apart from that, a positive preference shock on one country could have positive effect on competitiveness of other countries. This occurs since quality differentiation scope in selling to that market are widened following positive preference shock. Firms in all countries respond by rising quality of goods sold to that market. The responses are higher for more productive firms. Therefore, the productivity threshold of entering the market with preference shock rises. As for other countries without shocks, the least productive firms cannot profitably export to the market with the positive preference shock. This makes this group of firms unable to cover the sunk cost of entry. Thus, the least productive firms are driven out of the market, in all countries. The productivity thresholds of other countries without preference shock could also rise. The larger the country with preference shock, the higher the effects on productivity of other countries. Finally, if the trade liberalization negatively affect competitiveness of a third country, higher quality preference alleviate the negative effect. If the trade liberalization positively affect competitiveness of a third country, higher quality preference strengthen the positive effect. This occurs since higher quality preference have positive selection effect.

The multi-country setting of this paper enables computation of equilibrium. I bring the model to data to estimate the relevant parameters of quality in the model. An extended gravity model can be derived from the above theoretical framework. In addition to the bilateral trade costs and the importer/exporter fixed effects typically included in a gravity model estimation,[5] I include (a non-linear function of) quality preferences and costs into the the gravity equation. According to this gravity model, bilateral trade flow is positively affected by the destination country's quality preferences and negatively affected by the origin country's costs of improving quality.[6] I parameterize that gravity equation to estimate quality preferences/costs parameters as well as trade costs. After the estimation, I recover two measures of the degree of competition for each country-sector pair. The first measure is endogenous competitiveness. This is the productivity threshold above which firms can make non-negative profits. Thus, before a firm makes a random draw of productivity, a firm will be, ex ante, less likely to enter a market where the cutoff productivity is high and competition is fierce. The second is the exogenous measure of competitiveness. This is the fundamental productivity level in a market. Firms are more likely to draw a high productivity if the level of fundamental productivity is higher. I follow Corcos et al. (2011) and estimate the endogenous competitiveness first and back out the exogenous competitiveness using free-entry conditions.[7]

The structural analysis suggests that quality preferences are related to income and that considering quality enlarges differences in competitiveness across countries. First, the preference for quality is positively correlated with GDP per capita in more than half of the sectors studied.[8] This indicates that for these industries, the preferences for quality are on average stronger in richer countries. Second, the distribution of preferences for quality vary across sectors. The variance of the estimates across countries is particularly large for certain sectors such as HS 85 (Electrical machinery and equipment), which is 56.19, and small for certain sectors such as HS 37 (Photographic or cinematographic goods), which is approximately 9.94.[9] These findings are, to some extent, consistent with empirical evidence on the correlation between price and market size.[10] For example, Khandelwal (2010) and Kneller and Yu (2016) finds that prices are a good proxy for quality in some industries but not in

[5]The original gravity model starts from Tinbergen (1962) and is augmented by Anderson and Wincoop (2003).

[6]The details of this are discussed in the Section 1.3 and Section 1.4.

[7]This is discussed in detail in Section 1.4.

[8]For the rest of sectors, GDP per capita has insignificant effect on quality preferences.

[9]As for the cost of quality, it is found that the mean is smaller than the preference parameters within the same sector and the variance are also smaller.

[10]Syverson (2007) among other, reports a negative correlation between market size and output price, while Verhoogen (2008) and Hallak and Sivadasan (2009) report positive correlations.

others. I compare the endogenous competitiveness estimated from this model with that estimated from the MO canonical model. Comparing across countries by sector, it is noticeable that endogenous competitiveness is more dispersed under this model. This more dispersed distribution can be explained by the additional heterogeneity introduced by differentials in both quality preferences and costs of improving quality among countries.

A counterfactual exercise is performed to examine the competitiveness-enhancing effect of quality. Exogenous competitiveness and quality parameters are kept constant. I experiment with a 5% universal increase in international trade costs. This exercise is implemented under both this model and the MO model. In general, the productivity cutoffs, which measure the endogenous competitiveness, decrease in both models. This implies that the average productivity is lower and the economy becomes less competitive. Quantitatively, the decline of the productivity cutoff is 25% to 300% larger in this model with quality than that it is in the MO setup (depending on the sector). Furthermore, the differences between this model and the MO model in degrees of the declines of productivity cutoffs rise in the magnitude of preferences for quality, in most sectors. If consumers value quality more in some countries, the difference between the rise of productivity cutoffs in this model and in the MO model will be larger in these countries than the difference in other countries where quality is not valued. This suggests that gains from trade across countries are more heterogeneous than in a canonical model, in which quality is considered.

For the second counterfactual exercise, I simulate a universal positive shock in preference for quality. Although quality preferences are exogenous to this model, they can change over time by promoting consumers' awareness of product quality. Most countries experience gains in productivity of less than 141.2%. Approximately 25 countries experience a loss in productivity. The total gains in productivity is nearly 5 times the total losses in productivity, from the global scale. It is noticeable that large economies generally gain more than small economies. On average, 1% rise in population size leads to 7.876% more gains in productivity. This finding is consistent with the model implication that larger economies have wider scope for quality differentiation.

Quality in international trade has been intensively studied, but existing work pays limited attention to sources of quality variation from both the demand and the supply side and does not link them to heterogeneity among countries. Hallak (2006) estimates the demand for quality across countries on the demand side. Other studies focus more on firms' behavior in quality improvement (Bas and Strauss-Kahn (2015), among others). Nevertheless, Antoniades (2015) reconciles both the demand and the supply sides into a single theoretical framework. This paper uses a more general framework and compares predictive differences between that quality-extended model and the MO model.

The analysis of this paper provides new insight into the sources of unequal gains from trade from a quality perspective. That countries do not gain equally has been well documented. Gains from trade can be divergent among countries of different sizes (Markusen (1981), among others) or incomes (Trela and Whalley (1990), among others). A recent study by Anderson and Yotov (2016) suggests that free trade agreement (FTA) can bring -0.3% to 5% gains to different countries. However, little literature provides explanations for the unequal gains across countries. The paper points out and quantifies the strengthening effect on competition brought by higher quality preferences and quantifies it.

The paper relates to three strands of literature: heterogeneous firms' quality choices, pricing-to-market and non-homothetic preferences. Trade liberalization induces firms' quality-upgrading behavior (Fan et al. (2015), among others). Larger plants have higher output prices and use more expensive materials (Kugler and Verhoogen 2012).[11] This paper embraces the above findings by allowing quality choices to be endogenous to firms such that prices and markups vary with plant size and productivity. The model also includes findings by Feenstra and Romalis (2014) that export unit values vary to a larger extent than quality-adjusted prices.[12] Finally, the study, by estimating quality preferences and relating to the country-level income, incorporates non-homothetic preferences proposed by Fajgelbaum et al. (2011).[13]

The remainder of the paper is organized as follows. Section 1.2 uses firm-product level trade statistics to explore the relationship between price, market features and firm exporting performances. I use these statistics to show the micro foundations of the model. Section 1.3 lays out the theoretical framework under a multi-country and multi-product setting. Section 1.4 discusses the data and how relevant parameters are estimated. Section 1.5 implements the counterfactual analysis. Finally, Section 1.6 concludes.

[11] Other studies include Manova and Zhang (2012).

[12] Atkeson and Burstein (2008) finds that price deviate from purchasing power parity.

[13] Similarly, Fieler (2011) proposes that richer households consume higher-elasticity goods more thus leading to more trade flows between high income countries than between low-income ones.

1.2. Stylized Facts

1.2.1. Data

In order to document stylized facts regarding *f.o.b.* export prices across destinations and across firms within the same destination, I use a unique micro-level data and two sets of macro-level data. The specific micro dataset used here is the China Customs Trade Statistics (CCTS) issued in 2013 by The General Administration of Customs. The advantage of this dataset is that it is highly disaggregated in recording the import/exports of Chinese firms. Additionally, it records the prices of exports/imports, origins/destinations of imports/exports, the product (HS8) of the transaction, and the mode (ordinary or processing) of international trade. I use the CEPII-Dist dataset to obtain bilateral characteristics of destination countries and China. The Penn World Table dataset is used to obtain population of destination countries.

1.2.2. Empirical Findings

In this subsection, I report three stylized facts concerning export prices across destinations and across firms within destinations. Although the existing literature such as Manova and Zhang (2012) has documented these findings, it is important to show that they hold in the more recent years. Moreover, these are the facts to be embraced in the model and that lay the micro foundation in the model setup.

On export prices across destinations — Based on the entire customs export data in 2013, Table 1 reports the regression results using (log) export prices as the dependent variable and destination country's population as the main explanatory variable, controlling for destination's GDP per capita and distance to China. Columns 1-2 use the prices at the firm-HS8-country level and Columns 3-4 use HS8-country level. The coefficients on (log) population in all specifications are significantly positive, suggesting that export prices increase with the destination's market size, consistent with Manova and Zhang (2012). Thus, it is summarized as the following fact:

Stylized Fact 1: *On average, firms set higher export prices for the same product in larger markets.*

On export prices and revenues - Table 2 presents robust evidence that firms charging higher export prices earn greater revenues even within very narrowly defined destination-product markets. In Columns 1-2, I use prices at the firm-HS8-country level and Columns 3-4 I use prices at firm-product level. This relationship is highly statistically significant.

Importantly, it is also markedly stronger for goods with greater scope for quality upgrading, as proxied by sectors' R&D intensity compiled by Kroszner et al. (2007). The magnitudes and signs of estimated coefficients are relatively robust to different specifications and different level of aggregations. The elasticity of export prices with respect to revenues is 0.15. A doubling in firm sales in a given market is thus associated with 20% higher bilateral unit prices for the average product. That number is bigger for sectors with higher R&D intensity. This yields the following fact:

Stylized Fact 2: *On average, firms charge higher prices simultaneously earn greater revenues in each destination. The correlation between price and revenue is higher in R&D intensive sectors.*

On prices and market entry -As reported in Table 3, exporters that supply more countries systematically charge higher average prices (Columns 1-2). Firms selling to more destinations also exhibit greater price dispersion across importers (Columns 3-4). In this table, I use prices (or price dispersions) at firm-HS8 product level. These results are both largely enhanced by products with substantial potential for quality differentiation. As columns (2) and (4) show, the patterns are stronger for sectors with larger scope for quality differentiation, which is proxied by sectoral R&D intensity, defined as before. The finding is consistent with Manova and Yu (2017) and Manova and Zhang (2012) which use earlier versions of CCTS. This finding suggests the following fact:

Stylized Fact 3: *On average, exporters entering more destinations and offering a wider range of export prices charge higher prices. The correlation between price and market entry is higher in R&D intensive sectors.*

One caveat is that the above relationships can be sector-dependent. The above relationship exist only in a subset of sectors. In Figure 1 and 2, I plot the above 3 stylized facts for sector HS 24 (Tobacco) and HS 6, respectively. The findings of the three stylized facts continue to hold in the sub-sample of HS 6, while they are reversed in HS 24. From Figure (1a), the average price decreases with destination market size. Firms charging higher prices earn lower revenues, as in Figure (1b). The relationship between the firm's price charged and the number of market it entered (Figure (1c)) is not as significant as in sector HS 6 (2c). The comparison suggests that competition improves quality in only a subset of sectors. This is also consistent with the Table (2) -(3) where the relationship between price, revenue and market entry are "more positive" in R&D intensive sectors. In sector 30 (Pharmaceuticals), the average R&D intensity is approximately 58% while that ratio of sector 24 is 0.

1.3. Theory

I lay out theoretical frameworks that incorporate endogenous quality choices in the linear demand system. The demand side features heterogeneous quality preferences among different countries; In addition, quality upgrading requires additional variable and fixed costs such that producers endogenously choose the level of quality in their products. The model is built on a multi-country basis for the convenience of quantification in subsequent empirical studies. For simplicity, sector notations are dropped as there are no interactions between them.

1.3.1. Setup

I follow the framework of Antoniades (2015) and Foster et al. (2008), the preference of a consumer in country j is represented as (1). This utility function has the advantage that the price/quantity are linear in quality preference

$$\begin{aligned} U_j = \quad q_0^c \quad &+ \sum_s \left[\alpha_s \int_{\omega \in \Omega_s} q_s(\omega)^c d\omega + \kappa_{js} \int_{\omega \in \Omega_s} z_s(\omega) q_s(\omega)^c d\omega \right] \\ &- \sum_s \left[\frac{1}{2}\gamma_s \int_{\omega \in \Omega_s} (q_s(\omega)^c)^2 d\omega + \frac{1}{2}\eta_s \left(\int_{\omega \in \Omega_s} q_s(\omega)^c \right)^2 \right] \end{aligned} \tag{1}$$

where q_0^c and $q_s(\omega)$ are individual c's consumption in numeraire and differentiated goods (in sector s) respectively. The quality of each variety ω is given by $z_s(\omega)$ and the taste for quality by consumers in country j in sector s is κ_{js}. In the above utility function, $\kappa_{js} z_s(\omega)$ is equivalent to the variety-specific taste shifter in Foster et al. (2008).[14] If qualities of all varieties are zero or if the taste parameters are zero, the model becomes traditional Melitz and Ottaviano (2008) model. Finally, α_s and η_s capture the degree of substitution between each variety and the numeraire. The parameter γ measures the degree of differentiation between varieties. κ_{js} picks up the degree of preference for variety. Specifically, κ_{js} are assumed to be positive and differ across countries and sectors.

This generates a linear inverse demand function that depends on both quantity and quality:

$$p_j(\omega) = \alpha - \gamma q(\omega)^c + \kappa_j z(\omega) - \eta Q^c \tag{2}$$

[14]The difference between this paper and Foster et al. (2008) is that the latter regard the shifter as the idiosyncratic term.

where $Q^c = \int_{\omega\in\Omega} q(\omega)^c d\omega$. By re-arranging (2) one can obtain the total demand in country j of each variety:

$$q_j(\omega) = L_j q(\omega)^c = \frac{\alpha L_j}{\eta N_j + \gamma} - \frac{L_j}{\gamma} p_j(\omega) + \frac{L_j \kappa_j}{\gamma} z(\omega) + \frac{\eta N_j L_j}{\gamma\left(\eta N_j + \gamma\right)} \bar{p}_j - \frac{\eta N_j L_j \kappa_j}{\gamma\left(\eta N_j + \gamma\right)} \bar{z}_j \quad (3)$$

where $\bar{p}_j = \frac{1}{N_j} \int_{\omega\in\Omega} p_j(\omega) d\omega$ is the mean price over all varieties in country j, $\bar{z}_j = \frac{1}{N_j} \int_{\omega\in\Omega} z_j(\omega) d\omega$ is the mean quality over all varieties in j. This form of preference over quantity and quality ensures that demand function is linear in price and quality.

On the supply side, firms have to incur costs in both production and quality improvements. For simplicity, labor is assumed to be the only factor of production. As with most heterogeneous firm trade models, firms have to pay a sunk cost f_e before they draw the productivity c (marginal cost of production). If a firm in country i produce and sell to country j, it should choose both the quantity and the quality of its product, given the total cost function:

$$TC_{ij}(\omega) = q_{ij}(\omega)(\tau_{ij} c + \mu_i z_{ij}(\omega)) + \delta z_{ij}(\omega)^2 \quad (4)$$

where τ_{ij} is the ice-berg trade cost from country i to j and z_{ij} is the quality level of goods sold from i to j. The first term implies that firms have to incur additional marginal cost of quality upgrading,which depends on both quality level z_{ij} and quality improving technology at origin country μ_i, when producing in country i; the second term picks up the fixed cost of improving quality. To generate closed form solutions, I assume that the fixed cost is a quadratic function of quality level. A more generalized function form in the fixed cost can be found in Fan et al. (2015) in which CES preference is assumed. In the cost function (4), the marginal cost of upgrading quality differs across countries/sectors, since labor productivity are heterogeneous across countries. The multiplier in the fixed cost δ is assumed to be identical across countries, since the fixed costs of innovation across countries, which include high-skilled workers, tend to be homogeneous across countries.[15]

[15] This assumption is made since the highly skilled labor migrate to regions where wages are high, according to Parikh and Leuvensteijn (2003). Therefore the wage for high skilled workers tend to converge over time.

1.3.2. Firms' Problem

For a firm (of marginal cost c) from country i selling to each (potential) market $j \in J$, it chooses quantity and quality to maximize profit:

$$\pi_{ij}(c) = \max_{q_j(\omega), z_j(\omega)} p_{ij}(\omega) q_{ij}(\omega) - TC_{ij}(\omega) \tag{5}$$

Given the demand structure, the quantity of goods sold from country i to country j satisfies a linear function with respect to price p_{ij}:

$$q_{ij}(c, z) = \frac{Lj}{\gamma} \left[c_D^j - p_{ij}(c, z) + \kappa_j z_{ij} \right] \tag{6}$$

where c_D^j is the cost threshold so that firms with marginal cost of production $c \leq c_D^j / \tau_{ij}$ can sell to market j and make non-negative profits. Equation (6) shows that demand is linear to both price and quality. This makes it convenient for later analysis in optimal pricing.

Given the demand function and the firms' problem, the optimal price and quantity as a function of quality z is linear in marginal cost[16]:

$$p_{ij}(c, z) = \frac{1}{2}(c_D^j + \tau_{ij} c) + \frac{1}{2}(\kappa_j + \mu_i) z_{ij} \tag{7a}$$

$$q_{ij}(c, z) = \frac{L_j}{2\gamma}(c_D^j - \tau_{ij} c) + \frac{L_j}{2\gamma}(\kappa_j - \mu_i) z_{ij} \tag{7b}$$

where c_D^j is the cost-cutoff in country j, above which firms cannot profitably sell in market j. This is also the endogenous competitiveness of country j (lower cutoff, more endogenous competition), which changes with factors such as ice-berg trade costs, quality parameters and market size. Thus, that the profit of selling to market j can be re-written as

$$\pi_{ij}(c, z) = \frac{L_j}{4\gamma} \left[(c_D^j - \tau_{ij} c) + (\kappa_j - \mu_i) z_{ij} \right]^2 - \delta z_{ij}^2 \tag{8}$$

Solving for the first-order conditions for profit, the optimal quality choice to sell from i to j of firm c is written as a decreasing function of marginal cost so that more productive firms offer higher quality within a market

$$z_{ij}(c) = \rho_{ij}(c_D^j - \tau_{ij} c) \tag{9}$$

[16]Per unit trade cost $(\tau_{ij} - 1)\, c$ does not depend on quality

where $\rho_{ij} = L^j(\kappa_j - \mu_i)/\left(4\delta\gamma - L^j(\kappa_j - \mu_i)^2\right)$. As Equation (9) shows, the quality is linearly related to marginal cost c. Consistent with other international trade in quality literature,[17] for the same firm c from country i, it is expected to offer higher quality goods to larger markets and countries with higher taste for quality. Higher quality is also expected from countries with higher labor productivity in quality improvement (i.e., lower μ_i). It is noticeable that at the first glance, a lower cutoff resulting from trade liberalization seems to have negative impact on quality updates. However, a lower cutoff indicates that the average marginal cost is also lower, since firms with marginal cost above the new cutoff exit the market. Since firm-level quality $z(c)$ decreases with c, the average quality of products sold in the economy rises. That effect is higher the larger quality differentiation scope ρ_{ij}.

Given optimal quality function in (9) and price/quantity functions, it is evident that price and quantity can be further expressed as

$$p_{ij}(c,z) = \frac{1}{2}(c_D^j + \tau_{ij}c) + \frac{1}{2}(\kappa_j + \mu_i)\rho_{ij}(c_D^j - \tau_{ij}c) \tag{10a}$$

$$q_{ij}(c,z) = \frac{L_j}{2\gamma}(c_D^j - \tau_{ij}c) + \frac{L_j}{2\gamma}(\kappa_j - \mu_i)\rho_{ij}(c_D^j - \tau_{ij}c) \tag{10b}$$

So the for each firm with marginal cost of production c, the operating revenue of exporting from country i to j is:

$$r_{ij}(c) = \frac{\rho_{ij}\left((c_D^j)^2 - (\tau_{ij}c)^2\right) + \delta\rho_{ij}^2(\kappa_j + \mu_i)(c_D^j - \tau_{ij}c)^2}{\kappa_j - \mu_i} \tag{11}$$

Equation (10) and (11) implies that other things equal, more productive firms charge higher prices and earn greater revenues from each destination, if $(\kappa_j + \mu_i)\rho_{ij} > 1$. This is consistent with Stylized 2 in the prior section.

The operating profit can be expressed as[18]:

$$\pi_{ij} = \frac{L^j}{4\gamma}\left[1 + (\kappa_j - \mu_i)\rho_{ij}\right](c_D^j - \tau_{ij}c)^2 \tag{12}$$

Profit function in (12) implies that countries of higher quality preferences offer higher profits, all else being equal. This is related to the third stylized facts. From (12), more productive

[17] For example, see Fan et al. (2018) in which more productive firms offer higher quality products with lower quality-adjusted costs.

[18] Following Antoniades (2015), the fixed cost of upgrading quality is also regarded as sunk since this model is not dynamic.

firms earn higher profits and earn non-zero profits in a larger set of markets.

This profit function is a quality-adjusted form of Melitz and Ottaviano (2008), in which profits are magnified by a term larger than one. This quality-adjusted term is key to the later empirical analysis.

1.3.3. Equilibrium

In equilibrium, the free entry condition of each country implies that the expected profit (earned from selling to each market) of a firm is zero. Such that that

$$\sum_{j \in J} \int_0^{c_D^{J(c)}/\tau_{ij}} \pi_{ij}(c) dG_i(c) = f_E^i \tag{13}$$

where f_E is the sunk cost a firm have to pay prior to entry. It is assumed to be positive and can vary across countries and sectors. Equation (13) implies that operating profit from all markets are expected to merely compensate for the sunk cost.

Following prior literature, it is assumed here that marginal cost draws follow Pareto distribution: $G_i(c) = \left(\frac{c}{c_M^i}\right)^k$ so that firms draw the marginal cost c from the range $[0, c_M^i]$. The term c_M^i is the exogenous competitiveness in market i. Lower values indicates that a firm in country i is more likely to draw a lower cost. The power k governs the Pareto distribution dispersion: higher k implies that the distribution of c is more concentrated.

Given profit as in (12), one can re-write the equilibrium condition in (13) for country i so that the summation of expected profit from each market equals the sunk cost paid.

$$\sum_{j \in J} \frac{L^j}{4\gamma} \left[1 + (\kappa_j - \mu_i) \rho_{ij}\right] \tau_{ij}^{-k} (c_D^j)^{k+2} = \frac{(k+1)(k+2)\gamma f_e}{2} \left(c_M^i\right)^k \tag{14}$$

The same equilibrium condition can be written for each country h, in the matrix form. In the multi-country case, the vector of cost threshold c_D for each country j satisfies:

$$\mathbf{B} * \mathbf{L} * \mathbf{c_D}^{k+2} = 2\gamma\,(k+1)\,(k+2)\,\mathbf{f_e}\mathbf{c_M}^k \tag{15}$$

where matrix B is the the "quality adjusted" matrix of trade freeness. If there are a total of J countries, the dimension is $J \times J$. This matrix is represented as the following form:

$$\mathbf{B} = \begin{bmatrix} [1+(\kappa_1-\mu_1)\,\rho_{11}]\,\tau_{11}^{-k} & [1+(\kappa_2-\mu_1)\,\rho_{12}]\,\tau_{12}^{-k} & \dots & [1+(\kappa_J-\mu_1)\,\rho_{1J}]\,\tau_{1J}^{-k} \\ [1+(\kappa_1-\mu_2)\,\rho_{21}]\,\tau_{21}^{-k} & [1+(\kappa_2-\mu_2)\,\rho_{22}]\,\tau_{22}^{-k} & \dots & [1+(\kappa_J-\mu_2)\,\rho_{2J}]\,\tau_{2J}^{-k} \\ \dots & & & \\ [1+(\kappa_1-\mu_J)\,\rho_{J1}]\,\tau_{J1}^{-k} & [1+(\kappa_2-\mu_J)\,\rho_{J2}]\,\tau_{J2}^{-k} & \dots & [1+(\kappa_J-\mu_J)\,\rho_{JJ}]\,\tau_{JJ}^{-k} \end{bmatrix}$$

It is noticeable that whether elements in B are larger or smaller than one depends on the trade freeness, κ's and μ's. If trade cost is small (i.e., τ_{ij}^{-k} is larger) and κ_j is large, i, jth element can exceed one.

The matrix L is of dimension $J \times J$ and is the diagonal matrix of market size L_i for each country i:

$$\mathbf{L} = \begin{bmatrix} L_1 & 0 & \dots & 0 \\ 0 & L_2 & \dots & 0 \\ \dots & & & \\ 0 & 0 & \dots & L_J \end{bmatrix}$$

The last term on the right-hand-side of (15) $\mathbf{c_D}^{k+2}$ is the vector of cutoffs (to the power of $k+2$), with the ith element being $(c_D^i)^{k+2}$. On the right hand side of Equation (15), c_M^k is the vector of exogenous competitiveness (to the power k), with ith element being $c_M^{i,k}$. Both c_D^k and c_M^k are of dimension $J \times 1$.

By inverting matrix B, cost threshold c_D^j for each country j can be computed as follows:

$$\left(c_D^j\right)^{k+2} = \frac{2\gamma(k+1)(k+2)f_e}{\mid B \mid} \frac{\sum_i \mid C_{ij} \mid \left(c_M^i\right)^k}{L_j} \tag{16}$$

where $\mid B \mid$ is the determinant of matrix B and C_{ij} is the cofactor of B_{ij}. A closer examination of the matrices and Equation (16) implies that higher market size L_j leads to a lower calculated cutoff, all else being equal.[19] If ice-berg trade cost is symmetric, i.e. $\tau_{ij} = \tau_{ji}$, bilateral trade liberalization can have heterogeneous effects on cost cutoffs of different countries. Following this argument, bilateral trade liberalization can have negative externalities on countries without trade liberalization.

Proposition 1. *If ice-berg trade cost is symmetric, i.e.* $\tau_{ij} = \tau_{ji}$*, the effect of a bilateral trade liberalization between* i *and* j *on cutoffs is not universal i.e.* $\exists\ k,\ k' \in \{1, ..., J\}$ *such*

[19] This also holds under multi-product setting in Appendix A.1.

that $\frac{\partial c_D^k}{\partial \tau_{ij}} > 0$ *and* $\frac{\partial c_D^{k'}}{\partial \tau_{ij}} < 0$. *Additionally,* $\exists$ $\boldsymbol{B}$ *such that* $\frac{\partial c_D^i}{\partial \tau_{ij}}, \frac{\partial c_D^j}{\partial \tau_{ij}} > 0$ *and* $\frac{\partial c_D^k}{\partial \tau_{ij}} < 0, \forall k \neq i, j$. *The larger the trade liberalizing economies, the higher the effects on the cutoff of country* $k \in \{1, ..., J\}$.

Proof. See Appendix A.2 QED

The intuition for the negative externalities is comparable to the special case of two-country world. It is driven by the long-term entry.In the long run, the market entries in trade-liberalizing economies rise. This drives up the competitiveness, i.e. the cost cutoff decrease as a result. For other countries without trade liberalization, the profit from selling to these markets are higher, relative to countries with trade liberalization. This results in decreased entries and higher cost threshold.

Another implication from (16) is on the effect of a preference shock, i.e. a change in κ_j, on cutoffs of countries.

Proposition 2. *The effects of a shock in preference for quality* κ_j *of any country* j *on cutoffs are universal, i.e.* $\exists$ $\boldsymbol{B}$ *such that* $\frac{\partial c_D^k}{\partial \kappa_k} < 0, \forall\ k$. *The larger the country with preference shock, the higher the effects on the cutoff of country* $k \in \{1, ..., J\}$

Proof. See Appendix A.2 QED

The intuition for this lies in the selection effect. Quality differentiation scope in selling to that market are widened following positive preference shock. Firms in all countries respond by rising quality of goods sold to that market. The responses are higher for more productive firms. Therefore, the productivity threshold of entering the market with preference shock rises. As for other countries without shocks, the least productive firms cannot profitably export to the market with the positive preference shock. This makes this group of firms unable to cover the sunk cost of entry. Thus, the least productive firms are driven out of the market, in all countries. The productivity thresholds of other countries without any preference shock also rise.

Additionally, the average bilateral *f.o.b* price $\bar{p}_{ij}$ and trade value r_{ij} can be computed by aggregating over $c \in [0, c_D^i]$[20]

$$\bar{p}_{ij} = \frac{1}{2}\left[\frac{2k+1}{k+1} + \frac{1}{k+1}\left(\kappa_j + \mu_i\right)\rho_{ij}\right]\frac{c_D^j}{\tau_{ij}} \tag{17}$$

[20]Trade value is computed based on *f.o.b* price.

This is related to the first stylized fact, which links price with market size. From (17), one can observe that market size affect price both by decreasing the cost cutoff c_D^j and by increasing the scope for quality differentiation. If the latter dominates, the relationship between price and market size is similar to Figure (2a), otherwise, it is closer to (1a).

The total trade value from i to j

$$r_{ij} = \frac{kN_i^E(c_m^i)^{-k}}{2\gamma}L^j(\tau_{ij})^{-(k+1)}\left(c_D^j\right)^{k+2}[1+(\kappa_j-\mu_i)\rho_{ij}]\left(\frac{1}{k(k+2)}+\frac{(\kappa_j+\mu_i)\rho_{ij}}{k(k+1)(k+2)}\right) \tag{18}$$

where N_i^E denotes the expected number of entrants in country i. From Equation (17) and (18), the quality components have two effects: higher μ_i raises prices and reduces the trade values because of the additional (variable) costs incurred in manufacturing higher-quality goods in the origin country. Higher quality preferences in the destination country raise the willingness to pay and thus average price and trade value rise. Another countervailing effect is that, higher quality preferences drive down the cost cutoffs in the importing country thus to some extent lowering prices and values.

Finally, one can compute other aggregate variables, which are the number of varieties, entries, price indexes and welfare. The expected number of varieties in a country j (i.e., the number of producers from domestic and abroad servicing market j) is similar to the M.O model multiplied by a quality-adjustment term that is negatively related to κ (of the market j) and positively affected by μ (of each sourcing country). That can be characterized as:

$$N_j = \frac{2(k+1)\gamma}{\eta}\frac{\alpha - c_D^j}{c_D^j}\frac{1}{\overline{1+(\kappa_j-\mu)\rho}} \tag{19}$$

where $\overline{[1+(\kappa_j-\mu)\rho]} = \{[1+(\kappa_j-\mu_1)\rho_{1j}]\,N_{1j}+[1+(\kappa_j-\mu_2)\rho_{2j}]\,N_{2j}+...\}/N_j$. N_{kj} denotes the number of varieties sold from country k to country j. Equation (19) indicates that a higher preference for quality can be countervailing: κ can directly lower the number of varieties because it imposes higher requirements for the quality firms offer to market j such that fewer firms can meet the high-quality requirement. On the other hand, higher quality preferences lower the cutoffs as is previously argued, which then encourages entry by raising average profits.

One can solve for the number of entrants by noting that the number of producers from origin to destinations depends on the exogenous competitiveness of the origin country and the cutoff in the destination country. Equation (19) can be used to solve for the number of entrants in each country. Notice that the number of bilateral varieties N_{ij} satisfies the following condition

$$N_{ij} = N_i^E * G(c_D^{ij}) = N_i^E \tau_{ij}^{-k} c_j^k (c_M^i)^{-k}$$

For each country j, the total number of varieties from each sourcing country should equal Equation (19), which can be represented in the following condition

$$\sum_{i \in J} N_i^E \left[1 + (\kappa_j - \mu_i)\rho_{ij}\right] (\tau_{ij} c_M^i)^{-k} = \frac{2(k+1)\gamma}{\eta} \frac{\alpha - c_D^j}{c_D^{j,k+1}} \tag{20}$$

Under the multi-country set-up, refer to M.O model, re-arranging (19) leads to the following condition:

$$D * c_M^k * N^E = F \tag{21}$$

If there are J countries, D has the dimension of $J \times J$ and is the transpose of matrix B:

$$D = \begin{bmatrix} \left[1 + (\kappa_1 - \mu_1)\rho_{11}\right] \tau_{11}^{-k} & \left[1 + (\kappa_1 - \mu_2)\rho_{21}\right] \tau_{21}^{-k} & \dots & \left[1 + (\kappa_1 - \mu_J)\rho_{J1}\right] \tau_{J1}^{-k} \\ \left[1 + (\kappa_2 - \mu_1)\rho_{12}\right] \tau_{12}^{-k} & \left[1 + (\kappa_2 - \mu_2)\rho_{22}\right] \tau_{22}^{-k} & \dots & \left[1 + (\kappa_2 - \mu_J)\rho_{J2}\right] \tau_{J2}^{-k} \\ \dots & & & \\ \left[1 + (\kappa_J - \mu_1)\rho_{1J}\right] \tau_{J1}^{-k} & \left[1 + (\kappa_J - \mu_2)\rho_{2J}\right] \tau_{2J}^{-k} & \dots & \left[1 + (\kappa_J - \mu_J)\rho_{JJ}\right] \tau_{JJ}^{-k} \end{bmatrix}$$

The second term on the left hand side c_M^{-k} is the diagonal matrix of $c_M^{i,-k}$ and is also dimension of $J \times J$ written as

$$c_M^k = \begin{bmatrix} c_M^{1,-k} & 0 & \dots & 0 \\ 0 & c_M^{2,-k} & \dots & 0 \\ \dots & & & \\ 0 & 0 & \dots & c_M^{J,-k} \end{bmatrix}$$

and the third term N^E denotes the vector of entrants with dimension $J * 1$. The $i - th$ element is N_i^E.

On the right-hand-side, matrix F is of dimension $J * 1$ and the $i - th$ element is

$$\frac{2\gamma(k+1)(\alpha - c_D^i)}{\eta c_D^{i,k+1}}$$

The average price in a market is obtained by aggregating over the average delivered price over destinations. Using the bilateral price in (17), it is implied that the (weighted) expected price levels in country i are as follows:

$$p_i = \frac{2k + 1 + \overline{(\kappa_i + \mu)\rho}}{2(k+1)} c_D^i \tag{22}$$

where $\overline{(\kappa_i + \mu)\rho} = \left[(\kappa_i + \mu_1)\rho_{1i}N_{1i} + (\kappa_i + \mu_2)\rho_{2i}N_{2i} + ...\right]/N_i$. From (22), similar argument can be applied: higher κ can lower the cutoff thus lowering the price index. However, this raises prices, since the consumers could have a higher willingness to pay for high quality.

Finally, the welfare in country i is as follows:

$$\begin{aligned} U_i &= 1 + \sum_s \left[\frac{1}{2}\frac{N_i(\alpha_s - \bar{p}_i + \beta\bar{z}_i)^2}{\gamma_s + \eta_s N} + \frac{N_i}{\gamma_s}\left(\frac{1}{2}\sigma_p^2 + \frac{1}{2}\beta^2\sigma_z^2 - \beta Cov(p,z)\right)\right] \\ &= 1 + \sum_s \frac{1}{2\eta_s}(\alpha_s - c_D^i)\left[\alpha_s - \frac{k+1}{k+2}c_D^i + \frac{\overline{(\kappa_{is} - \mu_s)\rho_{jis}}}{k+2}c_D^i\right] \end{aligned} \tag{23}$$

where the quality component $\frac{\overline{(\kappa_{is}-\mu)\rho_{jis}}}{k+2}$ is defined in the similar manner as previous. Other things equal, higher valuation on quality always raises welfare: it directly raises welfare by raising the utility obtained from consuming higher quality goods; it indirectly increases welfare by reducing the cost cutoff so that more productive firms enters and provide higher quality goods.[21]

The above derivations indicate that the existence of quality can be double-sides. The subsequent proposition argues that if the quality scope is high, the quality preference amplifies the effect of the trade cost change.

Proposition 3. *The larger the scope for quality differentiation* $1 + (\kappa_j - \mu_i)\rho_{ij}$ $(i, j \in \{1, ..., J\})$*, the more likely the selection effect of quality preference* κ_j*, i.e.* $\frac{\partial^2 (c_D^h)^{k+2}}{\partial\kappa_j \partial\tau_{ij}^{-k}}$ *smaller.*

Proof. See Appendix A.2. QED

1.3.4. Discussion

The theory sketched above is based on linear demand, and it addresses the point of pricing-to-market. Specifically, it relates market toughness to the behavior of firms, and consequently,

[21] The third term in the square bracket has the opposite effect compared with the first two terms. I attempted to compute the last term (multiplied by $\frac{1}{2\eta}(\alpha - c_D^i)$) and found that its proportion to the total welfare is less than 5%.

to the economic aggregates such as price index and welfare. In such a setting, market toughness operates through two channels: an increase in competition and an increase in the scope for quality differentiation. The theory identifies the second channel through which market toughness affects firms' outcomes. An increase in market toughness (e.g., an increase in market size or a decrease in trade costs) raises the scope of quality differentiation because it makes it easier for firms to recover the fixed cost of innovation. Under such circumstances, each firm responds by raising quality, mark-ups, and prices. The (endogenous) relation between the scope of quality differentiation and market toughness is a key element of the model and constitutes an important deviation from past work.[22] For the most productive firms, quality, prices and profit rise as the innovation effect dominates the competition. These firms can earn positive profit from exporting to more competitive market. This features the advantages of exporters. The theory provides clarity on the relation between prices, productivity, market shares, and quality. In heterogeneous firms' trade models, if no quality is present, these models predict a negative correlation between prices and productivity. However, if quality is present, and if higher quality indicates higher prices, then the correlation between prices and productivity, and (possibly) between prices and firm size becomes positive. Furthermore, since these models produce a quality sorting along the productivity axis, then the correlation between prices and quality is also positive.

The model is also connected to prior theoretical frameworks. For example, Fan et al. (2018) modified CES utility by allowing positive baseline utility. The derived price is then positively related to the destination market's income. Variable markup is implied by this modification. The slight difference from this model is that quality does not depend on market size. The implications of the model are also consistent with other forms of extensions of Melitz-Ottaviano under quality framework. For example, using slightly different extensions of the MO framework with quality, Bellone et al. (2016) confirms the dominance of the quality-enhancing effect of competition using French firm-level data.

Furthermore, the setting can be extended to multi-product case. For instance, Eckel et al. (2015) discovers that core products have lower costs so that firms have more incentives to invest in upgrading quality in these groups of products. I follow Mayer et al. (2014) and extend the current framework by allowing firms to sell more than one product to a market.[23] The implications are isomorphic to this extension. Under this setup, it is concluded that

[22] These include works using CES framework, for example Gervais (2016), Mandel (2010) and Fan et al. (2015), etc.

[23] Details of setup and derivations are in Appendix A.1.

higher product customization costs lead to a more competitive market. For individual firms, rising market competitiveness exerts a larger effect on quality improvements of products closer to the core.

1.4. Quantification

This section discusses the dataset used in the study and the methodologies to compute relevant parameters. I focus on sectors that are for final consumption, since producers and consumers can have different attitudes towards quality.[24] As there is no sectoral interaction here, I carry out estimations sector by sector. According to the theoretical model, the parameters to be estimated are as follows: 1) preference $\kappa_{i,s}$ and cost $\mu_{i,s}$ for each country i and sector s; 2) cutoffs (endogenous competitiveness) $c_D^{i,s}$ for each country/sector; and 3) cost upper-bound (exogenous competitiveness) $c_M^{i,s}$. Finally, sector s refers to HS 2 product level. As one step in the counterfactual analysis, I perform the quantification under quality model and M.O model.

These are the steps to estimate the model:

Step 1. Given the bilateral trade flow in the data, the bilateral trade cost τ_{ij} can be estimated using aggregate bilateral trade flow in (18).

Step 2. Obtain the residuals from the first step estimation and compute preference for quality κ_i and cost of improving quality μ_i for each country i, using Generalized Method of Moments.

Step 3. With the above set of parameters, the cost cutoff (endogenous competitiveness, c_D^i) of each country is projected using bilateral price in (17).

Step 4. With parameters from the above three steps,the exogenous competitiveness (multiplied by fixed cost f_e) $c_M^i f_e$ can be computed from free entry condition in (15).

1.4.1. Data

The main dataset used here is the BACI world trade database provided by CEPII. The origin of the dataset is COMTRADE of the United Nations Statistical Division. The advantage of BACI data is that it reconciles records of both exporter and importer when there are inconsistencies in the transaction records from both sides (Gaulier and Zignago 2010). Thus, the dataset is more accurate since the reliability of the reported data of both exporter and

[24] Sectors for intermediate use, capital investment and final consumption are recognized by Broad Economic Classification (BEC) conversion.

importer are evaluated and cross-proofed. Another advantage is that the dataset is highly disaggregated: it reports the bilateral trade value and quantity at the HS6 level for more than 5,000 HS6 sectors.

To complement the dataset, I collect bilateral remoteness data to proxy for ice-berg trade cost. The major statistics is from GeoDist data compiled by CEPII. This dataset records bilateral information on distance, and other variables used in gravity equations to identify particular links between two countries. These variables include colonial relation, common languages, the contiguity (Mayer and Zignago 2011). Further, data on bilateral regional trade agreement and bilateral common currency relations are collected from de Sousa. These variables are used to proxy bilateral ice-berg trade cost. Finally, I proxy market size by population and this dataset is from Penn World Table.

I obtain Pareto distribution parameter from a global firm-level database. Here I use Orbis dataset for this purpose. The ORBIS database (compiled by the Bureau van Dijk Electronic Publishing, BvD) is a commercial dataset, which contains administrative data on 130 million firms worldwide. ORBIS is an umbrella product that provides firm-level data covering approximately 100+ countries, both developed and emerging, since 2008. This dataset covers both public and private firms. I access the financial module to obtain firm-level variables. Following Kalemli-Ozcan et al. (2015), I use total asset, employment and material cost (either recorded in the original dataset or imputed by subtracting the total cost of employees from the cost of goods sold) to estimate total factor productivity (TFP) at the firm level. To get k, I regress firm ranking (in TFP) on (computed) firm productivity.[25] This gives $k = 3.38$.

Prior to the empirical studies, some summary statistics for the feature of the data are displayed first. Table 4 reports the number of observations for each HS 2 sector. A small number of observations in one sector indicates that zero trade occur very frequently. It is implied that sectors are heterogeneous in international trade transactions: HS 61 and HS 62 (clothing) has the most observations, followed by HS 85 (machinery/equipment). Table 5 and Table 6 report the number of HS 6 products a country imports (Table 5) or exports (Table 6). From Table 5, the USA imports the highest number of products, followed by Italy, Netherlands and United Kingdom. From Table 6, China and the USA export the highest number of products, followed by Netherlands and Italy and United Kingdom. To some extent, a large exporter can also be a large importer. Finally, it is evident in Table

[25] I use Levinsohn and Petrin (2003) to compute TFP. In the sample of firms, the majority consists of manufacturing.

5 and Table 6 that the distribution of the number of HS 6 products exported/imported is uneven across countries. Some countries import/export fewer than 100 products.

Another stylized fact lies in the *f.o.b* price. Figure (3a) displays the relation between (log of average) *f.o.b* price and (log of) GDP per capita in the destination country for the sector of 020422 (meat sheep or goats; fresh, chilled or frozen). The price to a destination market is the average *f.o.b* price across all source countries exporting to that destination. Figure (3b) presents for the sector of 940169 (Seats). These two sectors are chosen since they have many importing countries. From the graph, it is implied that sectors can be heterogeneous in relation between price and destination market income. Therefore, the 'quality sorting' channel can exist only in a subset of sectors. The finding is to some extent consistent with Manova and Zhang (2012), which reveals that firms charge higher prices in richer destinations within a firm-product category, using Chinese Customs Trade Statistics. It is also consistent with with Kneller and Yu (2016), which uses the same dataset as Manova and Zhang (2012) and finds that quality sorting (competition raise quality and price) exists in a subset of HS 2 industries while some other industries have efficiency sorting (competition lowers price).

1.4.2. Quality Preference and Cost Parameters

I recover quality preference and cost parameters based on the estimation of the gravity equation. According to (18), the bilateral trade flow can be decomposed into origin fixed effects, destination fixed effects, bilateral trade costs and a non-linear function of κ_j and μ_i. Specifically, I estimate the following gravity equation for each HS2 sector s (I suppress sector notation here):

$$\ln r_{ij} = \delta_i + \delta_j - (k+1)\ln \tau_{ij} + \ln\left[1 + (\kappa_j - \mu_i)\rho_{ij}\right] + \ln\left(\frac{1}{k(k+2)} + \frac{(\kappa_j + \mu_i)\rho_{ij}}{k(k+1)(k+2)}\right) \quad (24)$$

where origin fixed effects $\delta_i = \ln(N_i^E \left(c_M^i\right)^{-k})$ and destination fixed effects $\delta_j = \ln\left(L^j \left(c_D^j\right)^{k+2}\right)$. This form is the original Melitz and Ottaviano (2008) gravity equation with additional quality terms. Equation (24) has the advantage of explaining residuals in the original MO model. The ice-berg trade cost is proxied by several bilateral variables, so that the specification of 24 can be re-written as

$$\begin{aligned}\ln r_{ij} = \delta_i + \delta_j + \beta_1 Contig + \beta_2 Comlang + \beta_3 Colony + \beta_4 Comcol + \beta_5 Curcol + \\ \beta_6 Smctry + \beta_7 LnDist + \beta_8 RTA + \beta_9 Comcur + \epsilon_{ij}\end{aligned}$$

In the above specification, $Contig = 1$ if the exporter (i) and the importer (j) are contiguous, and $Contig = 0$ otherwise. $Comlang = 1$ if i and j share common official language, $Colony = 1$ if i and j have ever in colonial relationship, $Comcol = 1$ if i and j have a common colonizer after 1945, $Curcol = 1$ if i and j are currently in colonial relation, $Smctry = 1$ if i and j were the same country. $LnDist$ is the (log) distance between i and j. [26] The data of those variables are from CEPII GeoDist. Additionally, $RTA = 1$ if i and j have reached any trade agreements and $Comcur = 1$ if i and j are in the same currency union. This is from Sousa (2012).

An issue with the ordinary least squares (OLS) is the presence of zero trade as is discussed before. The above gravity equation can be subject to bias due to the existence of zero bilateral trade, which to some extent suggested by Table 4. As is argued by Helpman et al. (2008), disregarding country pairs that do not trade with each other can cause biased estimates on the data. Additionally, it is documented in their empirical study that half of countries do not trade with each other. To address such issue, I use Poisson Pseudo Maximum Likelihood (PPML) proposed by Silva and Tenreyro (2006) by including zero trade flows. The same estimation strategy is also used in Corcos et al. (2011).

Table 7 reports results from PPML estimates for selected sectors. At the first glance, the coefficients are within expectations. Specifically, distance has negative effects on trade flows. Regional trade agreements, common language and colonial relations can have positive effects on bilateral trade. Common currency can have both positive and negative effects. It is noticeable that most other sectors not reported here have similar patterns in terms of trade cost proxies.

Given the estimated equation, I am able to back parameters of quality preferences and costs from the residuals. These parameters are recovered using residuals in specification (24). Although BACI covers more than 200 countries, only 168 of them have data on population in the Penn World Table. Thus, for each HS2 sector, I have at most 336 parameters to recover. There are much more residuals than parameters. Therefore, the system is over-identified and hence I employed a least square procedure to hunt for the optimal solution. [27]

I estimate those parameters for each sector and discovered stylized patterns from them. Table 8 reports the summary statistics of estimates of κ's for each sector; Table 9 reports the summary statistics of μ's. First, a comparison of Table 8 and Table 9 indicates that κ is on

[26] This is the simple distance, which is the distance between the most populated cities of the two countries.

[27] Specifically, the optimal κ and μ satisfy: $[\kappa, \mu] = \frac{1}{N} argmin \sum_{ij} \left[\ln\left[1 + (\kappa_j - \mu_i)\rho_{ij}\right] + \ln\left(\frac{1}{k(k+2)} + \frac{(\kappa_j+\mu_i)\rho_{ij}}{k(k+1)(k+2)}\right) - \epsilon_{ij}\right]^2$, where N is the number of observations of trade flows in each sector.

average larger than μ and tends to be more dispersed than μ. This to some extent implies that (dis) tastes for quality are more heterogeneous among countries than the technology of quality-improving. Second, a closer examination of Table 8 indicates that sectors differ in the dispersion of κ's across countries. For instance, HS 50 (textiles) has relatively small dispersion in κ, while HS 85 (electric motors and generators) has a very high dispersion. Thus, in some sectors countries tend to be homogeneous in preferences, while in other sectors countries can be divergent.

Table 10 attempts to explore the relation between the parameters and GDP per capita. Illustrations of the positive relation for 40 sectors are in the two panels of Figure 4. [28]. Table 10 presents coefficients in regressing estimated κ on GDP per capita for 63 HS 2 sectors. It is evident that the positive correlation between κ and GDP per capita exists in a subset of industries, while in other sectors insignificant effects exist. Comparing with Table 8, it is implied that sectors with medium level of dispersion tend to have κ correlated with GDP per capita. One caveat is that the formation of quality preferences κ is exogenous to the model. This differentiate with Feenstra and Romalis (2014) where quality preferences are modeled as endogenous to income. According non-homothetic preferences setup in Fajgelbaum and Khandelwal (2016), quality preference of a country can also depend on income inequality inside the country. In sum, consumer preferences result from multiple socio-economic conditions and it is out of the scope of the this paper.

In addition, I also examine the correlation between cost of quality and country income. Table 11 reports coefficients on GDP per capita in regressing μ on GDP per capita. Compared with Table 10, significant effects appear in fewer sectors. In addition, 3 of these sectors exhibit negative and significant results. The correlation between the marginal cost and income is less explicit compared with preferences. The explanation for this has two sides: the positive association can be accommodated by the fact that richer countries have higher labor cost while the negative association can be explained by that richer countries have a comparative advantage in producing higher quality goods since the demand for higher-quality is larger.

1.4.3. Endogenous and Exogenous Competitiveness

After parameters of preferences and cost of quality are estimated in the last subsection, the cost cutoff for each country is computed using the parameters estimated in the last step. Specifically, I use average bilateral $f.o.b$ price in (17), the calculated trade cost and κ_j (and

[28] Consistent with Table 10, I illustrate those sectors where GDP per capita has positive and significant effect on κ

μ_i) to back out the cost threshold for each country. However, it is worth noting that price calculated using value divided by quantity is noisy even though units are converted to tons. This potentially results in multiple cost cutoffs for one country in one sector. Thus, I modify (17) by allowing noisy terms. To account for this, I regress price on trade costs, nonlinear terms of κ /μ and destination country fixed effects, as in the following specification:

$$\ln p_{ij} = cons + \ln\left[\frac{2k+1}{k+1} + \frac{1}{k+1}\left(\kappa_j + \mu_i\right)\rho_{ij}\right] - \beta_1 \ln \tau_{ij} + \psi_j + \epsilon_{ij} \tag{25}$$

In (25), the exponential of the coefficients on each of the destination fixed effects are the cost cutoffs. [29] This corresponds to the endogenous competitiveness in Corcos et al. (2011).[30]

With the cutoffs obtained from the empirical implementations, I back out cost upper bounds (exogenous competitiveness) c_M^i (multiplied by f_e) for each country i in each sector s. For this set of parameters, I use Equation (16) to back out exogenous competitiveness for each country/sector $((c_M^i)^k f_e)$ by the following relation:

$$f_e * c_M^k = \frac{B * L * c_D^{k+2}}{2\gamma(k+1)(k+2)}$$

where c_M^k is the vector of $(c_M^i)^k$ and c_D^{k+2} is the vector of $(c_D^i)^{k+2}$, which is estimated as in Equation (25). Matrix B is defined in the prior subsection. I also implement above two steps under M.O by eliminating all quality components in the relevant equations. Table 12a and Table 12b report results as summaries in estimations of exogenous competitiveness across sectors.

Exogenous competitiveness displays several characteristics. First, the levels of these statistics vary to a large extent across sectors. For example, for HS 50, the figures are in 10^{12}, while in other sectors the mean is below one. The cause in the large variation across sectors can be attributed to the different degrees of variations in the multiplication $[1 + (\kappa_j - \mu_i)\rho_{ij}]$ for different sectors.[31] The different degrees of variation results from the dispersion differences in κ and μ across sectors, which are analyzed in the prior subsection. Comparing with preference for quality, sectors having a large variation in κ can also have large variations in c_M^k. Another explanation could be that the sunk cost f_e vary across industries.

[29] This follows from Allen and Atkin (2016), where preference parameters in that paper is recovered from good-level fixed effects.

[30] In Corcos et al. (2011), the cost cutoffs are computed using price index of countries in each sector. The practice is infeasible here due to data coverage issues.

[31] I perform the similar estimation of c_M^k following multi-country version of Melitz and Ottaviano (2008), typically, the means and standard deviations are smaller for almost all sectors.

The similar estimation strategy is also implemented without quality considerations. This follows from multi-country Melitz and Ottaviano (2008) and Corcos et al. (2011). Subsequently, I compute c_D^{k+2} implied by the two models. The purpose of this practice is to compare the predicted endogenous competitiveness of the two models. Table 13 and Table 14 summarize cutoffs computed from the two different models across sectors. Illustrations of the distribution of cutoffs implied by both models for all sectors are displayed in the two panels of Figure 5. In comparison with the two models, several implications arise. Firstly, for most sectors, the levels of cutoffs are on the same scale: the means in cutoffs do not significant differ from each other. Second, for most sectors, the distribution of cutoffs are more dispersed under quality model than under the MO model: the variances in Table 13 is larger and for most sectors, cutoffs under quality sorting have higher maximum values and smaller minimum values. Those comparisons suggest that adding quality sorting enlarges the inequality among countries in competitiveness.

To further compare the two models, I summarize the differences in the predictions in cutoffs across countries for each sector. Figure 6 displays the kernel density of prediction differences across countries of various sectors. For most industries, the majority of differences lie around zero. The distribution in differences vary across sectors, which is observed from the skewness. For sectors such as HS 2 and HS 3, the difference distributions are nearly normal so the probability of overestimation and underestimation are nearly equal. Right skewness occurs in sectors such as HS 74 and HS 82, indicating that quality model over-predicts more than it under-predicts. Left skewness happens in sectors such as HS 4 and HS 10 so that more under-estimates of quality model exist in these sectors. In general, within most sectors, predictive differences between the two models do not deviate to a large extent from zero.

1.5. Counterfactual Scenario

Having estimated the model, one can use it to simulate the effects of trade frictions/liberalizations. This is achieved by recomputing for each sector the (quality-adjusted) trade freeness matrix B while keeping the exogenous competitiveness, shape parameters and preference/costs for quality parameters constant. The resulting matrix is then used to compute new endogenous competitiveness. Specifically, the following statistic is to be computed:

$$\hat{c}_D^j = \frac{c_D^{\prime j}}{c_D^j} - 1$$

where $c_D^{'j}$ is the cutoff after trade liberalization. I estimated the above statistics under both this model and the M.O model and compare the differences between the two models to discover the underlying regularities leading to the differences.

Furthermore, I also experiment with preference and technological shocks. The purpose of the counterfactual is to explore the effect of preferences or technological progress (in improving quality) on endogenous competitiveness across countries and sectors. This practice is infeasible under the framework of Melitz and Ottaviano (2008) or other efficiency-based settings to the best of my knowledge. Thus, it is a significant contribution of this model.

1.5.1. International Trade Costs

The first exercise is to examine the effect of bilateral trade cost changes. I would like to examine the change in cutoffs across countries and sectors. I simulate a 5% increase in international trade cost while keeping intra-national trade costs constant. This counterfactual analysis is to examine the effect of protectionism on the endogenous competitiveness. This counterfactual analysis is relevant since the temptation of protectionism in the past decade has been large and increasing for a large number of policy makers. Thus there is possibility of introducing new external tariffs or other types of trade barriers.

As is noted above, I focus on two aspects: the changes in cutoffs and the differences in predictions implied by the two models. Table 15 summarizes the mean, standard deviation, minimum and maximum in the changes of cutoffs. Table 16 reports those statistics implied by Melitz and Ottaviano (2008). It is worth noting that in almost all sectors here, an increase in international trade cost (while keeping intra-national trade cost constant) can lead to a decrease in cost cutoff for some countries, regardless of the models. This decline in cutoff (or rise in the endogenous competitiveness) is justified by the rising entry of local producers since the relative cost of intra-national trade is cheaper than international costs. In the two-country case, consider that in MO with two countries, the cutoff is computed as

$$c_D^{i,k+2} = \tfrac{\gamma\phi}{L^i}\tfrac{1-\omega^j}{1-\omega^i\omega^j}$$

where $\omega_i = \tau_{ji}^{-k}$ and indicates the freeness of trade. If the both ω^j and ω^i increase, the change in cutoff is then

$$\Delta c_D^{i,k+2} = \frac{\gamma\phi}{L^i}\left(1-\omega^i\omega^j\right)^{-2}\left[(1-\omega^j)\omega^j\Delta\omega^i - (1-\omega^i)\Delta\omega^j\right]] \tag{26}$$

so that the direction of change in cutoff depends on the magnitudes of ω^i, ω^j and the degrees in the changes of both. Under the current model, ω^i and ω^j can be higher than 1, since in this model it is replaced with $\left[1+\left(\kappa_j-\mu_i\right)\rho_{ij}\right]\tau_{ij}^{-k}$ and thus the sign of Δc_D^{k+2} can be negative when $\Delta\omega^j$ and $\Delta\omega^i$ are negative.

Nonetheless, the aggregate cutoffs increase, for both models. A closer examination of the two sets of results implies the following regularities. First, the mean changes are all positive for both models, with the changes implied by the quality models higher than the MO model for most sectors. This difference can be partially driven by the higher maximum value in Table 15 (for most sectors). Second, and related to the prior section, the variance of changes is larger under this model. This is connected with the prior section in that variance under this model is higher than under Melitz and Ottaviano (2008) with additional quality components. Finally, under both models, the maximum of the change is larger than 1 for all sectors. Thus, the magnitude of effect on endogenous competitiveness is larger than the degree of trade cost rise.

Finally, it is worth exploring the underlying forces driving these changes. The focal points lie in whether such difference is systematic across countries in some (or all) sectors. If such regularities exist, then one can argue that these changes are not randomly driven. For all sectors, I attempt to correlate with quality preference of each country.[32] In the two panels of Figure 7, I tried to plot the (log) quality preferences with the prediction differences (changes predicted by this model minus changes predicted by MO).[33] All else being equal, the higher the quality preference of the country, the larger the predicted difference between the current model and MO model. This result indicates that in models with quality preference differentials across countries, the disparity in terms of loss from higher trade barriers is larger than in models without quality considerations. This implication is to some extent consistent with simulations on the market size by Antoniades (2015), in which it is shown that larger market size results in larger cutoff decrease in countries with higher quality preferences.

1.5.2. Preference/Cost Changes

The second counterfactual exercise is to examine the effect of a universal preference or technology shocks on endogenous competitiveness. This analysis is infeasible under models

[32] I also attempt to link them with cost of quality of each country. However, no systematic regularities are found.

[33] I find similar patterns in the following sectors: HS2, HS4, HS7, HS8, HS9, HS11, HS15, HS16, HS17, HS18, HS19, HS35, HS36, HS38, HS39, HS52, HS58, HS63, HS64, HS65, HS69, HS73, HS76, HS81, HS86, HS95 and HS96.

of MO or other models based on the efficiency sorting of heterogeneous firms in international trade. It is perceived to be relevant since consumers' preferences are changing over time. Although quality preferences are exogenous to this model, they can be altered in several ways. An increase in quality preference can result from higher expectations of consumers for the products they purchase. For instance, in food industry, food safety issues motivate more consumers to pursue organic food, which is perceived to be high-quality, thus raising the willingness-to-pay (Grunert 2005). The pervasiveness of advertisements and other multi-media can also shape consumers' preference for high quality products. Apart from that technology progress drives down the cost of quality updates.

Essentially, the two changes are consistent. As is shown in the model, higher preference and lower marginal cost in quality raise the scope for quality differentiation. Therefore, I combine the two exercises by adding/ subtracting 0.1 units in either κ_j/ μ_i in computing ρ_{ij}. All else being equal, individual producers entering each market raise product quality and charge higher prices. If other conditions remain unchanged, resulting cost cutoffs are lowered. In the long run, a trade diversion effect can occur in that a subset of countries can experience a rise in their cost cutoffs. This arises since the cutoff of each country depends on both its own κ (and μ) and others' κ (μ). This can be explained in detail in Equation (26) if one replaces ω_i with $[1 + (\kappa_i - \mu_j)\, \rho_{ji}]\, \tau_{ji}^{-k}$. Therefore, the direction of change in cutoffs depends on the magnitudes of κ and μ across countries.

As is expected, trade diversion occurs in a few countries. Table 17a and 17b summarize the percentage changes in cost cutoffs across countries. Figure 8 visualizes the changes using the world map. I compute the weighted cutoff changes for each country. The weight is calculated as an industry's share of total value of imports of a country. Although the majority experience rising market competitiveness revealed in declining cost cutoffs, 25 of them have the opposite change. Overall, the magnitude of increase in cost cutoffs is lower than decrease: the decrease in cost cutoffs ranges from around 500% to around 0.6%. Thus positive preference or technology shocks brings more positive effects on productivity improving globally. A further plot in Figure 8 reveals that the more than half of the countries have their declines in cutoffs falling less than 141.2%. The change in endogenous competitiveness falling in the range of $[-141.2, 0.58]$ occupies the most area.

Large countries generally gain more than small economies. This can be supported from the optimal quality choice in (9). Loss in utility which is revealed from rise in cost cutoff occur mostly in small economies. The justification of this observation can be that small economies have smaller scopes for quality differentiation, thus firms have less incentive to sell high-quality goods. Faced with the same degree of preference rise, firms are diverted to sell higher-quality goods to larger markets. I prove that by regressing gains from trade on their (log) population and other country level controls in Table (18). They reveal negative relationship between the change in cost cutoffs and population size. This exercise implies that market size is negative associated with changes in cost cutoff, i.e., positively related to changes in productivity and welfare gains. On average, 1% rise in population size leads to 7.876% more gains in productivity. However, one caveat is that the aggregate gain in productivity is affected by other factors such as compositions of imports of a country.

1.6. Conclusion

This paper extends a theory on quality with endogenous markups. Theoretical framework is of multi-country type, which is a generalization of two-country model commonly used in Melitz and Ottaviano framework. Different from competition on cost, the theory identifies that in some sectors and countries, firms can also compete on quality. Tough competition featured by larger market, lower trade cost and higher preference for quality are more likely to induce firms to improve quality. The selection effect is larger when quality differentiation scope is wide.

Empirical study is undertaken to compare this theory with efficiency framework. Structural estimation is used to identify relevant parameters. These parameters are later used to compute cutoffs and average prices under quality competition. The same steps are used to compute counterparts under efficiency competition. The structural estimation implies that considering quality differentials among countries enlarges heterogeneities in competitiveness. The counterfactual study points out that in most sectors, the higher the quality preference of a country, the larger the loss from rising trade barrier, compared with Melitz and Ottaviano. Finally, positive universal preference shocks generally bring more gains to larger countries.

Though the paper addresses the importance of considering quality preference differentials across countries, it still has insufficiencies in investigating this issue. This study can be extended to examine the spatial distribution in quality preferences and technologies, using more disaggregated data, such as China Customs Trade Statistics and China Inter-Provincial Input-Output Statistics. Furthermore, one can compare the impacts of international and intra-national trade costs on competitiveness of different regions in China, under both the current model and Melitz-Ottaviano model.

2. Informal Institutions and Comparative Advantage of South-Based MNEs: Theory and Evidence

2.1. Introduction

The accumulated knowledge of the FDI literature (see for example the survey by Helpman, 2006) has provided us a good understanding of the incentives and constraints of multinational enterprises (MNEs) in their choices (of organizational forms and production locations) in response to their own firm characteristics, the nature of the industry, and the country where they operate from. In these existing theoretical frameworks, MNEs are often theorized to be based in the North. This supposition, although understandable given the North MNEs' leading edge in R&D and technology, is increasingly incongruent with the facts. In 2006–2010, 17% of the world FDI outflows originate from the South (Dixit 2012). At the same time, the share of FDI inflows from the developing country received by their peer South is disproportionately large at 36% in 2000 (Dilek and Dilip 2004). By 2013, FDI from the developing country (including transition economies) has accounted for 39% of global FDI outflows (UNCTAD 2014). It is thus important that theoretical framework be developed to formalize the comparative advantage of South-based MNEs. This paper makes one such contribution.[34]

It has been suggested by a lecture of Dixit (2012) that similarly poor governance endowments may be a source of comparative advantage for South-based MNEs when investing in developing countries. Several empirical studies such as Darby et al. (2009), Cuervo-Cazurra (2008), Bénassy-Quéré et al. (2007) and Habib and Zurawicki (2002) have found patterns consistent with this hypothesis.[35] In these studies, 'experiences', 'skills' and 'abilities' of

[34]In the general framework of Arkolakis et al. (2018), it is possible to have MNEs originating from all countries. However, because the pattern of multinational production (MP) is determined in large part by the efficiency parameters T_{il} characterizing the productivity of firms originating from i conducting MP production in country l, the framework implies a dominance of MNEs based in the North given their technology superiority.

[35]Darby et al. (2009) found that South MNEs are less (or not at all) deterred by bad institutional quality in the host country than North MNE, based on bilateral FDI count data (on the number of MNEs from a country of origin present in a destination country). Cuervo-Cazurra (2008) measured the proportion of developing-country MNEs among the largest foreign firms in each of 50 LDCs and found that developing-country MNEs are more prevalent in LDCs with poorer regulatory quality and lower control of corruption (although this negative relationship does not apply to all aspects of institutional quality, e.g., rule of law). Bénassy-Quéré et al. (2007), using a gravity model for bilateral FDI from OECD countries to the other countries, found that good institutions in the home country have no or even negative impact on outward FDI, and institutional distance has often a negative impact on bilateral FDI. Last but not least, Habib and

firms based in the South 'to manage under difficult conditions' and their 'familiarity' with the norms in the host country are often cited as the potential explanations. Exactly how these comparative advantages arise endogenously is, however, less than fully understood, because often the relative cost advantages of the North and the South MNEs have been assumed rather than derived.

In this paper, we propose a theoretical model to micro-found the cost structure of firms, given their endogenous response to the state institutions of the country in which they are based and where their production facilities might be. Firms' optimal choice of FDI location, sourcing decision (FDI or domestic production), and production decision (produce or not) are fully characterized, in a vertical-FDI model with many countries, industries, and heterogeneous firms. The main hypothesis predicts an institutional assortative matching in the state institutional qualities of FDI origins and destinations, all else being equal.

The theory is built on the fundamental assumption that the fixed operating cost of firms increases with poorer state institutions, but decreases with firms' own investment in informal in- stitutions, and the investment in informal institutions is more effective in reducing overhead cost in environments of poorer formal institutions. As an endogenous outcome, when and where the formal institutions are weaker, the private sector tends to build more informal institutions to sub- stitute the former. Evidence abounds in the literature that documents the endogenous response of the private sector to the formal institutions the state provides. For the purpose of exposition, we may categorize them as economic, legal, or political informal institutions. First, where the market- supporting institutions such as contract enforcement and bank credit are lacking, firms tend to fill in the void with relational contracting and trade credit. These patterns are documented for example by McMillan and Woodruff (1999) for Russia, China, Poland and Vietnam. John McMillan and Christopher Woodruff (1999) provide detailed accounts of how these informal economic institutions work in Vietnam under reputation incentives and threat of community sanction. A similar argument is suggested by Acemoglu and Johnson (2005) that reputation-based mechanisms can, at least in part, alleviate the problems originating from weak contracting institutions.

Second, where the state legal institution is weak, the private sector tends to turn to informal legal institutions such as private patrols, private protection agencies or informal courts to substitute for police protection and judicial systems (Hay and Shleifer 1998). For

Zurawicki (2002) focused on corruption and observed that the distance in the corruption level between the home and host countries reduce bilateral FDI flows.

example, Frye and Zhuravskaya (2000) find that higher levels of regulation and weak legal institutions are associated with a higher probability of contact with a private protection organization in Russia.

Finally (and perhaps the most controversial of the three given its many faceted implications), where the state's bureaucratic system is inefficient and regulatory quality poor, firms tend to build political connection, for example, Fisman (2001) and Faccio (2006), with politicians and government officials, or directly participate in politics. Political connection may help firms reduce regulatory burden (e.g., fewer days to obtain business permit, fewer agencies to register or fewer on-site inspections) but also secure property rights (e.g., lower expropriation via tax or fines) and enforce contracts. For example,Li et al. (2006) found that in China, the probability of entrepreneurs entering politics decreases by 8–20% when the institutional index in a region improves by one standard deviation. J.P.Chen et al. (2011) similarly show that firms are more likely to establish political connections in regions in which the government has more discretion in allocating economic resources. Song (2014) provide a vivid account of how in the aluminum and auto industries, Chinese local governments may have a large leverage in providing public goods (such as land and capital) to their cronies and alter the terms of competition in the market. In general, firms may engage in all three types of informal institutional building (economic, legal or political). For example, Cai et al. (2011) infer that the entertainment and travel costs expenditures of Chinese firms consist of grease money to obtain better government services, protection money to lower tax rates, and also business expenditures to build relational capital with suppliers and clients.

The term informal institution has been used in the literature to refer to many things ranging from customs, traditions, norms, religion (Williamson 2000), social capital, trust (Chan et al., 2015) to culture. Here, we adopt the definition of Helmke and Levitsky (2004) that distinguishes informal institution from informal behavioral regularities, shared values and the broader concept of culture. Specifically, informal institutions are defined as socially shared rules, usually unwritten, that are created, communicated, and enforced outside of officially sanctioned channels.

This paper proceeds to show that in spite of the endogenous choice of heavier investment in informal institutions that combat the fixed operating cost, firms based in the South still have an absolute disadvantage than their peer in the North because the state institution's first-order effect dominates. Nonetheless, they have a comparative advantage in conducting FDI in countries of poorer institutional qualities, because their heavier investment in informal institution plays a more important role in FDI destinations of poorer state institutions. Thus, a MNE from a country of poorer state institutions than another MNE will tend more likely to invest in a destination of poorer state institutions than the other MNE's choice of destination, all else being equal.

The paper also derives the implications on the volume of bilateral FDI flows at the country level, given the firm-level choice of FDI destination, by aggregating the FDI activities across sectors (of different market sizes) and across firms (of heterogeneous productivity levels). The model generates the endogenous presence of zero FDI for some country pairs. Conditional on positive bilateral FDI flows, complementarity in institutions (of FDI origins and destinations) continues to hold at the intensive margin: multinational firms tend to generate more net profits in countries of poorer institutional qualities, the poorer the institutional environment at home. At the extensive margin, subject to qualifying conditions, more multinational firms tend to conduct FDI in countries of poorer institutional qualities, the poorer the institutional environment at home.

The empirical studies cited earlier have presented evidence (at least in part) supporting the above hypothesis. They are however limited in the following ways. First, institutional distance is often used as a control variable in this empirical literature (except Darby et al. (2009)). In contrast, the current theory suggests that it is the sorting in institutional qualities that matters, and hence, a more appropriate control is the interaction of the institutional qualities of the FDI origin and destination. Second, the countries included in these studies are often restricted to the least developed countries as the host country (Cuervo-Cazurra 2008) or developed countries as the home country (Bénassy-Quéré et al. 2007). Third, when the country coverage is comprehensive, it is often at the cost of using the FDI count data (ie, the number or percentage of firms; Darby et al. (2009)) instead of the FDI flows/stocks (that incorporate the intensive margin in addition to the extensive margin). To provide a direct and comprehensive test of the proposed hypothesis, this paper assembles a panel dataset of bilateral FDI stocks (and flows) for 219 economies in years 2001–2010 based on the UNCTAD's Bilateral FDI Statistics. This extends the country coverage to include almost all economies in the world, which allows us to examine the behavior of FDI flows from (to) the whole spectrum of countries in terms of institutional qualities. The state institutional quality is measured by the World Bank's Worldwide Governance Indicators commonly used in the literature. To test the theory's main prediction of a positive assortative matching pattern in institutions, bilateral FDI activities are regressed on the level and the interaction of the institutional quality indicators of the home and host countries. An extensive set of gravity variables (to proxy for communication and transaction costs of FDI) are also included, in addition to home and host country characteristics (such as GDPs, GDPs per capita, and general production cost levels) and variables suggested by competing hypotheses of FDI. In particular, since income levels and institutional qualities are correlated, the difference in GDPs per capita between the home and host countries is included to control for the Linder effect on FDI as proposed by Fajgelbaum et al. (2014). Overall, the paper finds support for the theory's prediction. The coefficient on the institutional interaction term is positive and significant, and the conclusion is robust to the FDI series used (inward or outward, stocks or flows), the measures of institutional quality, the estimation specifications, and the inclusion of zero FDI observations.

We provide further evidence on the theory's prediction at the firm level using the fDi Markets dataset on worldwide firm-level greenfield FDI during 2009–2016, which was merged with the Orbis financial dataset on private companies to obtain parent firms' key performance measures (and to estimate their productivity levels). For the period 2009–2016, there are 35,039 unique firms from 168 origin countries that conduct greenfield FDI in 200 destination countries. Each observation refers to an incident of greenfield foreign capital investment in a sector and year by a firm reported by fDi Markets, and the corresponding characteristics of the investing firm, origin and destination countries. We regress capital investment on the interaction of the institutional quality indicators of the home and host countries, on firm productivity and its interaction with destination institutional quality, on firm R&D intensity and its interaction with destination institutional quality, and the same set of gravity variables as the country-level analysis. An extensive set of fixed effects (origin- year, destination-year, destination-sector) are also controlled for.

We continue to find a positive and significant coefficient on the interaction term of the origin and destination institutional qualities. This provides the firm-level evidence for the institutional complementarity effect. In addition, more productive firms tend to invest more in countries of poorer state institutions, which is consistent with the theory's prediction (as these firms with larger market shares have stronger incentives to locate production in countries of lower wages, and they are able to afford the higher fixed cost associated with larger investment in informal institution in such countries). On the other hand, firms of higher R&D intensity (and technology sophisticatedness) makes less FDI, but such negative effects are moderated by better destination institutions. This is consistent with the quality-control theory of Chang and Lu (2012), where the risk of quality-control failure in cross-border production arrangement discourages high-technology firms from locating their production in countries of weaker technology capacity or institutional support.

Singapore often ranks among the top in terms of good governance. For example, in 2012, it clinched the 1st in terms of GE and RQ, the 4th in CC, and the 5th in RL. Thus, when its government undertook to jointly develop the China-Singapore Suzhou Industrial Park (SIP) with the Chinese government in 1994, by transplanting its Singapore-style institutions overseas in the Chinese land of cheap labor, it was greeted by the investor community with great enthusiasm. Take a few examples from Pereira (2002):

We are a Western multinational company. We operate entirely above board. We don't like hidden costs and personal benefits in business. We came on the basis that there would be a Singaporean system here. We can justify every single entry honestly in our account books. (Manager, European company, male, Germany citizen, aged 40-50)

Things here [at the SIP] are very straightforward. All the rules are clear, all the personnel are very professional, and the estate is very modern. So this has allowed our company to focus on doing business rather than worry about all the other aspects. (Manager, US company, male, Singapore citizen, aged 30-40)

Few expected that the joint venture would soon 'sour' in 2001. There are no typical barriers in terms of language, ethnicity, or cultural origins. As the Singaporean leaders later reflected, the Singapore government misjudged the importance of relationship with local authorities. In particular, it underestimated the extent of latitude that the Chinese local officials had versus Beijing in altering the terms of competition (Pereira 2002). The quotations cited above and the overall incident bring home the point that institutional endowments of an investor (what it is endowed with in formal institutions and what it develops in informal institutions) play a non-negligible role in the operation and the outcome of FDI.

The rest of the paper is organized as follows. Section 2 develops the theoretical model and predictions. Sections 3 and 4 present the country-level and firm-level evidence, and Section 5 concludes.

2.2. Model

This model is designed to highlight the mechanism of institution on FDI activities, and to keep the model tractable, we intentionally drop many other mechanisms that the previous literature has shown to be important. Thus, it is not a quantitative FDI model suitable for calibration. Rather, the theoretical prediction in this section will be tested as a 'partial' effect of institution on FDI in the empirical section (after controlling for other relevant determinants of FDI). We discuss possible extensions of the current framework to incorporate these other elements of interest in Section 2.5. For recent developments in quantitative FDI models, see for example, Garetto (2013), Ramondo and Rodríguez-Clare (2013), Irarrazabal et al. (2013) and Arkolakis et al. (2018).

Suppose there are a continuum of countries indexed by $r \in R$, where r is an inverse measure of the quality of formal institutions. The larger r is, the poorer the institution of the country. There are a continuum of sectors indexed by j producing differentiated goods, and one sector producing homogeneous good (used as the numeraire). The only factor of production is labor, and the homogeneous good is produced with constant unit labor requirement. We abstract away from any kind of trade frictions (and thus the incentives of horizontal FDI driven by market access). This implies that there is a single world market for goods. Labor endowment is assumed to be large enough in each country such that the homogeneous good is always produced. As a result, a country's labor productivity in the numeraire good determines its wage rate w. Countries with better formal institutions are assumed to have higher labor productivity in the numeraire good and hence a higher wage: $w = \omega(r)$ and $\omega'(r) \equiv d\omega(r)/dr < 0$.

Each variety of the differentiated goods requires a headquarter service component and a manu- factured component using a Cobb-Doublas production function (Antràs and Helpman 2004), where each component has a unit labor requirement equal to one. This implies a unit cost of production equal to $= w_h^{\eta} w_d^{1-\eta}/\varphi$, where φ indexes the productivity of the firm producing the variety, η denotes the headquarter intensity in the production, and w_h and w_d corresponds to the wage rate of the country where the headquarter and the manufacturing facility of the firm are located, respectively.

The world is populated by a unit measure of consumers with identical preferences: $U = x_0 + \frac{1}{\mu}\int X_j^{\mu} dj$, $0 < \mu < 1$, where x_0 indicates the consumption of the numeraire good, and X_j a CES function over all available varieties $x_j(i)$ in sector j with an elasticity of substitution σ. We drop the sector index j for the time being to simplify the notation until Section 2.4. Given monopolistic competition, the CES preferences imply the standard pricing and profit function. Each firm charges a constant markup over its marginal cost of production $p(c) = \frac{\sigma}{\sigma-1}c$, sells a quantity of $x(p(c)) = X_j^{\sigma(\mu-1)+1} p(c) - \sigma$ and earns a variable profit:

$$\pi = (p(c) - c)\, x(p(c)) = B\tilde{\phi}\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} \tag{27}$$

where $B \equiv \frac{1}{\sigma} X_j^{\sigma(\mu-1)+1}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}$ can be taken as an index of the world market size for the sector (exogenous from the point of view of the individual firm) and $\tilde{\phi} \equiv \varphi^{\sigma-1}$a transformed index of the firm productivity level.

2.2.1. Choice of Informal Institution

A firm given its productivity level chooses whether to produce or not. If it chooses to produce both components at home, it incurs a fixed overhead cost $f(r_h, I)$, which depends on: i) the quality of the formal institution where the firm is headquartered and, ii) the informal institution I that the firm invests in. If it chooses to produce the manufactured component in a country different from where it is headquartered, it incurs an additional overhead cost $f(r_d, I)$, which depends on the quality of the formal institution in the country where the production facility is located, and similarly, its choice of informal institutional investment.

The fixed overhead cost is assumed to depend on the formal and informal institutions as follows. First, it is assumed that $f(r, I)$ strictly increases in r: $f_r \equiv \partial f(r, I)/\partial r > 0$. That is, worse formal institution increases the fixed overhead cost. Next, $f(r, I)$ strictly decreases in I: $f_I(r, I) \equiv \partial f(r, I)/\partial I < 0$, i.e., firm-specific informal institution helps reduce the fixed overhead cost. Finally, it is assumed that

$$\frac{\partial}{\partial r}\left(\frac{\partial f(r, I)}{\partial I}\right) < 0 \tag{28}$$

that is, informal institution is more effective in reducing the fixed overhead cost in environments of poorer formal institutions.

The investment in informal institution is assumed to be a common good within the boundary of the firm: it can be used at home or in the country where its production facility is located. Investing in informal institution, however, costs the firm $k(I)$, which is assumed to be increasing and convex in I.

A firm chooses $I*$ that minimizes $F(r_h, I) \equiv f(r_h, I) + k(I)$ if it chooses local production. Alternatively, the firm chooses $I_{FDI,*}$ that minimizes $F^{FDI}(r_h, r_d, I) \equiv f(r_h, I) + f(r_d, I) + k(I)$ if it chooses to undertake FDI. Define $F * (r_h) \equiv f(r_h, I * (r_h)) + k(I * (r_h))$ and $F^{FDI,*}(r_h, r_d) \equiv f(r_h, I^{FDI,*}(r_h, r_d)) + f(r_d, I^{FDI,*}(r_h, r_d)) + k(I_{FDI,*}(r_h, r_d))$; i.e., they are the respective minimal fixed cost of local production and FDI. We could characterize the choice and impacts of informal institutions as follows:

Proposition 4. *(i) The investment in informal institution will be higher for firms engaging in multinational production than for firms engaging only in local production:* $I^{FDI,*}(r_h, r_d) >$

$I*(r_h)$; (ii) The total fixed cost of production will be higher for multinational production than for local production: $F^{FDI,*}(r_h, r_d) > F*(r_h)$; (iii) The total fixed cost of multinational production will be higher in FDI destination of poorer institutions: $dF^{FDI,*}(r_h, r_d)/dr_d > 0$; (iv) For a given FDI destination, the total fixed cost of multinational production will be higher for MNEs based in countries of poorer institutions: $dF^{FDI,*}/dr_h > 0$.

Proof. (i) $\frac{\partial F^{FDI}}{\partial I}|_{I=I*} = \frac{\partial f(r_h,I*)}{\partial I} + \frac{f(r_d,I*)}{\partial I} + k'(I) = \frac{\partial f(r_d,I*)}{\partial I} < 0$, where the second equality follows by the FOC condition for $I*$: $\frac{\partial f(r_h,I*)}{\partial I} + k'(I*) = 0$ and the last inequality follows by the assumption that $f(r, I)$ strictly decreases in I. This implies that $I^{FDI,*} > I*$. (ii) We can write $F^{FDI,*} - F* = \{F^{FDI,*} - F(r_h, I^{FDI,*})\} + \{F(r_h, I^{FDI,*}) - F*\} > 0$. The inequality holds since $F^{FDI,*} - F(r_h, I^{FDI,*}) = f(r_d, I^{FDI,*}) > 0$ by the setup, and $F(r_h, I^{FDI,*}) - F* > 0$ by the definition of $F*$ and the fact that $I^{FDI,*} \neq I*$. (iii) By the evelope theorem, we have

$$\frac{dF^{FDI,*}}{dr_d} = \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d} + \frac{\partial F^{FDI}(r_h, r_d, I^{FDI,*})}{\partial I}\frac{\partial I^{FDI,*}}{\partial r_d} > 0 \qquad (29)$$

where the sign follows by the assumption that $f(r, I)$ strictly increases in r and by the FOC for $I^{FDI,*}$ such that $\frac{\partial F^{FDI}(r_h,r_d,I^{FDI,*})}{\partial I} = 0$. (iv) The proof is similar to (iii), by replacing r_d with r_h. QED

The predictions in Proposition 4 are derived under the endogenous choice of I by firms and yet they are consistent with many typical assumptions (observations) often made in the FDI literature. First, note that firms will have a stronger incentive to invest in informal institutions when they engage in multinational production than if they produce only locally, because in the former case, the informal institution can be used to help lower the overhead cost of both the headquarter operation at home and the production abroad. This prediction is in line with the fact that larger firms tend to be more politically connected or politically active (Hellman et al. (2003); Faccio (2006); Li et al. (2006); J.P.Chen et al. (2011)), because MNEs also tend to be larger in size than domestic firms. Second, multinational production sets a higher threshold than local production in terms of fixed costs. This helps explain the typical sorting of MNEs and local firms in terms of productivity. Third, poor state institutions discourage inward FDI by raising the total fixed cost of multinational production ($dF^{FDI,*}/dr_d > 0$). This is in spite of the fact that firms endogenously undertake heavier investment in informal institutions should they choose such locations. Thus, the direct effect of weak state institutions still dominates the countervailing effect of self-remedy. Finally, poor state institutions also impose an absolute disadvantage on firms based in the South;

they incur a higher total fixed cost of multinational production than firms based in the North given the same choice of FDI destination ($dF^{FDI,*}/dr_h > 0$). This helps explain in part the dominance of MNEs from the North.

Proposition 5. *Multinational firms headquartered in countries of poorer institutions will invest more in informal institution:* $\frac{\partial I^{FDI,*}(r_h,r_d)}{\partial r_h} > 0$. *As a corollary, multinational firms headquartered in countries of poorer institutions will be more effective at reducing its overhead fixed cost at a given FDI destination:* $\frac{df(r_d,I^{FDI,*})}{dr_h} < 0$.

Proof. Let $f_{II}(r,I) \equiv \frac{\alpha^2 f(r,I)}{\partial I^2}$. The FOC for $I^{FDI,*}$ requires that at $I^{FDI,*}$,

$$f_I(r_h, I) + f_I(r_d, I) + k'(I) = 0 \tag{30}$$

Take total differentiation of (30) with respect to r_h and $I^{FDI,*}$, we have

$\frac{\partial I^{FDI,*}}{\partial r_h} = -\frac{\frac{\partial f_I(r_h,I)}{\partial r_h}}{f_{II}(r_h,I)+f_{II}(r_d,I)+k''(I)} > 0$

at $I^{FDI,*}$, by the SOC for the $I^{FDI,*}$, and the assumption in (28).[36] As a corollary,

$\frac{df(r_d,I^{FDI,*})}{dr_h} = f_I(r_d, I^{FDI,*})\frac{\partial I^{FDI,*}}{\partial r_h} < 0$ by the assumption $f_I(r,I) < 0$ and the previous result $\frac{\partial I^{FDI,*}}{\partial r_h} > 0$ QED

To interpret this result, note that the marginal benefit to invest in informal institution is higher for firms based in a country of poorer state institution, because the firm-specific informal institution reduces the fixed overhead cost of headquarter operation by more in such environment. The heavier investment in informal institution in turn enables these firms to reduce the overhead cost of production at the FDI destination. Propositions 4 and 5 together imply that for each given FDI destination r_d, although South-based MNEs have a higher total fixed cost of multinational operation due to their home institutional disadvantage and the higher cost incurred to build I, they actually incur a lower fixed cost of production at the FDI destination, $f(r_d, I)$. As an implication, the comparative advantage of South-based MNEs will be stronger in destinations of poorer state institutions, as the following analysis formally shows.

[36] We impose the necessary condition on $f_{II}(r,I)$ to ensure that the SOC, $f_{II}(r_h,I)+f_{II}(r_d,I)+k^{''}(I) > 0$, is satisfied. Given the convexity of $k(I)$, a sufficient condition is $f_{II}(r,I) > 0$.

2.2.2. Optimal FDI Destination

If a firm chooses to produce locally, its net profit is

$$\Pi^D \equiv \pi^D - F * (r_h) = B\tilde{\phi}(w_h)^{1-\sigma} - F * (r_h) \tag{31}$$

which increases in $p\tilde{h}i$ linearly. Note that $F * (r_h)$ has taken into account the optimal choice $I*$ given the home institutional environment r_h. If a firm chooses to undertake FDI, its net profit is instead

$$\Pi^{FDI} = \pi^{FDI} - F^{FDI,*}(r_h, r_d) = B\tilde{\phi}\left(w_h^\eta w_d^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d) \tag{32}$$

where again $F^{FDI,*}(r_h, r_d)$ has taken into account the optimal choice $I^{FDI,*}$ given the destination r_d ad the MNE's home institution r_h. Given Proposition 4 (ii) that the fixed cost of production of FDI is higher than local production, if firms choose FDI, they necessarily choose a destination with lower wages than at home ($w_d < w_h$, i.e. $r_d > r_h$) such that the higher variable profit of FDI helps offset the higher fixed cost of FDI. This is in line with most vertical-FDI models in the literature, where FDI is driven by differences in the production cost across countries. Of course, in the data, reverse FDI ($r_d < r_h$) can take place for reasons not modeled in the paper (such as market access or technology acquisition motives). Thus, if we do find empirical pattern in support of our hypotheses, it suggests that the mechanism proposed in the paper is strong enough to dominate potential countervailing forces.

Among possible destinations of FDI, firms trade off lower wages with higher fixed costs associated with poorer institutions, and choose r_d that maximizes (32). The FOC for the optimal choice r_d* requires that at r_d*:

$$\frac{\partial \pi^{FDI}}{\partial w_d} w'(r_d) - \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d} = 0 \tag{33}$$

where $\partial F^{FDI,*}(r_h, r_d)/\partial r_d = \partial f(r_d, I^{FDI,*})/\partial r_d$ by the evelope theorem. Equation (33) defines the optimal choice of the FDI destination r_d^* as an implicit function of the firm, industry and home country characteristics: $r_d* \equiv H(r_h, \tilde{\phi}, \eta)$. In particular, these include the institution r_h, the productivity level $p\tilde{h}i$, the world demand for the sector B, and the headquarter intensity of the industry η.

Proposition 6. *(i)* ***(Complementarity of Institutional Qualities at Firm-level FDI)*** *ll else being equal, a firm will choose to undertake FDI in countries of poorer institutional* *qualities, the poorer the institutional quality at home:* $\frac{\partial r_d *}{\partial r_h} > 0$*; (ii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the more productive the firm is:* $\frac{\partial r_d *}{\partial \tilde{\phi}} > 0$*; (iii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the larger the world demand for the sector is:* $\frac{\partial r_d *}{\partial B} > 0$*; (iv) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the less headquarter-intensive the sector is:* $\frac{\partial r_d *}{\partial \eta} < 0$

Proof. (i) Totally differentiate (33) with respect to $r_d *$ and r_h, we obtain

$$\frac{\partial r_d *}{\partial r_h} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h} w'(r_d) w'(r_h) - \frac{\partial^2 f}{\partial I \partial r_d} \frac{\partial f^{FDI,*}(r_h, r_d)}{\partial r_h}}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} > 0 \tag{34}$$

The inequality holds because $\frac{\partial^2 \Pi^{FD}}{\partial r_d^2} < 0$ by the SOC for $r_d *$,[37] and the numerator is positive by the fact that: (a) $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h} = \eta(1-\eta)(1-\sigma)^2 \pi^{FDI}/(w_h w_d) > 0$ and $w'(r) < 0$, and (b) $\frac{\partial^2 f}{\partial I \partial r_d} < 0$ by the assumption in (28) and $\frac{\partial I^{FDI,*}(r_h, r_d)}{\partial r_h} > 0$ by Proposition 5.

(ii) Similarly, taking total differentiation of (33) with respect to $r_d *$ and $\tilde{\phi}$, we have

$$\frac{\partial r_d *}{\partial \tilde{\phi}} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \tilde{\phi}} w'(r_d)}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} > 0, \tag{35}$$

because $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \tilde{\phi}} = (1-\eta)(1-\sigma)\pi^{FDI}/(w_d \tilde{\phi}) < 0$ and $w'(r) < 0$

(iii) It is straightforward to see that B has an analogous (positive) effect as $\tilde{\phi}$ on $r_d *$, because B and $\tilde{\phi}$ enter π^{FDI} multiplicatively.

(iv) Finally, by similar derivations, we have

$$\frac{\partial r_d *}{\partial \eta} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \eta} w'(r_d)}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} < 0$$

where $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \eta} = (1-\sigma)\left[(1-\eta)(1-\sigma)\ln(\frac{w_h}{w_d}) - 1\right]\frac{\pi^{FDI}}{w_d} > 0$, since $w_h > w_d (r_d > r_h)$ holds at the optimal choice of FDI destination. QED

To understand Proposition 6(i), note that institutional complementarity at the firm level in bilateral FDI flows arises for two reasons. First, firms based in countries of poorer institutional qualities tend to be more heavily endowed with firm-specific informal institutions,

[37] We make the necessary assumptions on $\omega''(r)$ and $\frac{\partial^2 f(r,I)}{\partial r^2}$ to ensure that the SOC, $\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2} < 0$, for r_d^* is satisfied.

which gives them a comparative advantage in conducting FDI in destinations of poorer institutional qualities (as the adverse effect of weak institutions at the destination on fixed cost is reduced by the firm- specific institutional investment, and more so in destinations of poorer institutions). This is the key mechanism proposed by the paper. In addition, given the supermodularity between the headquarter and the intermediate component implied by the Cobb-Douglas production function, a lower wage at home (a lower-cost headquarter input) also increases the marginal benefit (increments in variable profits) of securing a lower-cost manufactured component. This second mechanism reinforces the main mechanism and strengthens the institutional complementarity effect.

Next, note that a larger $\tilde{\phi}$ (or B) increases the marginal benefit of producing the manufactured component at a location with lower wages w_d, since the market share of the firm at stake (or the size of the aggregate demand for the industry) is larger. This encourages the firm to take on higher fixed costs associated with FDI in countries of poorer institutions so as to access the cheaper labor pool in these destinations. In contrast, when a sector is more headquarter intensive, the cost of the manufactured component becomes less important a concern, which weakens the incentive of firms to locate FDI in countries with weaker institutional support.

The prediction that a more productive firm will choose to engage FDI in countries of poorer institutions may come across as a surprising result. But it is no different from the traditional vertical-FDI models where the more productive firms in the North are more likely than the less productive firms to engage FDI in the South: the more productive firms with larger market shares stand to gain more from the lower variable production cost in the South, and at the same time, they can afford the higher fixed cost of FDI. Naturally, there are factors outside the model that may moderate this stark prediction.

2.2.3. Sorting of Firms

Proposition 6(ii) (that the more productive firms choose FDI in countries of poorer institutions) implies that the net profit function of FDI will be an increasing and convex function of firm productivity level $\tilde{\phi}$ for a given sector and home country. To see this, define

$$\Pi^{FDI,**} \equiv \max_{r_d}\{\pi^{FDI}(r_h, r_d, \tilde{\phi}, B, \eta) - F^{FDI,*}(r_h, r_d)\}$$

and $\pi^{FDI,**}$ and $F^{FDI,**}$ the corresponding variable profit and fixed cost given the optimal choice of destination r_d*. Applying the envelope theorem, we have

$$\frac{d\Pi^{FDI,**}}{d\tilde{\phi}} = \frac{\partial \pi^{FDI,**}}{\partial \tilde{\phi}} = B(w_h^{\eta} w_d^{1-\eta})^{1-\sigma} > 0$$

$$\frac{d^2\Pi^{FDI,**}}{d\tilde{\phi}^2} = (1-\eta)(1-\sigma)w_d^{-1} B(w_h^{\eta} w_d^{1-\eta})^{1-\sigma} w'(r_d*)\frac{\partial r_d*}{\partial \tilde{\phi}}$$

where the sign for the second derivative follows by Proposition 6 (ii). In addition, by Proposition 4 and 6 (ii) again, we have

$$\frac{dF^{FDI,**}}{d\tilde{\phi}} = \frac{dF^{FDI,**}}{dr_d*}\frac{dr_d*}{d\tilde{\phi}}$$

Thus, as the more productive firms choose FDI in countries of higher r_d, they earn a higher variable profit margin but also incur a higher fixed cost. This is illustrated in Figure 1 by firms of three representative productivity levels $\tilde{\phi}_1 < \tilde{\phi}_2 < \tilde{\phi}_3$. Their respective choice of r_d (with $r_{d,1} < r_{d,2} < r_{d,3}$) implies increasingly steeper variable profit margins and higher fixed costs. The net profit function $\Pi^{FDI,**}$ corresponds to the upper contour of the net profit functions across the continuum of FDI destinations.

The profit function of producing locally and that of FDI are juxtaposed in Figure (10). Given a convex profit function $\Pi^{FDI,**}$ for FDI but a linear one for local production, and a higher fixed cost for FDI than local production (Proposition 4(ii)), there exists a productivity level $\tilde{\phi}^{FDI}$ at which firms are indifferent between FDI and local production ($\Pi^{FDI,**} = \Pi^D$). Let $\tilde{\phi}^D$ denote the productivity cutoff level for local firms to break even. Further, assume $\Pi^{FDI,**}(\tilde{\phi}^D) < 0$ such that not all firms undertake FDI. It follows that firms with $\tilde{\phi} \in \left[\tilde{\phi}_{min}, \tilde{\phi}^D\right]$ will choose not to produce and exit the industry, firms with $\tilde{\phi} \in \left[\tilde{\phi}^D, \tilde{\phi}^{FDI}\right]$ will produce locally, and firms with $\tilde{\phi} \in \left[\tilde{\phi}^{FDI}, \tilde{\phi}_{max}\right]$ will undertake FDI. The cutoffs are defined implicitly by:

$$B\tilde{\phi}^D w(r_h)^{1-\sigma} = F^*(r_h) \tag{36}$$

$$B\tilde{\phi}^{FDI}\left[w(r_h)^{\eta} w(r_d(\tilde{\phi}^{FDI}))^{1-\eta}\right]^{1-\sigma} - B\tilde{\phi}^{FDI} w(r_h)^{1-\sigma} = F^{FDI,*}(r_h, r_d(\tilde{\phi}^{FDI})) - F^*(r_h) \tag{37}$$

The sorting condition $\Pi^{FDI,**}(\tilde{\phi}^D) < 0$ can be rewritten as $\left(\frac{w(r_h)}{w(r_d(\tilde{\phi}^D))}\right)^{(1-\eta)(\sigma-1)} < \frac{F^{FDI,*}(r_h, r_d(\tilde{\phi}^D))}{F^*(r_h)}$, that is, the extra fixed cost of FDI dominates the wage advantage FDI offers for the least productive surviving firms (given its endogenous choice of r_d if it were to undertake FDI). We assume that this condition holds since sorting of firms by productivity levels into domestic and multinational firms is a well-documented stylized fact.

2.2.4. Aggregate Bilateral FDI

As suggested by Figure (9), in the limiting scenario with a continuum of destinations r_d, for each destination r_d^o, there is one unique productivity level $\tilde{\phi}^o$ of firms in each sector that consider rdo as the optimal FDI destination. To arrive at an expression for the aggregate bilateral FDI at the country level, we impose some structures on the sectoral-level parameters. In general, sectors may differ in terms of its global market size B, headquarter intensity η and firm productivity distribution. For simplicity, we suppress the latter two sectoral heterogeneity and work with only the sectoral demand heterogeneity because of its simple multiplicative relationship with firm productivity. We discuss the possibility of generalizing the framework in Section 2.2.5.

Suppose that the global market size has a uniform distribution across sectors such that $B \sim U(0,1)$. In addition, assume that firm productivity in each sector follow the same cumulative density function $G(\tilde{\phi})$ with support $\tilde{\phi} \in [1, \infty)$.

For illustrative purposes, focus on a particular destination r_d^o. For a given home country r_h and sector B, this pins down the firm productivity level $\tilde{\phi}^o$ that will choose r_d^o as a preferred FDI destination. Specifically, the FOC for r_d^* in (33) requires that $\tilde{\phi}^o = C(r_h, r_d^o)/B$, where $C(r_h, r_d) = \{w_h^{\eta(1-\sigma)} w_d^{(1-\eta)(1-\sigma)-1}(1-\eta)(1-\sigma)\omega'(r_d)\}^{-1} \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d}$ is a constant given r_h and r_d. Thus, a lower sectoral demand B raises the corresponding productivity level of firms that would prefer r_d^o. More formally, we have $\frac{d\tilde{\phi}^o}{dB} = -\frac{\tilde{\phi}^o}{B}$.

Whether the firm indeed undertakes FDI in r_d^o, however, depends on whether the firm productivity level $\tilde{\phi}^o$ exceeds the threshold $\tilde{\phi}^{FDI}$. If this is not the case, the FDI profit $\Pi^{FDI,**}$ falls short of domestic profit Π^D and FDI will not realize. Using the cutoff condition (37) for FDI, we can similarly derive the effect of the sectoral demand B on the cutoff productivity $\tilde{\phi}^{FDI}$. In particular, take total differentiation of (37) with respect to B and $\tilde{\phi}^{FDI}$, applying the FOC (7), we have $d\tilde{\phi}^{FDI}/dB = -\tilde{\phi}^{FDI}/B$. Thus, a lower sectoral demand also raises the productivity cutoff for FDI.

Given the response of $\tilde{\phi}^o$ and $\tilde{\phi}^{FDI}$ to the sectoral demand B, we can characterize the bilateral FDI flows across sectors and country pairs. Starting with the highest sectoral demand level $B = 1$, label the corresponding productivity level in this sector that would prefer r_d^o as a potential FDI location as $\tilde{\phi}^o(1)$, and the FDI cutoff level in this sector as $\tilde{\phi}^{FDI}(1)$. It turns out that there are only two possible scenarios.

In the first scenario, suppose$\tilde{\phi}^o(1) < \tilde{\phi}^{FDI}$ holds. This implies zero FDI in r_d^o from r_h in the sector with the largest demand. As we look across sectors with lower B, since

$$\mid d\tilde{\phi}^o/dB \mid=\mid -\tilde{\phi}^o/B \mid<\mid -\tilde{\phi}^{FDI}/B \mid=\mid d\tilde{\phi}^{FDI}/dB \mid \tag{38}$$

$\tilde{\phi}^o$ rises by less than $\tilde{\phi}^{FDI}$. As a result, the firm who might prefer r_d^o as a possible FDI destination in a sector always finds domestic production preferable to FDI. Thus, there would be no FDI in r_d^o from r_h for all $B \in [0,1]$, and hence zero bilateral FDI at the aggregate.

On the other hand, suppose $\tilde{\phi}^o(1) > \tilde{\phi}^{FDI}(1)$ holds, which implies positive FDI from r_h in r_d^o in the sector with the highest demand. Since in this case,

$$\mid \tilde{\phi}^o/dB \mid=\mid -\tilde{\phi}^o/B \mid>\mid -\tilde{\phi}^{FDI}/B \mid=\mid d\tilde{\phi}^{FDI}/dB \mid \tag{39}$$

$\tilde{\phi}^o$ increases faster than $\tilde{\phi}^{FDI}$ as B decreases. Hence, firms who might choose r_d^o as a potential FDI destination also find FDI more profitable relative to domestic production for all $B \in [0,1]$.

Aggregating across all sectors and firms, we have the bilateral FDI activity from country r_h to r_d^o (when measured in net profit) as:

$$\begin{aligned}
V(r_h, r_d^o) \equiv \quad & \int_0^1 \int_1^\infty \Pi^{FDI}\left(\tilde{\phi}, B, \eta; r_h, r_d^o\right) \delta\left(\tilde{\phi} - \tilde{\phi}^o(B)\right) g(\tilde{\phi}) d\tilde{\phi} dB \\
&= \int_0^1 \int_1^\infty \left(B\tilde{\phi}(w_h^\eta \omega(r_d^o)^{1-\eta})^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right) \delta\left(\tilde{\phi} - \tilde{\phi}^o(B)\right) g(\tilde{\phi}) d\tilde{\phi} \\
&= \int_{\tilde{\phi}^o(1)}^\infty \left(C(r_h, r_d^o)(w_h^\eta \omega(r_d^o)^{1-\eta})^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right) g(\tilde{\phi}) d\tilde{\phi} \\
&= \left(C(r_h, r_d^o)(w_h^\eta \omega(r_d^o)^{1-\eta})^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right) \int_{\tilde{\phi}^o(1)}^\infty g(\tilde{\phi}) d\tilde{\phi} \\
&= \left(C(r_h, r_d^o)(w_h^\eta \omega(r_d^o)^{1-\eta})^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right) \left(1 - G(\tilde{\phi}^o(1))\right)
\end{aligned} \tag{40}$$

where δ is a Dirac delta function and $g \equiv dG/d\tilde{\phi}$ is the density function of firm productivity. Recall that $\tilde{\phi}^o(B) = C(r_h, r_d^o)/B$ by the FOC in (30). In the above derivations, the first equality holds because B has a uniform distribution and only firms with productivity $\tilde{\phi}^o(B)$ ill choose to engage FDI in destination r_d^o given sectoral demand level B. The second equality substitutes in the expression of the FDI profit, and the third equality follows by integrating over the combinations of $(B, \tilde{\phi})$ that satisfy the FOC (30) such that $B\tilde{\phi}^o = C(r_h, r_d^o)$. The lower bound $\tilde{\phi}^o(1) = C(r_d, r_d^o)$ corresponds to the productivity level of firms that choose r_d^o in the sector with the highest demand ($B = 1$). As B decreases toward zero across sectors, the corresponding productivity level of firms that choose r_d^o increases toward infinity.

We may interpret the first term in (40) as reflecting the 'intensive margin' and the second term the 'extensive margin' of FDI activity. They correspond, respectively, to the average net FDI profit per firm and the mass of firms from country rh engaging FDI in country r_d^o.[38]

At the extensive margin, poorer institutions, as shown in Proposition 4(iv), raises the total fixed cost of production for MNEs based in these countries, which reduces the outward FDI from the South relative to the North. However, so long as this higher total fixed cost of FDI does not kill the outward FDI from r_h toward a destination r_d^o, home countries with poorer institutions have a larger mass of firms investing in the given destination r_d^o. Intuitively, the higher informal institutional investment made by firms in the South allows less productive firms than their peers from the North to survive in a given FDI destination.

Whether this advantage of the South at the extensive margin is stronger in destinations with poorer institutions depends on two components. First, it depends on whether a higher r_h lowers the productivity cutoff $\tilde{\phi}^o(1)$ by a larger margin in destinations of higher r_d^o. The answer is positive on second-order approximations. Next, it also depends on $g'(\tilde{\phi}^o(1))$, the curvature of the productivity distribution at the cutoff. Intuitively, as r_d^o increases and the corresponding productivity threshold $\tilde{\phi}^o(1)$ increases, the advantage of the South is stronger if $g'(\tilde{\phi}^o(1)) > 0$, as we move up to a productivity level where the density of firms is higher; the reverse is true if $g'(\tilde{\phi}^o(1)) < 0$. Overall, the institutional complementarity effect will hold at the aggregate FDI level if the intensive margin dominates this potential countervailing force at the extensive margin.

2.2.5. Discussions of the Model

We discuss several possible extensions of the model. First, in the model, we have implicitly assumed that labor productivity is the same across countries in the production of intermediate (headquarter or manufactured) components for differentiated goods. We can relax this assumption without affecting the result, if the wage rate adjusted for labor productivity remains lower in countries of poorer institutional qualities.

[38] The intensive and extensive margins are defined here conditional on positive bilateral FDI flows. This is not exactly the same as how these two margins are sometimes used in the literature. For example, some studies in the trade literature define the extensive margin by the proportion of active trade status among the universe of country-pairs, sectors, or product groups.

Second, for modeling simplicity, we have also assumed that informal institutional endowment is a common good within the firm boundary and fully transnational (i.e., equally effective in combatting weak formal institutions in foreign countries as at home). Admittedly, the informal institution built likely cannot be fully transferred across countries. In alternative setups, we may allow firms to build local informal institutions at home and in the host country separately. The main result will continue to hold, so long as the level of informal institution that a firm can build in the host country is constrained by its home institutional environment.

Third, in the literature, several studies have suggested that larger firms tend to be more politically connected or politically active (Hellman et al. (2003); Faccio (2006); Li et al. (2006); J.P.Chen et al. (2011)). In the current setup, domestic firms do not differ in their choices of I. However, as shown by Proposition 3(ii), conditional on firms making the cutoff for FDI, the more productive firms will choose FDI destinations of higher rd. Since the more productive firms are also larger and the informal institution a firm develops increases with rd in the current model, this establishes a positive correlation between firm size and firm-specific investment in informal institutions.

Fourth, the prediction of Proposition 6(ii) is derived from pure vertical-FDI incentives. We can think of some potential factors outside the model that may moderate this stark prediction. For example, in alternative setups with trade frictions, firms may conduct FDI in several destinations (of good or bad institutions) for market-access motives. Nonetheless, it is still likely that the lower bound of institutional qualities of the destinations where a firm engages FDI will be lower, the higher the firm productivity level (all else being equal); intuitively, the higher fixed cost at a destination of poorer institutional qualities raises the bar on firm entry. Yet another possible mod- erating factor is quality-control risk. If higher firm productivity is partly due to more sophisticated production technologies a firm uses, higher risk of quality-control failure may create disincentives for more productive firms to locate production in countries with lower wages but poorer institutions (Chang and Lu 2012). As a result, there may arise a non-monotonic relationship between the firm productivity level and the institutional quality of a firm's chosen FDI destination. In firm-level empirical analysis below, we will control for both firm productivity and firm technology intensity to distinguish their different interactions with the destination institutional quality.

Fifth, in deriving the aggregate bilateral FDI, we have assumed the firm productivity support to be unbounded. We may instead impose some upper bound on the productivity support Helpman et al. (2008). This will not affect the zero FDI conclusion in the first scenario but will introduce additional incidence of zero FDI in the second scenario. Zero FDI in this case will occur not only at the bilateral country level but also at the sectoral level. In particular, let $\bar{\tilde{\phi}}$ be the upper bound of the firm productivity support. Define $b \equiv C(r_h, r_d^o)/\bar{\tilde{\phi}}$; i.e., b is the cutoff on the sectoral demand where the most productive firm would undertake FDI in r_d^o from r_h. For $B < b$, the required productivity level for a firm to choose rdo exceeds the upper bound of the productivity support. Thus, FDI will occur only in sectors of sufficiently large demand with $B \in [b, 1]$ for given r_h and r_d^o. We have zero FDI from r_h in r_d^o inallsectors if $b > 1$.

Seventh, in deriving the aggregate FDI flows, we have also suppressed possible heterogeneity in headquarter intensity across sectors. In principle, it is possible to introduce another layer of sub-sectors characterized by $\eta \in [0, 1]$ within each sector $B \in [0, 1]$. For given (B, η), we can identify the unique productivity level $\tilde{\phi}^o(B, \eta)$ of firms that would prefer r_d^o as a FDI destination. Assume $\eta \sim U(0, 1)$, the aggregate bilateral FDI can in principle be derived in a similar way as in (40). The difficulty is to identify the boundary between zero and positive bilateral FDI in terms of both parameters (B, η) and as a result, a closed-form solution for the aggregate bilateral FDI.

Without doubts, the current model has missed some relevant features of multinational production, such as outsourcing and horizontal FDI. It is possible to introduce the sorting structure of outsourcing and FDI in Antràs and Helpman (2004) such that the fixed cost of FDI is greater than outsourcing in the South taking into account the endogenous choice of firm-specific informal institution, and at the same time, the FDI variable profit margin is steeper than outsourcing in a given destination. Similar to how the FDI profit function is derived in Figure 9, the outsourcing profit function taking into account firm's optimal choice of destination will likely be an increasing convex function and cut the domestic and FDI profit functions in the middle spectrum of firm productivity, creating a lower cutoff for outsourcing and an upper cutoff for FDI. Institutional complementarity effect at the firm level is likely to follow for outsourcing as for FDI by a similar mechanism.

In models of horizontal FDI, firms may engage FDI in multiple destinations for market-access motives. However, the same institutional complementarity effect identified in this paper at the firm level is likely to apply to this alternative setting. Assume away differences in wage costs (and thus vertical-FDI incentives). MNEs based in poorer institutions still have a comparative advantage at reducing the overhead cost of FDI at a destination given their heavier informal institutional investment at home, and thus will be more likely to choose FDI over exporting to serve the market with poorer institutions, all else being equal.

2.3. Empirical Evidence: FDI activities at the firm level

We now provide further analysis based on firm-level data to test the predictions of Proposition 6, and estimate the following specification:

$$
\begin{aligned}
\ln(FDI_{fshdt}) \quad = \quad & \beta_1(G_{h,t-11} * G_{d,t-1}) + \beta_2 \ln(prod_{f,t-1}) + \beta_3(\ln(prod_{f,t-1}) * G_{d,t-1}) \\
& + \beta_4 RD_{f,t-1} + \beta_5 RD_{f,t-1} * G_{d,t-1} \\
& + \beta_6 \mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid + \gamma' X_{hd,t-1} \\
& + \chi_{ht} + \zeta_{dt} + \kappa_{ds} + \epsilon_{hdsft} \qquad (41)
\end{aligned}
$$

where FDI_{hdsft} measures FDI activity in sector s by firm f of origin h in destination d in year t, $G_{c,t1}$ country c's institutional quality in year $t-1$, $prod_{f,t1}$ firm f's productivity in year $t-1$, and $RD_{f,t1}$ firm f's R&D intensity in year $t-1$.

By Proposition 6(i), we expect to find $\beta_1 > 0$ such that firms from countries of better institutions tend to engage more FDI in destinations of better institutions (relative to another firm of similar characteristics except countries of origin) and vice versa. The next two terms test the prediction of Proposition 6(ii), which suggests $\beta_3 < 0$ because more productive firms with larger market shares have stronger incentives to locate production in cheaper locations (poorer institutions in the current framework). To distinguish this effect of productivity on FDI from that of quality control risk as suggested by Chang and Lu (2012), we also include R&D intensity to proxy for a parent firm's technology sophisticatedness. The theory of Chang and Lu (2012) suggests that firms with more complicated production technology have weaker incentives to engage in vertical FDI for risk of quality-control failure ($\beta_4 < 0$), but such disincentive is less severe in destinations of better institutions ($\beta_5 > 0$).

The three sets of indicator variables, $\{\chi_{ht}, \zeta_{dt}, \kappa_{ds}\}$, control for origin-year, destination-year, and destination-sector fixed effects. For example, the effects of sectoral demand and headquarter intensity on the choice of FDI location, as suggested by Proposition 6 (iii)–(iv), will be absorbed by the destination-sector FEs. The remaining terms - difference in log GDPs per capita and country relational characteristics - are again included to control for the Linder effect and other determinants of FDI.

2.3.1. Data and Measurement

We construct a panel of firm-level FDI data for the period 2009–2016, combining the *fDi Markets* database (that tracks the greenfield FDI activities) and the Orbis dataset (that provides the firm-level financial information). The period of study is dictated by the availability of the Orbis firm-level data.

The *fDi Markets* database is a service offered by the Financial Times that tracks cross-border greenfield investment in all sectors and countries. It provides real-time monitoring of investment projects, capital investment and job creation. For every project initiated overseas, this dataset records the date when a project is carried out, the parent firm initiating it, the location of the parent firm (country-state-city), the industry sector of FDI, the host country (and city), the capital investment of the project (in million USD), and the number of jobs created. The advantage of fDi Markets is that each project is cross-referenced against multiple sources so that the information is relatively accurate.

This dataset is used as the primary source of greenfield FDI information by various organizations such as UNCTAD and World Bank. It is also increasingly used in FDI studies. For example, Desbordes and Wei (2017) use this dataset to examine the effect of financial constraints on FDI activities. M. Chan J. and Zheng (2017) study the effect of networks on outward FDI;Castellani and Lavoratori (2017) exploit the information on the type of project to study the co-location and agglomeration of FDI.

We collapse the firm-level capital investment (originally reported by date and at the city level) into year and destination country basis. Thus, the measure of FDI is at the level of firm, sector, origin country, destination country, and year. For the period 2009–2016, there are 35,039 unique firms from 168 origin countries that conduct greenfield FDI in 200 destination countries.

Firm-level financial data (lagged one year) were retrieved from Orbis (compiled by Bureau van Dijk). This dataset provides comprehensive information on private companies worldwide. In particular, we use the information on operating revenues, number of employees, total assets, material costs, and research and development (R&D) expenses. Data were downloaded in US dollars. The Orbis dataset includes over 280 million companies across the globe, so it is infeasible to download all observations. We download the subset of firms that satisfy the following criteria during 2008–2016: (i) firms with observations in at least one year on operating revenues, number of employees, and total assets, and (ii) also with observations in at least one year on material costs (or alternatively, costs of goods sold and costs of employees), since these variables are required in the estimation of firm productivity.[39]

We then merge firms from the FDI dataset with the Orbis observations to obtain the parent firm's annual financial data for the period 2008–2016. The merge process relies on match of two key identifiers — firm name and home country — from both datasets, based on fuzzy matching programs and manual inspection.[40] In the end, we have about 25% of firms in the *fDi Markets* dataset that are successfully matched to firms from Orbis.

Given the set of parent firms with financial data, we then estimate their productivity using the Levinsohn and Petrin (2003) (LP) method.[41] In the estimation process, we allow the production functions to differ across sectors, where the sector is defined according to the industry sector of FDI reported for the firm by the fDi Markets dataset (39 sectors in total). This process provides a panel of productivity estimates for each firm across years according to its sector of FDI. The R&D intensity is constructed as the ratio of R&D expenses to operating revenues.

In sum, the sample of observations used in the analysis refer to an incident of greenfield foreign capital investment in a sector and year by a firm reported by *fDi Markets* and the corresponding characteristics of the investing firm, origin and destination countries (lagged by one year). Thus, effectively, the observations use variations in FDI during 2009–2016 and those of firm/country characteristics during 2008–2015.

Table (19) provides the summary statistics of the firm-level variables. For the period 2009–2016, the minimum positive FDI value is 8 thousand USD, while the maximum is 18.5 billion USD, with mean at approximately 35.9 million USD. This indicates a large extent of heterogeneities in FDI capital investment across years and across firms.

Next, we present in Table (20) the institutional quality of home and destination countries

[39]When the information on material costs is missing, it is proxied by the difference between the costs of goods sold and the costs of employees.

[40]Stata provides a fuzzy matching program, *reclink2*. It is an algorithm for probabilistic record linkage. In particular, it compares strings to determine whether records are 'similar' and provides scores of similarity. The package also provides an algorithm, *stnd compname*, to pre-process (standardize) company names. We standardize each firm's name in both datasets before applying the matching program. Because *reclink2* is a fuzzy matching algorithm, manual check is required to ensure the accuracy. We inspect each record of matched pairs and verify whether they are indeed the same company. Matched pairs where the (core) standardized names are different are dropped.

[41]A possible alternative is the methodology proposed by Olley and Pakes (1996a) (OP). We choose the LP approach because it uses intermediate inputs as a proxy for unobserved productivity; it is common that firms report positive use of materials, so that we may preserve as many observations as possible. In contrast, the OP method relies on investment as the proxy, whose level depends on the depreciation rate assumed and may be non-positive. See Van Beveren (2012) for a review of alternative methodologies to estimate firm productivity.

of FDI in terms of the six WGI indicators. First, it is evident that FDI origins on average have better institutional qualities. This is to some extent consistent with the theory's setting, where FDI tends to flow South ($w_h > w_d$, i.e., $r_h < r_d$) such that the higher variable profit of FDI helps offset the higher fixed cost of FDI. Second, the table also indicates that FDI recipient countries are more dispersed than origins in terms of institutional qualities (standard deviations are larger, while means are lower, for FDI recipient countries).

Unlike the country-level analysis, it is infeasible to conduct analysis incorporating the extensive margin using Probit or Tobit estimations, because the universe of FDI relations (nil or active) across all firm-sector-origin-destination-year combinations is too large for typical computing capacity to handle. Thus, the subsequent analysis focus on firms that were recorded to have undertaken FDI during 2009–2016. We will use the PPML estimator, because zero FDI values exist where the firm does not reveal the amount of capital investment.

We measure a country's institutional quality based on the Worldwide Governance Indicators (WGI), in six dimensions: voice and accountability (VA), political stability and absence of violence (PV), government effectiveness (GE), regulatory quality (RQ), rule of law (RL), and control of corruption (CC).[42] Kaufmann et al. (2011) provide details on the construction of these indicators. Since these indicators are highly correlated with one another, we include them one at a time in the estimation of (15). For each governance indicator, a country receives both a point estimate ranging from approximately -2.5 (weak) to 2.5 (strong), and a percentile ranking among all countries. The higher the index, the better the institutional quality. We report the results based on the point estimate, although findings are qualitatively similar based on the percentile ranking.

The data on GDP per capita (in current US dollars) are based on the World Development Indicators.[43] We construct the general price level of a country relative to the United States by the ratio of its GDP (per capita) in current US dollars to its GDP (per capita) in current PPP dollars. This variable aims to capture the overall cost of production (including, e.g., rent, wages, intermediate materials and infrastructure) facing the firms operating in the country.

The transaction and information cost proxies $X_{hd,t-1}$ were compiled from several sources. The CEPII website provides the data on bilateral distance, and whether two countries are contiguous (contig), share a common language (comlang), have ever had a colonial link (colony), have had a common colonizer after 1945 (comcol), are currently in a colonial

[42]http://data.worldbank.org/data-catalog/worldwide-governance-indicators.
[43]http://data.worldbank.org/data-catalog/world-development-indicators.

relationship (curcol) or were/are the same country (smctry).[44] The data on whether two countries are currently in a regional trade agreement (rta), and whether they use a common currency (comcur) were retrieved from de Sousa's website.[45] Last but not least, the data on bilateral investment treaties were obtained from UNCTAD. We construct a dummy variable that equals one if a BIT is currently in force between a country pair and zero otherwise, according to the date a BIT enters into force (and the date it is terminated if ever).[46]

All regressors (if time variant) are lagged one period relative to the FDI variable, to reduce the concern of reverse causality. We also experiment using longer lags of the right-hand-side variables in unreported exercises; the results are similar.

2.3.2. Results

Table (21) reports the PPML estimation results of equation (41). As shown by the table, the coefficient on $(G_h G_d)$ is positive and significant across all the six governance indicators. This provides support for the paper's main theoretical prediction of an institutional complementarity effect on firm-level FDI activities. In addition, the negative sign of the coefficient on $(prod_f * G_d)$ is also consistent with Proposition 6(ii). That is, more productive firms in fact have stronger incentives to engage more FDI in destinations of lower wages, given their larger market shares. At the same time, their heavier investment in informal institutions allow them to operate in such destinations of poorer institutions. Interestingly, the theory of Chang and Lu (2012) also finds support in this exercise, where the coefficient for RD_f is significantly negative but that for $(RD_f * G_d)$ is positive. Thus, quality-control risk does present itself as a critical concern in firms' FDI decision.

Coefficients on the country-level variables, when precisely estimated, are in general consistent with prior expectations. One notable exception is the positive sign of the coefficient on the difference in GDPs per capita, contrary to the Linder hypothesis of Fajgelbaum et al. (2014). This result could be due to the pooling of both vertical and horizontal FDI. As vertical FDI is motivated by cost-saving considerations, larger differences in incomes between origins and destinations can promote FDI flows. Unfortunately, there is no satisfactory way to disentangle the two modes of FDI in this exercise (following methods such as in Alfaro and Charlton (2009)), because the fDi Markets dataset reports the type of FDI activity in

[44] http://www.cepii.fr/cepii/en/bdd modele/presentation.asp?id=6. See Mayer and Zignago (2011) for further de- tails.

[45] http://jdesousa.univ.free.fr/data.htm. See also Sousa (2012).

[46] http://investmentpolicyhub.unctad.org/IIA. We set the cutoff date to be July 1st of the current year in defining the year-varying dummy bit.

only very broad categories.

2.3.3. Robustness Checks

We carry out similar robustness checks as for the country-level FDI. The qualitative results are very similar if we use the WGI percentile ranking (of institutions across countries) instead of point estimates. We continue to find a complementarity pattern in institutional qualities, a negative effect of destination institutional quality on the FDI of more productive firms, and a positive effect of destination institutional quality on the FDI of firms of higher R&D intensity.

We then consider dropping countries deemed to be tax havens. The patterns documented above for the benchmark sample continue to hold in this scenario.

We then add, as extra controls, the similarity of industrial structures of the home and destination countries, or the similarity of their religion compositions. Similarity in industrial structures increases FDI by firms. Nonetheless, our key theoretical predictions continue to hold in the data. In fact, the estimate of the institutional complementarity effect increases in magnitude across the board. Likewise, similarity in religion compositions has positive effects on firm-level FDI, but including the extra control does not alter the conclusion for all key variables of interest discussed above in the benchmark scenario.

Finally, instead of the revenue production function, we also estimate firm productivity levels based on the value-added production function using the LP method. The institutional complemen- tarity effect continues to be positive and highly statistically significant. The coefficient on R&D intensity remains to be negative and that on its interaction with destination institutional qual- ity positive. Nevertheless, the coefficient on the interaction term of productivity and destination institutional quality, despite being negative across five of six governance indicators, is in general statistically insignificant unlike the benchmark case.

In sum, we find robust empirical support for the theory's main prediction of an institutional complementarity effect at the firm-level FDI (*cf.* Proposition 6 (i)).

2.4. Conclusion

In this paper, we have proposed a theoretical framework to micro-found the hypothesis that South- based MNEs have a comparative advantage to deal with the inefficiency associated with weak formal institutions and to maneuver in relationship-based investment environment, relative to their peers from the North. The theory predicts a complementarity in institutional qualities of the home and host countries in bilateral FDI flows. This helps explain the greater presence of South-based MNEs in countries of relatively poorer institutions.

We have conducted an extensive test of the theory using bilateral FDI for 219 economies during the period 2001–2010. The results indicate a statistically significant complementarity effect in institutional qualities. The finding is robust to the FDI series studied, the institutional indicators used, the inclusion of multilateral country fixed-effects, and the consideration of zero FDI. In addition to predictions on bilateral FDI activity at the country level, the paper's theoretical framework also suggests interesting testable predictions at the firm and sectoral levels. In particular, a firm will choose to undertake FDI in countries of poorer institutional qualities, the poorer the institutional quality at home and the more productive the firm is, all else being equal. Using a worldwide firm-level FDI dataset during the period 2009-2016 (with 35,039 unique firms from 168 origin countries that conduct greenfield FDI in 200 destination countries), we find evidence supporting these firm-level predictions.

3. Financial Constraints, Agency Problem and International Trade

3.1. Introduction

Chen (2014) constructs a model à la Melitz (2003) that captures the agency problem inside the firm in order to explain why some agency firms improve productivity after trade liberalization. This model predicts that small surviving agent non-exporters' productivity increases compared with the small surviving neoclassical non-exporters after trade liberalization. The mechanism of this prediction is that agents subject to the agent problem in the small surviving agent non-exporting firms have the incentives to exert more effort to induce their owners to produce after trade liberalization. That proposit gets the consistent empirical supports using Colombia plant-level data.

On the other hand, Manova (2013) incorporates financial frictions into a heterogeneous-firm model à la Melitz (2003) and applies it to a large panel of bilateral trade for 27 industries during 1985-1995. She identifies and quantifies the three mechanisms through which credit constraints affect trade: the selection into production, the selection into exporting, and the exporters' foreign sales. She shows that financially developed economies have comparative advantages in financially vulnerable sectors because better financial institutions lead to more destination markets (J. M. Chan and Manova 2015), more export product varieties, and more aggregate trade volumes.

In this study, we would present a heterogeneous-firm model à la Melitz (2003) where firms suffer from both agency problem inside the firms and financial frictions outside the firms. In Chen (2018), he argues that the partnership firm is a perfect example of the type of firm he considers. In real world, most firms are organized as agency firms described in that paper. Inevitably, the credit constraints are pervasive for almost all firms. Therefore, firms with these two problems are more relevant to the reality compared to firms with only either problem.

The firms with two problems we consider in this paper are everywhere. A large corporation with multiple plants is the perfect example. Consider the case of Ford Motor Company (Ford for short). Ford has many brands and plants. When deciding whether to set up a new plant and export or not, the owner needs to raise enough money. A fraction of the initial investment is usually covered by outside capital, typically from investors. At this step, the financial frictions emerge naturally. At the same time, the owner of Ford also need to hire a manager to run this new plant. And agency problem comes into being as Chen's paper since effort exerted by the manager is observable but not verifiable.

In our theoretical model, credit frictions and agency problems are substitutes. Firms with the highest initial productivities can overcome problems of credit frictions with operating profits higher than financing costs. In this case, managers exert first-best effort invariably and these firms export. Firms with *not-so-high* productivity have their financial constraints binding and export, since managers have the incentive to exert "second-best" (higher than the "first-best") efforts. The "second-best" effort level is contingent upon external credit constraints, since operating profits can only cover the financing cost. Firms with the lowest productivity exit the exporting market since payoffs to managers are lower than his outside option.

The work is connected to studies regarding trade and finance. The impacts of financial constraints have been paid attention to in recent trade literature. Most theoretical/empirical studies are based on Melitz (2003) (typically, for example, Antràs et al. (2007), and Foley and Manova (2015)). Generally, lower financial development, such as the lack of loans, costly financial contracting and weak investor protection raise the cutoff for both domestic production and exporting. Advantage in access to finance exerts larger influence on trade in financially more vulnerable sectors (Manova et al. 2015). The mechanism is that weaker financial contracting and investor protection imposes higher risks for investors (creditors), which demands high pay-back from debtors (entrepreneurs). Also, insufficient loans in the economy drives up financing costs for entrepreneurs. In addition, it's generally recognized that exporting requires higher costs than selling domestically. In this paper, we identify that agency problem is another mechanism through which financial constraints hinders trade.

This work is also linked to moral hazard in the open economy. For majority of literature examining institutional quality and trade, the human capital is mostly fixed exogenously ((Costinot 2004) and (Grossman 2004), for example), however, Vogel (2007) argues that human capital is endogenous to open to trade under moral hazard. Better Institutional quality can alleviate problems relating to moral hazard. The theoretical framework in this paper incorporates the above arguments by allowing managers to choose their optimal efforts in different firms. Better institutional quality (more advanced financial system here) enables more managers to have "first-best" efforts.

The paper is organized as follow. Section 3.2 and Section 3.2.8 explain the theoretical framework in this paper. Section 3.3 presents econometric framework for empirical study and explains the data. Section 3.4 presents results from empirical study and discussed implications from results. Section 3.5 concludes.

3.2. The Model of Credit Constraints and Agency Problem in International Trade

3.2.1. Set up

We incorporate credit constraints, agency problem and firm heterogeneity into a static, partial equilibrium à la Melitz (2003). Manova regards firm as a black box, i.e., the manager and owner are not distinguished. We follow approach the approach by Chen (2018) and incorporate agency problem into Manova's paper. But firm in that model is in the financial frictionless world, which is unrealistic in fact. We revised the operating profit function by allowing credit constraints.

There are four types of agents in the economy: investors (bankers), owners (entrepreneurs), workers, and managers. The managers can choose to be either managers or workers. Their endowments are I, O, M, and L, respectively, and those endowment amounts are fixed throughout the firm's operating process. Workers are homogeneous and their labor is the only input to production. They receive a uniform wage from employment. We also assume that the measures of bankers and entrepreneurs are large enough such that free-entry condition holds. Managers are also homogeneous, and some of them are matched with the entrepreneurs after the entrepreneurs enter the industry.

Differentiated varieties are produced by a continuum of firms in each of J countries and S sectors. The utility of a representative agent in country i is a Cobb-Douglas aggregate

$$U_i = \prod_s C_{is}^{\mu_s}, \tag{42}$$

where μ_s is the share of each sector s in total expenditure, $\sum_s \mu_s = 1$ and C_{is} is sector-specific CES consumption:

$$C_{is} = \left[\int_{\omega \in \Omega_{is}} q_{is}(\omega)^{\frac{\sigma_s - 1}{\sigma_s}} d\omega\right]^{\dfrac{\sigma_s}{\sigma_s - 1}}, \tag{43}$$

where Ω_{is} is the set of available varieties in country i sector s, and $q_{is}(\omega)$ is the consumption of variety ω in sector s, and σ_s is the elasticity of substitution of sector s.

From the utility function above, we can get the demand of a consumer in i for a variety with price $p_{is}(\omega)$ as

$$q_{is}(\omega) = \left(\frac{p_{is}(\omega)}{P_{is}}\right)^{-\sigma_s} \frac{\mu_s Y_i}{P_{is}}, \tag{44}$$

where Y_i is the total expenditure and P_{is} is the ideal price index and defined as

$$P_{is} \equiv \left[\int_{\omega \in \Omega_{is}} p_{is}(\omega)^{1-\sigma_s} d\omega\right]^{\dfrac{1}{1-\sigma_s}}. \tag{45}$$

3.2.2. The Rule

The rule which investors, owners, worker and managers obeys is described as the following

First, an entrepreneur in sector s, country j pays a sunk entry cost $c_{js}f_{ej}$ where c_{js} is the cost of a cost-minimizing bundle of inputs specific to each country and sector. According to Manova's setting, c_{js} captures differences in aggregate productivity, factor prices, and factor intensities across countries and sectors. And the entrepreneur is randomly matched with a manager. After the match, a firm is set up, the manager and the investor discuss an implementable idea with initial quality ρ, which is randomly realized drawing from a cumulative distribution function $F(\rho)$, which does not depend on j and s.

Second, the manager makes his occupational choice. He can quit the firm and become a worker, in which case the entrepreneur receives zero profit afterwards. Alternatively, he can choose to work for the entrepreneur and exert effort ψ, to develop the implementable idea that leads to a blueprint for a product (i.e., variety ω).

Third, if the manager chooses to work for the entrepreneur, the entrepreneur needs to decide whether or not to pay a fixed production cost $c_{js}f_{js}$ to start production and a fixed cost $c_{js}f_{ji}$ to export to country i, where $f_{ji} > 0$ for $i \neq j$ and $f_{ji} > f_{jj} = f_{js} = 0$. Firms need to incur a larger cost to export than just to serve the domestic market. An iceberg trade cost is incurred so that $\tau_{ji} > 1$ units of a variety need to be shipped for 1 unit to arrive from country j to i. We assume that the entrepreneur observes the overall quality of the implementable idea, which equals $\rho\psi$, when deciding whether or not to start production and export. The overall quality of the implementable idea determines the labor productivity of the firm in the subsequent production.

At this stage, the problem of financial frictions emerges. The entrepreneur needs to decide the optimal financial contract with investor. The details will be discussed in next section. The entrepreneur is willing to produce, if and only if the operating profit can cover the fixed costs the entrepreneur should pay and the money he should pay back to the lender.

Fourth, if the production starts, the manager decides the price and quantity in each market given external credit F chosen by the entrepreneur. At this point, firms compete with each other in each market, revenue is received, and the variable cost is paid. At this stage, the financial contract with investor is also enforced. At last, the operating profit is realized. The labor productivity of the firm is $\rho\psi(\rho)$. The manager will exert effort level $\psi(\rho)$ and the payoff is a fraction α of firm's operating profit minus the dis-utility of exerting that effort. The manager's effort depends on the initial firm productivity ρ and is not a continuous function of it. The detail of this point will be discussed in the following sections. The manager will choose an optimal effort level accordingly and becomes a worker if her payoff is lower than the outside option c_{js}. In the latter case, the entrepreneur will not produce and exit the market.

Finally, the entrepreneur and the manager bargain over the operating profit to receive income. They play a generalized Nash bargaining game. As a result, the manager and the entrepreneur receive fractions α and $1-\alpha$ of the operating profit, respectively.

3.2.3. The Firm's Problem under Open Economy

We incorporate the effect of credit constraints on exporting. We make the assumption that entrepreneurs need to finance their fixed costs in selling abroad only. The above assumption follows Manova (2013) which assumes that entrepreneurs finance their domestic activities with cash flows from operations, and they face liquidity constraints in financing their foreign sales.

Entrepreneurs face liquidity constraints in financing their domestic production and their exporting. While variable costs can be funded internally, a fraction $d_{jst} \in (0,1)$ of the fixed costs is borne up-front and has to be covered by outside capital for firms in sector s and they must pledge collateral to borrow in country j. A fraction of $t_{jst} \in (0,1)$ of the sunk entry cost is assumed to be used as collateral. d_{jst} and t_{jst} vary across sectors for technological reasons innate to a sector and are exogenous from the individual firms' perspective.

Countries differ in their level of financial contractibility. An investor can expect to be repayed with probability $\lambda_j \in (0,1)$, which is exogenous to the model and determined by the strength of j's financial institutions. With probability $(1-\lambda_j)$ the investor is not repayed, i.e. the entrepreneur defaults. In that case, the creditor seizes the collateral $t_{jst}c_{js}f_{ej}$. To continue operations and be able to borrow in the future, the entrepreneur then needs to replace this collateral.

Financial contracting proceeds as follows. In the beginning of each period, every entrepreneur makes a take-it-or-leave-it offer to a potential investor. This contract specifies the amount the entrepreneur needs to borrow, the repayment F , and the collateral in case of default. After that, the entrepreneur starts his operation and receives profits. Finally, the creditor receives repayment or the collateral.

3.2.4. Credit-Constrained Exporters

We consider the open economy. As discussed before, firms require outside capital for a fraction d_{jst} of the fixed costs associated with entering each market. Companies in sector s in country j has the probability λ_j to enforce contracts and t_s is fraction in sunk cost required as collateral. We consider the case of a multi-country world, for generalization. The ice-berg trade cost is $\tau_{jis} \geq 1$ and the fixed cost of entering market is f_{ji}. The entrepreneur's problem is represented as

$$\begin{aligned}\max_{p,q,F} \pi_{jis}(\rho,\psi) &= (1-\alpha)\left[p_{jis}(\rho,\psi)q_{jis}(\rho,\psi) - \frac{\tau_{jis}c_{js}}{\rho\psi(\rho)}q_{jis}(\rho,\psi)\right] \\ &\quad -(1-d_{jst})c_{js}f_{ji} - \lambda_j F(\rho,\psi) - (1-\lambda_j)t_{jst}c_{js}f_{ej} \end{aligned} \tag{46}$$

$$\begin{aligned} s.t. \quad (46,1) \quad & q_{jis}(\rho,\psi) = \left(\tfrac{p_{jis}(\rho,\psi)}{P_{is}}\right)^{-\sigma_s} \tfrac{\mu_s Y_i}{P_{is}}, \\ (46,2) \quad & A_{js}(\rho,\psi) \equiv (1-\alpha)\left[p_{jis}(\rho,\psi)q_{jis}(\rho,\psi) - \tfrac{\tau_{jis}c_{js}}{\rho\psi(\rho)}q_{jis}(\rho,\psi)\right] - (1-d_{jst})c_{js}f_{ji} \geq F(\rho,\psi), \\ (46,3) \quad & B_{jis}(\rho,\psi) \equiv -d_{jst}c_{js}f_{ji} + \lambda_j F(\rho,\psi) + (1-\lambda_j)t_{jst}c_{js}f_{ej} \geq 0. \end{aligned}$$

Following Manova (2013) investors break even in expectation and producers adjust the payment $F(\rho,\psi)$ so that $B_{jis}(\rho,\psi) = 0$. Here, we follow Manova (2012) to assume that $t_{jst}c_{js}f_{ej} \leq d_{jst}c_{js}f_{ji}$, so that we can get

$$(1-d_{jst})c_{js}f_{ji} + F(\rho,\phi) \geq (1-d_{jst})c_{js}f_{ji} + \lambda_j F(\rho,\psi) + (1-\lambda_j)t_{jst}c_{js}f_{ej}$$

i.e. as long as condition (5.2) is satisfied, the entrepreneur will always get positive payoff. The operating profit $\tilde{\pi}_{jis}$ under this problem is

$$\tilde{\pi}_{jis} = \tfrac{1}{\sigma_s}R_{jis}(\rho,\psi) = \tfrac{1}{\sigma_s}\left(\tfrac{\sigma_s\tau_{jis}c_{js}}{(\sigma_s-1)P_{is}\rho\psi(\rho)}\right)^{1-\sigma_s}\mu_s Y_i = \tau_{jis}^{1-\sigma_s}\beta(\phi)\phi\eta_{jis},$$

where $\phi = \rho^{\sigma_s-1}$, $\beta = \psi^{\sigma_s-1}$ and $\eta_{jis} = \frac{c_{js}}{\sigma_s}(\frac{\sigma_s-1}{\sigma_s})^{\sigma_s-1}\mu_s Y_i$

3.2.5. Agency Problem

The manager's problem is represented by the following:

$$\max_{\psi} \quad \alpha\tilde{\pi}_{jis}(\rho,\psi) - c_{js}\gamma\psi^{\theta_0} \tag{47}$$

$$s.t. \quad \alpha\tilde{\pi}_{jis}(\rho,\psi) - c_{js}\gamma\psi^{\theta_0} \geq c_{js} \tag{48}$$

where $c_{js}\gamma\psi^{\theta_0}$ is the dis-utility of the manager and $\tilde{\pi}_{jis}$ is the operating profit of the firm. The setting follows Chen (2018). Similar to that paper, we assume the cost of effort $\theta_0 > \sigma_s - 1$. In the constraint, the outside option for the manager is normalized to be c_{js}. Using the transformation in the previous subsection, the manager's problem can be re-written as

$$\max_{\beta} \alpha\tau_{jis}^{1-\sigma_s}\beta(\phi)\phi\eta_{jis} - c_{js}\gamma\beta^{\theta} \tag{49}$$

$$\text{st. } \alpha\tau_{jis}^{1-\sigma_s}\beta(\phi)\phi\eta_{jis} - c_{js}\gamma\beta^{\theta} \geq c_{js}$$

and $\theta = \frac{\theta_0}{\sigma_s - 1}$, so that the dis-utility is convex in the effort.

If manager's participation constraint is satisfied, the solution to the optimization problem is

$$\beta(\phi) = \beta_x^*(\phi) = (\frac{\alpha\phi\eta_{jis}\tau_{jis}^{1-\sigma_s}}{\theta\gamma c_{js}})^{\frac{1}{\theta-1}} \tag{50}$$

The above is "first-best" effort.

3.2.6. Self-select into Exporting

It is worth noting here that when the initial quality ϕ is sufficiently small, the profit the entrepreneur gets from manager's first-best effort is not enough to cover the repayment, i.e. the condition (3.2.4) cannot be satisfied. Therefore, there exist a cutoff ϕ_{jis}^* below which the manager cannot compensate the entrepreneur by the first-best effort in market i. Formally, the cutoff is defined as

$$(1-\alpha)\tau_{jis}^{1-\sigma_s}\phi_{jis}^*\beta(\phi_{jis}^*)\eta_{jis} = (1-d_s)c_{js}f_{ji} + F(\rho,\psi)$$

Furthermore, an uninteresting case will occur if the manager choose to be a worker in a firm with ϕ_{jis}^*, so, we make the assumption that

$$\alpha\tau_{jis}^{1-\sigma_s}\beta(\phi_{jis}^*)\phi_{jis}^*\eta_{jis} - c_{js}\gamma\beta(\phi_{jis}^*)^{\theta} \geq c_{js}$$

or formally, the assumption is

$$\alpha \geq \frac{c_{jis}}{\left[D_{jis}(1-\frac{1}{\theta})+c_{jis}\right]} \tag{51}$$

and the cutoff is

$$\phi^*_{jis} = (\frac{D_{jis}}{1-\alpha})^{\frac{\theta-1}{\theta}}(\frac{\tau_{jis}^{\theta(\sigma-1)}c_{js}\theta\gamma}{\alpha\eta^\theta})^{\frac{1}{\theta}} \tag{52}$$

where $D_{jis} = (1-d_{jst})c_{js}f_{ji} + F(\rho, \phi)$.

It is argued by Chen (2018) that for managers working with firms with initial productivity lower than ϕ^*_{jis}, she can exert higher effort to induce the entrepreneur to enter market i and she still get payoff higher than the outside option. Her optimal effort level in this case should be $\beta(\phi^*_{jis})\frac{\phi^*_{jis}}{\phi}$, which decreases with the firm's initial productivity.

Finally, if the initial idea quality is too low, exerting effort $\beta(\phi^*_{jis})\frac{\phi^*_{jis}}{\phi}$ gives the manager the payoff lower than her outside option. In this case, the manager does not have the incentive to induce the entrepreneur to enter market i. Formally, this cutoff ϕ_x is defined as

$$\alpha\tau_{jis}^{1-\sigma_s}\beta(\phi^*_x)\phi^*_x\eta_{jis} - c_{js}\gamma(\beta(\phi^*_x)\frac{\phi^*_x}{\phi_x})^\theta = c_{js}$$

Solving the constraints, we can have the lower cutoff as

$$\phi_{jis} = \frac{(\alpha D_{jis})^{\frac{1}{\theta}}}{(\theta\left[\alpha D_{jis} - (1-\alpha)\right])^{\frac{1}{\theta}}}\phi^*_{jis} < \phi^*_{jis} \tag{53}$$

Figure 1 shows the relation between effort levels and firm's initial productivity, conditional on the entrepreneur entering market i. It plots the effort level $\beta(\phi)$ against ϕ.

3.2.7. Comparative Statistics

The two cutoffs are related to financial frictions both at sectoral and country levels. The cutoffs ϕ^*_{jis} and ϕ_{jis} are higher when external financial dependence (d_{jst}) is higher and when asset tangibility (t_{jst}) and country financial development λ_j are lower. In addition, country level financial development lowers the cutoffs more in financially more vulnerable sectors. The reasoning is that, since the financing cost is

$$D_{jis} = (1-d_{jst})c_{js}f_{ji} + F(\rho, \phi)$$

and the banker's constraints always binds. Then, the financing cost D_{jis} can be re-written as:

$$D_{jis} = c_{js}\left[f_{ji} + \frac{1-\lambda_j}{\lambda_j}(d_{jst}f_{ji} - t_{jst}f_{ej})\right]$$

These arguments is formalized by the following proposition.

Proposition 7. *The productivity cutoff for profitable exporting is higher in financially more vulnerable sectors and lower in financially more developed countries (* $\frac{\partial \phi^*_{jis}}{\partial d_{jst}} > 0$, $\frac{\partial \phi^*_{jis}}{\partial t_{jst}} < 0$*,and* $\frac{\partial \phi^*_{jis}}{\partial \lambda_j} < 0$*). Financial developments lowers this cutoff relatively more in financially more vulnerable sectors (* $\frac{\partial^2 \phi^*_{jis}}{\partial d_{jst}\partial \lambda_j} < 0$ *and* $\frac{\partial^2 \phi^*_{jis}}{\partial t_{jst}\partial \lambda_j} > 0$*).*

Proof. The cutoff ϕ^*_{jis} increases with the fixed cost D_{jis}:

$$\frac{\partial \phi^*_{jis}}{\partial D_{jis}} = \frac{\theta-1}{\theta}\frac{\tau_{jis}^{\theta(\sigma_s-1)}c_{js}\theta\gamma}{\alpha(1-\alpha)^{\theta-1}\eta^{\theta}}D_{jis}^{-\frac{1}{\theta}} > 0$$

, with $\theta > 1$ With the functional form of D_{jis}, the following relations hold:

$$\frac{\partial D_{jis}}{\partial d_{jst}} = c_{js}f_{ji}\frac{1-\lambda_j}{\lambda_j} > 0 \tag{54}$$

$$\frac{\partial D_{jis}}{\partial t_{jst}} = -c_{js}f_{ej}\frac{1-\lambda_j}{\lambda_j} < 0 \tag{55}$$

$$\frac{\partial D_{jis}}{\partial \lambda_j} = -\frac{c_{js}}{\lambda_j^2}(d_{jst}f_{ji} - t_{jst}f_{ej}) < 0 \tag{56}$$

$$\frac{\partial^2 D_{jis}}{\partial d_{jst}\partial \lambda_j} = -c_{js}f_{ji}\frac{1}{\lambda^2} < 0 \tag{57}$$

$$\frac{\partial^2 D_{jis}}{\partial t_{jst}\partial \lambda_j} = c_{js}f_{ej}\frac{1}{\lambda_j^2} > 0 \tag{58}$$

With equations (13)-(17), we can then arrive at the following implications:

$$\frac{\partial \phi^*_{jis}}{\partial d_{jst}} = \frac{\partial \phi^*_{jis}}{\partial D_{jis}}\frac{\partial D_{jis}}{\partial d_{jst}} > 0$$

$$\frac{\partial \phi^*_{jis}}{\partial d_{jst}} = \frac{\partial \phi^*_{jis}}{\partial D_{jis}}\frac{\partial D_{jis}}{\partial t_{jst}} < 0$$

$$\frac{\partial \phi^*_{jis}}{\partial d_{jst}} = \frac{\partial \phi^*_{jis}}{\partial D_{jis}}\frac{\partial D_{jis}}{\partial \lambda_j} < 0$$

$$\frac{\partial^2 \phi^*_{jis}}{\partial t_{jst}\partial \lambda_j} = \frac{\partial}{\partial t_{jst}}\frac{\partial \phi^*_{jis}}{\partial D_{jis}}\frac{\partial D_{jis}}{\partial \lambda_j} = \frac{\theta-1}{\theta}f_{ej}D^{\frac{-1}{\theta}}\frac{\tau_{jis}^{\theta(\sigma_s-1)}c_{js}\theta\gamma}{\alpha(1-\alpha)^{\theta-1}\eta^{\theta}}\frac{c_{js}}{\lambda_j^2} > 0$$

$$\frac{\partial^2 \phi^*_{jis}}{\partial d_{jst}\partial\lambda_j} = \frac{\partial}{\partial d_{jst}}\frac{\partial\phi^*_{jis}}{\partial D_{jis}}\frac{\partial D_{jis}}{\partial\partial\lambda_j} = -\frac{\theta-1}{\theta} f_{ji} D^{\frac{-1}{\theta}} \frac{\tau_{jis}^{\theta(\sigma_s-1)} c_{js}\theta\gamma}{\alpha(1-\alpha)^{\theta-1}\eta^{\theta}} \frac{c_{js}}{\lambda_j^2}\frac{c_{js}}{\lambda_j^2} < 0$$

QED

At this stage, it can be implied that final productivity and financial development are substitutes. In other word, when financial development is low, firms with the lower productivity need to be more productive to produce and export, since the probability of exporting of a firm f in country j to country i in sector s is

$$M_{fjis} = \frac{\phi_H - \phi_{jis}}{\phi_H - \phi_L} \tag{59}$$

where it's assumed that $\phi \in [\phi_L, \phi_H]$, then we can derive the following:

$$\frac{\partial M_{fjis}}{\partial d_{jst}} < 0,\ \frac{\partial M_{fjis}}{\partial t_{jst}} > 0, \text{and } \frac{\partial M_{fjis}}{\partial \lambda_j} > 0,$$

$$\frac{\partial^2 M_{fjis}}{\partial d_{jst}\partial\lambda_j} > 0 \text{ and } \frac{\partial^2 M_{fjis}}{\partial t_{jst}\partial\lambda_j} < 0$$

For a firm with initial productivity $\phi \in [\phi_{jis}, \phi^*_{jis}]$, the final productivity is

$$\beta(\phi)\phi = \frac{\beta(\phi^*_{jis})\phi^*_{jis}}{\phi}\phi = (\frac{\alpha\eta_{jis}\tau_{jis}^{1-\sigma_s}}{\theta\gamma c_{js}})^{\frac{1}{\theta-1}} \phi_{jis}^{*\frac{\theta}{\theta-1}}$$

Additionally, for an exporting firm from j to i, manager's effort levels increases with financial frictions, if firms' initial productivity is between the two thresholds. We apply similar rationale here. For such a firm with $\phi \in [\phi_{jis}, \phi^*_{jis}]$, manager's effort is

$$\beta(\phi) = \beta^*_{jis}(\phi^*_{jis})(\frac{\phi^*_{jis}}{\phi}) = (\frac{\alpha\eta_{jis}\tau_{jis}^{1-\sigma_s}}{\theta\gamma c_{js}})^{\frac{1}{\theta-1}} \frac{\phi_{jis}^{*\frac{\theta}{\theta-1}}}{\phi} \tag{60}$$

Since ϕ_{jis} increases with d_{jst} and decrease with λ_j, the following relations hold:

$$\frac{\partial\beta(\phi)}{\partial d_{jst}} > 0,\ \frac{\partial\beta(\phi)}{\partial t_{jst}} < 0 \text{ and } \frac{\partial\beta(\phi)}{\partial\lambda_j} < 0$$

$$\frac{\partial^2 \beta_{jis}(\phi)}{\partial d_{jst}\partial\lambda_j} < 0 \text{ and } \frac{\partial^2\beta(\phi)}{\partial t_{jst}\partial\lambda_j} > 0$$

Thus, we can conclude that to some extent, the optimal effort and financial development are substitutes for the firms in the margin of surviving. When the firm face less financial frictions, managers working with that firm can exert less effort so that the firm can export. Figure 2 and Figure 3 compare the effort levels of two firms selling in market i with different

λ_j. Note that 2 cases exist here. In Figure 2, when financial frictions (or trade costs) the two firms face does not differ too much , the higher cutoff of the less constrained firm is still higher than the lower cutoff of the more constrained firm. In Figure 3, when financial frictions (or trade costs) the two firms face differ to a large extent, the higher cutoff of the less constrained firm is even lower than the lower cutoff of the more constrained. In both cases, it's evident that financial constraints lead to higher efforts for marginal exporting firms in the destination market.

3.2.8. The Role of Agency Problem

In this subsection, we explore how the agency problem affects changes in firm productivity in the multi-country model, since some firms still are not subject to the agency problem in reality. In order do this, we consider a world without the agency problem. As there is no separation of ownership and control for firms in this alternative world, the manager (i.e., the owner) chooses the effort to maximize the total profit.

In this case, the manager (owner) has the objective function of

$$\max_{\beta} \phi\beta(\phi)\eta_{jis} - c_{js}\gamma\beta^{\theta} \tag{61}$$

$$st.\phi\beta(\phi)\eta_{jis} - c_{js}\gamma\beta^{\theta} \geq (1 - d_{jst})c_{js}f_{ji} + F(\rho, \psi)$$

Therefore, the "first-best" effort is

$$\beta(\phi) = \left(\frac{\eta_{jis}\phi}{c_{jis}\gamma\theta}\right)^{\frac{1}{\theta-1}} \tag{62}$$

In a world without the agency problem, the introduction of the manager's effort choice into Melitz (2003) does not change the property of the Melitz model. Namely, the ratio of the payoff for two owners with differential initial draws is still proportional to the ratio of the initial quality draws. Therefore, all the results obtained in Melitz (2003) also work here.

3.3. Empirical Specification and Data

To provide evidence for the theories above, we run a reduced form regression of management scores on various credit constraints variables, firm productivity, and interactions of them.

The empirical specification takes the following form

$$\begin{aligned} ManagementScore_{fsit} &= \alpha_0 + \alpha_1 FinDev_{it} + \alpha_2 Ext.Dep_{it} \times Ext.Dep_{ist} \\ &+ \alpha_3 FinDev \times Productivity_{fst} + X_{fst} + \psi_t + \psi_s + \psi_{mne} + \psi_i + \epsilon_{fst} \end{aligned} \tag{63}$$

where $ManagementScore_{fsit}$ denotes the management score of firm f in sector s at year t in country i, $FinDev_{it}$ denotes the financial development level of country i at year t, $FinVul_{ist}$ denotes the financial vulnerability of sector s at year t in country i, $Productivity_{fst}$ is the initial productivity of firm f at sector s at year t, and X_{fst} is the vector of firm-level characteristics such as the proportion of exports and its ownership, etc. ψ_t, ψ_s, ψ_{mne} and ψ_i are year, sector, MNE, and country fixed effects. ϵ_{fsit} is the idiosyncratic error. The data are further split to observations with firm size above 7 and those below 7. Under the theoretical framework, estimated coefficients are expected to be significant if samples with firm size below 7 and insignificant using firms with firm size above 7[47].

Following Chen (2018) and Bloom and Van Reenen (2007), the major dataset we use here is World Management Survey (WMS) which is the major project by WMS team. Here, we only focus on exporting firms.

The dataset is intended to measure the quality of management practices in establishments in various countries. The data is at firm-year level from 20 countries[48] in all manufacturing sectors (at 3-digit SIC levels). The advantage of the dataset is that it provides measures of managerial efforts by 18 management practice questions. For instance, good monitoring and good system of rewarding are related to more hard-working managers. So, the average score of the 18 management questions serves as the proxy for efforts. In addition, the log of employment serves as the proxy for initial productivity. Another advantage of the dataset is that it provides other firm-level characteristics such as the proportion of outputs exported (export intensity)[49], the proportion of managers (and non-managers) with a college degree, number of competitors, and multi-national corporation (MNC) (local and foreign) identity.

The summary statistics are presented in Table 1. As Table 1 suggests, the average of management score is slightly less than 3, with a relatively small standard deviation. The (log) firm size has an average of around 6.2 with a standard deviation of 1.481. Firms differ to a large extent in terms of exports, with the mean proportion of exporting 31.96%. Notice

[47] other threshold values such as 6.5 and 7.5 are also used and we get similar results as here

[48] These 20 countries are: Argentina, Australia, Chile, China, France, Germany, Greece, India, Italy, Japan, Mexico, New Zealand, Poland, Portugal, Ireland, Sweden, United Kingdom and United States

[49] For missing values, we let them equal to the last observation for a given firm

that the employment rigidity index and PPP-to-GDP ratio are at country-year level.

Secondly, the financial constraint data are from two sources. The national level financial development data is obtained from World Bank, which provides the database of indicators of financial developments across more than 120 countries and over 1960 to 2011. Of the 31 indicators, the variable "Private Credit by Banks and Other Financial Institutions as to GDP" is selected to proxy λ_j, following J. M. Chan and Manova (2015). Table 2 summarizes financial development across countries and years. Additionally, sectoral financial vulnerability is calculated following Braun (2005), which are based on global publicly listed companies from Compustat's annual industry files. The industry level financial vulnerability is proxied by external financial dependence (EFD_{jst}), which is defined as the share of capital expenditures not financed with cash flows from operations (Rajan and Zingales 1998). Different from previous work, we construct EFD_{jst} at country-industry-year basis, to capture possible changes in industrial developments. Thus, we firstly calculate the EFD at firm level and then choose the median value firm each country-year-industry group (Bilir et al. 2016). As Table 38 shows, the external dependence has a larger variation across years than across country-industry pairs.

From the Table 37, it's inferred that financial development differs both across countries and years. The gaps in credits among countries are much larger than that over years. Also, industry-specific external dependence are reported in Table 38 for 27 SIC 3- digit industries across countries and years in the Compustat firm sample. External finance dependence has a higher standard deviation. Further, they have a weak correlation of -0.0408, i.e. an industry can have a high asset tangibility while rely heavily on external financial resources.

In this study, we match country-level financial development and vulnerability data with WMS data. In the WMS data, the industrial classification is SIC (3-digits), which is then transferred to ISIC Rev.3 according to Haveman's Industrial Concordance. The ISIC Rev. 3 codes are further transferred to ISIC Rev. 2, which is used as industrial classification in Braun (2003) financial vulnerability.

3.4. Results

In this section, we discuss the results in the above empirical studies and rationale for them are discussed. Samples are separated into two parts: those with (log) firm size below or equal to 7 and those above 7 and other thresholds around 7 are also used. Firstly, we examine the theoretical predictions by using different aspects of managerial efforts as the dependent variable. The productivity threshold selected here is (log) employment of 7: Table 39 uses the sub-sample of firms with (log) employment less than or equal to 7.

In general, point estimates are in line with theoretical predictions. The coefficients on credit-to-GDP ratio are negative and significant when dependent variable is "management"; the interaction term of credit-GDP ratio with (the dummy of) higher external dependence (FinDev*Ext.Dep) is negative and significant. They are robust when adding additional controls (comparing Column 1 and 2; Column 3 and 4, with the exception of using dependent variable "people"). Thus, if a firm is in an industry with low external financial dependence, 1% increase in loan-to-GDP ratio decreases the managerial score by 0.0017; if a firm is in an industry with higher external financial dependence, corresponding managerial score decreases by 0.0018, other conditions held constant.

To completely examine our theoretical models, we use the same empirical specification but focus on firms with higher productivity. Thus, in Table 40, we use firms with (log) employment higher than 7. As Table 40 shows, non of the corresponding point estimates are significant for larger firms. It is then implied that our model prediction that the management efforts in the most productive firms are not affected by financial constraints in the exporting market.

We further add robustness to the above results by altering the productivity cutoff. Table 41 shows results using firms with (log) employment lower than 7.5 and Table 42 reports results using those with (log) employment lower than 6.5. As is shown by Table 41 and Table 42, point estimates remain stable over different sub-samples.

3.5. Conclusion

The paper presents a model which captures the coexistence of financial constraints outside a firm and agency problem inside a firm. The main prediction in the model is that for *some* exporting firms entering foreign market, agency problems can arise from credit frictions, since managers are incentivized to exert more effort to induce their owners to export to a market. That substitution effect *does not* apply to firms with large enough initial productivity since they are not subject to financial constraints. Finally, smallest firms does not export since revenues from manager's second-best efforts are not high enough to cover financing costs.

Using WMS data, we provide evidence to support the model predictions on relationship between managerial effort and financial constraints. In the data, only managerial efforts in small-and-medium size exporting firms are affected by financial constraints. The biggest firms' managerial efforts are invariant to credit frictions at industry and country levels.

From the above analysis, we identify a new mechanism through which financial constraints affect trade. Nevertheless, much remains to be done. From the theoretical point, a more comprehensive work can be done in exploring the effect of trade costs in managerial incentives/efforts. Welfare analysis can be taken in a counter-factual practice such as raising loan ratio by 10% in the economy.

References

Acemoglu, Daron and Simon Johnson (2005). "Unbundling Institutions". *Journal of Political Economy* 113 (5), pp. 949–995.

Alfaro, Laura and Andrew Charlton (Dec. 2009). "Intra-industry Foreign Direct Investment". *American Economic Review* 99 (5), pp. 2096–2119.

Allen, Treb and David Atkin (2016). *Volatility and the Gains from Trade*. NBER Working Paper 22276.

Anderson, James E. and Eric van Wincoop (2003). "Gravity with Gravitas: A Solution to the Border Puzzle". *American Economic Review* 93 (1), pp. 170–192.

Anderson, James E. and Yoto V. Yotov (2016). "Terms of trade and global efficiency effects of free trade agreements, 1990–2002". *Journal of International Economics* 99, pp. 279–298.

Antoniades, Alexis (2015). "Heterogeneous Firms, Quality, and Trade". *Journal of International Economics* 95 (2), pp. 263–273.

Antràs, Pol, Mihir A. Desai, and C. Fritz Foley (2007). "Multinational Firms, FDI Flows and Imperfect Capital Markets". *Quarterly Journal of Economics* 124 (3), pp. 1171–1129.

Antràs, Pol and Elhanan Helpman (2004). "Global Sourcing". *Journal of Political Economy* 112 (3), pp. 552–580.

Arkolakis, Costas, Natalia Ramondo, Andrés Rodríguez-Clare, and Stephen Yeaple (2018). "Innovation and Production in the Global Economy". *American Economic Review* 108 (8).

Atkeson, Andrew and Ariel Burstein (2008). "Pricing-to-Market, Trade Costs, and International Relative Prices". *American Economic Review* 98 (5), pp. 1998–2031.

Baldwin, Richard and James Harrigan (2011). "Zeros, Quality, and Space: Trade Theory and Trade Evidence". *American Economic Journal: Microeconomics* 3 (2), pp. 60–88.

Baller, Silja (2015). *Market Size, Trade and Quality: Evidence from French Exporters*. CEPII Working Papers 2015-14.

Bas, Maria and Vanessa Strauss-Kahn (2015). "Input-Trade Liberalization, Export Prices and Quality Upgrading". *Journal of International Economics* 95 (2), pp. 250–262.

Bellone, Flora, Patrick Musso, Lionel Nesta, and Frederic Warzynski (2016). "International Trade and Firm-Level Markups When Location and Quality Matter". *Journal of Economic Geography* 16 (1), pp. 67–91.

Bénassy-Quéré, Agnès, Maylis Coupet, and Thierry Mayer (2007). "Institutional Determinants of Foreign Direct Investment". *The World Economy* 30 (5), pp. 764–782.

Bilir, Kamran, Davin Chor, and Kalina Manova (Apr. 2016). *Host-Country Financial Development and Multinational Activity*. NBER Working Paper 20046.

Bloom, Nicholas and John Van Reenen (2007). "Measuring and Explaining Management Practices Across Firms and Countries". *The Quarterly Journal of Economics* 122 (4), pp. 1351–1408.

Braun, Matias (2005). *Financial Contractability and Asset Hardness*. Working Paper 2522890. Universidad Adolfo Ibanez.

Cai, Hongbin, Hanming Fang, and Lixin Colin Xu (2011). "Eat, Drink, Firms, Government: An Investigation of Corruption from the Entertainment and Travel Costs of Chinese Firms". *The Journal of Law Economics* 54 (1), pp. 55–78. ISSN: 00222186, 15375285.

Castellani, Davide and Katiuscia Lavoratori (2017). *Location of RD abroad. An analysis on Global Cities*. John H Dunning Centre for International Business Discussion Papers jhd-dp2017-03. Henley Business School, Reading University.

Chan, Jackie M.L. and Kalina Manova (2015). "Financial Development and the Choice of Trade Partners". *Journal of Development Economics* 116, pp. 122–145. ISSN: 0304-3878.

Chan Jackie, M.L. and Huanhuan Zheng (Jan. 2017). “Migrant Networks, Greenfield FDI, and Cross-Border Mergers and Acquisitions”. *SSRN Electronic Journal*.

Chang, Pao-Li and Chia-Hui Lu (2012). “Risk and the technology content of FDI: A dynamic model”. *Journal of International Economics* 86 (2), pp. 306–317. ISSN: 0022-1996.

Chen, Cheng (2018). *Trade Liberalization, Agency Problem and Aggregate Productivity*. FREIT Working Paper 936. Hong Kong University.

Corcos, Gregory, Massimo Del Gatto, Giordano Mion, and Gianmarco I.P. Ottaviano (2011). “Productivity and Firm Selection: Quantifying the ‘New’ Gains from Trade”. *The Economic Journal* 122 (561), pp. 754–798.

Costinot, Arnaud (2004). *Imperfect Contract Enforcement, Firm Size, and the Pattern of Trade*. Princeton University Working Paper.

Crozet, Matthieu, Keith Head, and Thierry Mayer (2012). “Quality Sorting and Trade: Firm-level Evidence for French Wine”. *The Review of Economic Studies* 79 (2), pp. 609–644.

Cuervo-Cazurra, Alvaro (2008). “Transforming disadvantages into advantages: developing-country MNEs in the least developed countries”. *Journal of International Business Studies* 39 (957), pp. 957–979. ISSN: 0047-2506.

Darby, Julia, Rodolphe Desbordes, and Ian Wooton (2009). “Does public governance always matter? How experience of poor institutional quality influences FDI to the South”.

Demir, F. Banu (Dec. 2011). *Trading Tasks and Quality*. University of Oxford Department of Economics Economics Series Working Papers 582.

Dilek, Aykut and Ratha Dilip (2004). “South-South FDI flows: how big are they?” *Transnational Corporations* 13 (1), pp. 149–176.

Dixit, Avinash (2012). “Governance, development, and foreign direct investment”.

Eckel, Carsten, Leonardo Iacovone, Beata Javorcik, and J. Peter Neary (2015). “Multi-Product Firms at Home and Away: Cost- versus Quality-based Competence”. *Journal of International Economics* 95 (2), pp. 216–232.

Faccio, Mara (2006). “Politically Connected Firms”. *The American Economic Review* 96 (1), pp. 369–386. ISSN: 00028282.

Fajgelbaum, Pablo, Gene M. Grossman, and Elhanan Helpman (2011). “Income Distribution, Product Quality, and International Trade”. *Journal of Political Economy* 119 (4), pp. 721–765.

— (2014). “A Linder Hypothesis for Foreign Direct Investment”. *The Review of Economic Studies* 82 (1), pp. 83–121. ISSN: 0034-6527.

Fajgelbaum, Pablo and Amit Khandelwal (2016). "Measuring the Unequal Gains from Trade". *The Quarterly Journal of Economics* 131 (3), pp. 1113–1180.

Fan, Haichao, Yao Amber Li, Sichuang Xu, and Stephen Ross Yeaple (2018). *Quality, Variable Markups, and Welfare: A Quantitative General Equilibrium Analysis of Export Prices*. HKUST Working Papers 92813.

Fan, Haichao, Yao Amber Li, and Stephen R. Yeaple (2015). "Trade Liberalization, Quality, and Export Prices". *The Review of Economics and Statistics* 97 (5), pp. 1033–1051.

Feenstra, Robert C. and John Romalis (2014). "International Prices and Endogenous Quality". *The Quarterly Journal of Economics* 129 (2), pp. 477–527.

Fieler, Ana Cecília (2011). "Nonhomotheticity and Bilateral Trade: Evidence and a Quantitative Explanation". *Econometrica* 79 (4), pp. 1069–1101.

Fisman, Raymond (2001). "Estimating the Value of Political Connections". *The American Economic Review* 91 (4), pp. 1095–1102. ISSN: 00028282.

Foley, C. Fritz and Kalina Manova (2015). "International Trade, Multinational Activity, and Corporate Finance". *Annual Review of Economics* 7, pp. 119–146.

Foster, Lucia, John Haltiwanger, and Chad Syverson (2008). "Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?" *American Economic Review* 98 (1), pp. 394–425.

Frye, T and E Zhuravskaya (2000). "Rackets, Regulation, and the Rule of Law". *The Journal of Law, Economics, and Organization* 16 (2), pp. 478–502. ISSN: 8756-6222.

Garetto, Stefania (2013). "Input Sourcing and Multinational Production". *American Economic Journal: Macroeconomics* 5 (2), pp. 118–151. ISSN: 19457707, 19457715.

Gaulier, Guillaume and Soledad Zignago (2010). *BACI: International Trade Database at the Product-Level. The 1994-2007 Version*. CEPII Working Papers 2010-23.

Gervais, Antoine (2016). "Product quality and firm heterogeneity in international trade". *Canadian Journal of Economics/Revue canadienne d'économique* 48 (3), pp. 1152–1174.

Grossman, Gene.M. (2004). "The Distribution of Talent and the Pattern and Consequences of International Trade". *Journal of Political Economy* 112 (1), pp. 209–239. ISSN: 00223808, 1537534X.

Grunert, Klaus G. (2005). "Food quality and safety: consumer perception and demand". *European Review of Agricultural Economics* 32 (3), pp. 369–391.

Habib, Mohsin and Leon Zurawicki (2002). "Corruption and Foreign Direct Investment". *Journal of International Business Studies* 33 (2), pp. 291–307. ISSN: 00472506, 14786990.

Hallak, Juan Carlos (2006). “Product quality and the direction of trade”. *Journal of International Economics* 68 (1), pp. 238–265. ISSN: 0022-1996.

Hallak, Juan Carlos and Jagadeesh Sivadasan (2009). *Firms' Exporting Behavior under Quality Constraints*. NBER Working Paper 14928.

Hay, Jonathan R. and Andrei Shleifer (1998). “Private Enforcement of Public Laws: A Theory of Legal Reform”. *The American Economic Review* 88 (2), pp. 398–403. ISSN: 00028282.

Hellman, Joel S, Geraint Jones, and Daniel Kaufmann (2003). “Seize the state, seize the day: state capture and influence in transition economies”. *Journal of Comparative Economics* 31 (4), pp. 751–773. ISSN: 0147-5967.

Helmke, Gretchen and Steven Levitsky (2004). “Informal Institutions and Comparative Politics: A Research Agenda”. *Perspectives on Politics* 2 (4), pp. 725–740. ISSN: 15375927, 15410986.

Helpman, Elhanan, Marc J. Melitz, and Yona Rubinstein (2008). “Estimating Trade Flows: Trading Partners and Trading Volumes”. *The Quarterly Journal of Economics* 123 (2), pp. 441–487.

Irarrazabal, Alfonso, Andreas Moxnes, and Luca David Opromolla (2013). “The Margins of Multinational Production and the Role of Intrafirm Trade”. *Journal of Political Economy* 121 (1), pp. 74–126. ISSN: 00223808, 1537534X.

J.P.Chen, Charles, Zengquan Li, Xijia Su, and Zheng Sun (2011). “Rent-seeking incentives, corporate political connections, and the control structure of private firms: Chinese evidence”. *Journal of Corporate Finance* 17 (2). Corporate Finance and Governance in Emerging Markets, pp. 229–243. ISSN: 0929-1199.

Kalemli-Ozcan, Sebnem, Bent Sorensen, Carolina Villegas-Sanchez, Vadym Volosovych, and Sevcan Yesiltas (2015). *How to Construct Nationally Representative Firm Level data from the ORBIS Global Database*. NBER Working Paper 21558.

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi (2011). “The Worldwide Governance Indicators: Methodology and Analytical Issues”. *Hague Journal on the Rule of Law* 3 (2), pp. 220–246. ISSN: 1876-4053.

Khandelwal, Amit (2010). “The Long and Short (of) Quality Ladders”. *The Review of Economic Studies* 77 (4), pp. 1450–1476.

Kneller, Richard and Zhihong Yu (2016). “Quality Selection, Sectoral Heterogeneity and Chinese Exports”. *Review of International Economics* 24 (4), pp. 857–874.

Kroszner, Randall S., Luc Laeven, and Daniela Klingebiel (2007). “Banking crises, financial dependence, and growth”. *Journal of Financial Economics* 84 (1), pp. 187–228. ISSN: 0304-405X.

Kugler, Maurice and Eric Verhoogen (2012). “Prices, Plant Size, and Product Quality”. *Review of Economic Studies* 79 (1), pp. 307–339.

Levinsohn, James and Amil Petrin (2003). “Estimating Production Functions Using Inputs to Control for Unobservables”. *Review of Economic Studies* 70 (2), pp. 317–341.

Li, Hongbin, Lingsheng Meng, and Junsen Zhang (2006). “Why Do Entrepreneurs Enter Politics? Evidence from China”. *Economic Inquiry* 44 (3), pp. 559–578.

Mandel, Benjamin R. (2010). *Heterogeneous Firms and Import Quality : Evidence from Transaction-Level Prices*. Federal Reserve Board International Finance Discussion Papers 2010-991.

Manova, Kalina (2013). “Credit Constraints, Heterogeneous Firms, and International Trade”. *The Review of Economic Studies* 80 (2), pp. 711–744.

Manova, Kalina, Shang-Jin Wei, and Zhang Zhiwei (2015). “Firm Exports and Multinational Activity Under Credit Constraints”. *The Review of Economics and Statistics* 97 (3), pp. 574–588. ISSN: 0034-6535.

Manova, Kalina and Zhihong Yu (2017). “Multi-product firms and product quality”. *Journal of International Economics* 109, pp. 116–137. ISSN: 0022-1996.

Manova, Kalina and Zhiwei Zhang (2012). “Export Prices Across Firms and Destinations”. *The Quarterly Journal of Economics* 127 (1), pp. 379–436.

Markusen, James R. (1981). “Trade and the Gains from Trade with Imperfect Competition”. *Journal of International Economics* 11 (4), pp. 531–551.

Mayer, Thierry, Marc J. Melitz, and Gianmarco I. P. Ottaviano (2014). “Market Size, Competition, and the Product Mix of Exporters”. *American Economic Review* 104 (2), pp. 495–536.

Mayer, Thierry and Soledad Zignago (2011). *Notes on CEPII’s distances measures: The GeoDist database*. CEPII Working Papers 2011-25.

McMillan, J and C Woodruff (1999). “Dispute prevention without courts in Vietnam”. *The Journal of Law, Economics, and Organization* 15 (3), pp. 637–658. ISSN: 8756-6222.

McMillan, John and Christopher Woodruff (1999). “Interfirm Relationships and Informal Credit in Vietnam*”. *The Quarterly Journal of Economics* 114 (4), pp. 1285–1320. ISSN: 0033-5533.

Melitz, Marc J. (2003). “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity”. *Econometrica* 71 (6), pp. 1695–1725.

Melitz, Marc J. and Gianmarco I. P. Ottaviano (2008). “Market Size, Trade, and Productivity”. *The Review of Economic Studies* 75 (1), pp. 295–316.

Olley, G. Steven and Ariel Pakes (1996a). “The Dynamics of Productivity in the Telecommunications Equipment Industry”. *Econometrica* 64 (6), pp. 1263–1297. ISSN: 00129682, 14680262.

— (1996b). “The Dynamics of Productivity in the Telecommunications Equipment Industry”. *Econometrica* 64 (6), pp. 1263–1297.

Parikh, Ashok and Michiel Van Leuvensteijn (2003). “Interregional labour mobility, inequality and wage convergence”. *Applied Economics* 35 (8), pp. 931–941.

Pereira, Alexius A. (2002). “The Suzhou industrial park project (1994 - 2001): The failure of a development strategy”. *Asian Journal of Political Science* 10 (2), pp. 122–142.

Rajan, Raghuram G. and Luigi Zingales (1998). “Financial Dependence and Growth”. *The American Economic Review* 88 (3), pp. 559–586. ISSN: 00028282.

Ramondo, Natalia and Andrés Rodríguez-Clare (2013). “Trade, Multinational Production, and the Gains from Openness”. *Journal of Political Economy* 121 (2), pp. 273–322.

Silva, JMC Santos and Silvana Tenreyro (2006). “The Log of Gravity”. *The Review of Economics and Statistics* 88 (4), pp. 641–658.

Song, Michael (2014). *Crony Capitalism with Chinese Characteristics*. 2014 Meeting Papers 1145. Society for Economic Dynamics.

Sousa, José de (2012). “The currency union effect on trade is decreasing over time”. *Economics Letters* 117 (3), pp. 917–920. ISSN: 0165-1765.

Syverson, Chad (2007). “Prices, Spatial Competition and Heterogeneous Products: An Empirical Test”. *The Journal of Industrial Economics* 55 (2), pp. 197–222.

Tinbergen, Jan (1962). *Shaping the World Economy; Suggestions for an International Economic Policy*. Twentieth Century Fund, New York.

Trela, Irene and John Whalley (1990). “Global Effects of Developed Country Trade Restrictions on Textiles and Apparel”. *The Economic Journal* 100 (403), pp. 1190–1205.

UNCTAD, UN (2014). “World investment report 2014: Investing in the SDGs: An action plan”. *United Nations publication. Retrieved May* 5, p. 2015.

Van Beveren, Ilke (2012). “TOTAL FACTOR PRODUCTIVITY ESTIMATION: A PRACTICAL REVIEW”. *Journal of Economic Surveys* 26 (1), pp. 98–128.

Verhoogen, Eric (2008). “Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector”. *The Quarterly Journal of Economics* 123 (2), pp. 489–530.

Vogel, Jonathan (2007). “Institutions and moral hazard in open economies”. *Journal of International Economics* 71 (2), pp. 495–514. ISSN: 0022-1996.

Williamson, Oliver E. (2000). “The New Institutional Economics: Taking Stock, Looking Ahead”. *Journal of Economic Literature* 38 (3), pp. 595–613. ISSN: 00220515.

A. Appendix to Chapter 1

A.1. Multi-Product Extension

The theoretical model is based on single product. The setup in the model assumes that each firm produces one product only. However, it can be generalized to assume that each firm produces multiple products and sells to multiple countries. The utility function in (1) and the production cost in (4) remain unchanged. I follow Mayer et al. (2014) by assuming that there exist "product ladder" with increasing customization cost for products further from the core product. Specifically, I assume that each product m produced by a firm with core marginal cost c incurs the marginal cost of

$$v(m, c) = \lambda^{-m} c \tag{64}$$

with $\lambda \in (0, 1)$.

In the above setup, more peripheral products require higher customization costs. In (64), m is positive and represents the distance from the core product of firm c: $m = 0$ indicates that product m is the core product and higher m implies that product m requires higher adjustment cost. Higher m reflects decreasing product appeal. Thus, if a firm in country i decides to sell product m to country j, its total cost becomes

$$TC_{ij}(c, m) = q(c, m)(c + \mu_j z(c, m)) + \delta z(c, m)^2 \tag{65}$$

and its problem becomes:

$$\pi_{ij}(c, m) = \max_{q_j(c,m), z_j(c,m)} p_{ij}(c, m) q_{ij}(c, m) - TC_{ij}(c, m) \tag{66}$$

Similar to the case of single-product model, one can derive the optimal quality of product m as

$$z_{ij}(c, m) = \rho_{ij}(c_D^j - \tau_{ij}\lambda^{-m} c) \tag{67}$$

where $\rho_{ij} = L^j(\kappa_j - \mu_i)/\left(4\delta\gamma - L^j(\kappa_j - \mu_i)^2\right)$. Therefore, within a firm, more peripheral products are sold with lower quality. More productive firms provide higher-quality core products. Additionally, products are affected differently within a firm. A simple algebra in (67) implies that competitiveness of market j (revealed in trade costs and market size) imposes heterogeneous effects on products of different hierarchies. To see this, the first-order derivative of $z_{ij}(c,m)$ with respect to τ_{ij} is

$$\frac{\partial z_{ij}(c,m)}{\partial \tau_{ij}} = \rho_{ij}\left(\frac{\partial c_D^j}{\partial \tau_{ij}} - \lambda^{-m}c\right)$$

That derivative with respect to m is then

$$\frac{\partial^2 z_{ij}(c,m)}{\partial \tau_{ij}\partial m} = \rho_{ij}c\lambda^{-m}\ln\lambda \leq 0 \tag{68}$$

since $0 < \lambda < 1$. From (68), second order derivative implies that products closer to the core (lower m) are affected by market competition more significantly.

The number of products a firm can offer to the destination market depends on the firm-level marginal cost c. Firms with lower marginal cost c generally produce more products to a destination market. If the cost cutoff to export from i to j is c_x^{ij}, the number of products the firm $c \leq c_x^{ij}$ offers is

$$M_{ij}(c) = \max\left\{m \mid c \leq c_x^{ij}\lambda^m\right\} + 1$$

the total profit of firm c in exporting to country j is the sum of profits from all products:

$$\Pi_{ij}(c) = \sum_{m=0}^{M_{ij}(c)} \pi_{ij}(c,m) \tag{69}$$

A.1.1. Equilibrium

Similar to single product setting, a firm draws its marginal cost c prior to entry to the market with sunk cost f_e. The expected profit from selling to all markets equal to the sunk cost in equilibrium. The total expected profit can then be decomposed into profits from each product sold to each destination. This can then be expressed as

$$\sum_{j\in J}\int_0^{c_x^{ij}} \Pi_{ij}(c)dG(c) = \sum_{j\in J}\sum_{m=0}^{\infty}\left[\int_0^{\lambda^m c_x^{ij}} \pi_{ij}(c,m)dG(c)\right] = f_e \tag{70}$$

Again, I assume Pareto distribution of c. Thus the expected profit of a firm in country i can be expressed as

$$\frac{2c_M^{-k}}{(k+1)(k+2)}\left(1-\lambda^k\right)^{-1}\sum_{j\in J}\frac{L_j}{4\gamma}\left[1+(\kappa_j-\mu_i)\,\rho_{ij}\right]\tau_{ij}^{-k}\left(c_D^j\right)^{k+2} = f_e \tag{71}$$

The above form can be re-written for J countries. Thus, one can write the condition (71) in the matrix form in a similar manner as in single product setting. The cutoff c_D^j satisfies the following:

$$\left(c_D^j\right)^{k+2} = \frac{2\gamma(k+1)(k+2)(1-\lambda^k)f_e}{\mid B \mid} \frac{\sum_i C_{ij}\left(c_M^i\right)^k}{L_j} \tag{72}$$

where $\mid B \mid$ is the determinant of matrix B and C_{ij} is the cofactor of B_{ij}. Other parameters in (72) are defined in the similar manner as in single product setting. It is implied from the above condition that endogenous competitiveness can also depend on product flexibility λ: if $(1-\lambda^k)^{-1}$ is large, the cutoff is small and the market is more competitive.

Other aggregate variables are derived in the similar approach as in single product setup. It is important to notice that the product flexibility can vary across countries and sectors. The aggregate bilateral trade value from i to j also depends on the product flexibility and larger flexibility implies higher bilateral trade value. The expected number of entrants are also determined by the product flexibility.

$$r_{ij} = \frac{kN_i^E(c_m^i)^{-k}}{2(1-\lambda^k)\gamma} L^j(\tau_{ij})^{-(k+1)}\left(c_D^j\right)^{k+2}\left[1+(\kappa_j-\mu_i)\rho_{ij}\right]\left(\frac{1}{k(k+2)} + \frac{(\kappa_j+\mu_i)\rho_{ij}}{k(k+1)(k+2)}\right) \tag{73}$$

For computing the number of entrants, the matrix F becomes

$$\frac{2\gamma(k+1)(1-\lambda^k)(\alpha-c_D^i)}{\eta c_D^{i,k+1}}$$

A.2. Proofs of Propositions

A.2.1. Proof of Proposition 1

By the free entry condition in 15, we can obtain J conditions in the following form:

$$\left[1+(\kappa_1-\mu_i)\rho_{i1}\right]L_1\tau_{i1}^{-k}(c_D^1)^{k+2} + \ldots + \left[1+(\kappa_J-\mu_i)\rho_{iJ}\right]L_J\tau_{iJ}^{-k}(c_D^J)^{k+2} = 2\gamma(k+1)(k+2)f_e c_M^k \tag{74}$$

When $\tau_{ij} = \tau_{ji}$ and when there is a bilateral trade liberalization, the first-order condition with respect to $\tau_{ij}(\tau_{ji})$ implies the following:

$$\sum_{d\in J} B_{dd'}L_{d'}\frac{\partial (c_D^{d'})^{k+2}}{\partial \tau_{ij}^{-k}} = 0 \tag{75}$$

if $d \neq i, j$

and

$$\sum_{d' \in J} B_{id'} L_{d'} \frac{\partial (c_D^{d'})^{k+2}}{\partial \tau_{ij}^{-k}} + \frac{B_{ij}}{\tau_{ij}^{-k}} L_j (c_D^j)^{k+2} = 0 \tag{76a}$$

$$\sum_{d' \in J} B_{jd'} L_{d'} \frac{\partial (c_D^{d'})^{k+2}}{\partial \tau_{ji}^{-k}} + \frac{B_{ji}}{\tau_{ji}^{-k}} L_i (c_D^i)^{k+2} = 0 \tag{76b}$$

for countries i and j respectively.

Since $\frac{B_{ji}}{\tau_{ji}^{-k}} L_i c_D^i > 0$ and $\frac{B_{ij}}{\tau_{ij}^{-k}} L_j c_D^j > 0$, from (76), at least one of $\frac{\partial (c_D^{d'})^{k+2}}{\partial \tau_{ji}^{-k}}$ (or $\frac{\partial (c_D^{d'})^{k+2}}{\partial \tau_{ji}^{-k}}$, $d' \in \{1, ..., J\}$) is negative. However, if all of them are negative, the condition in (75) cannot be satisfied. The conditions in (75) and (76) can be written in the matrix form:

$$\mathbf{BLc'} = \mathbf{F} \tag{77}$$

where $\mathbf{B}$ and $\mathbf{L}$ is defined the same as in Section 1.3. $\mathbf{c'}$ is the vector with the d th element being $\partial (c_D^d)^{k+2} / \partial \tau_{ij}^{-k}$. On the right hand side, $\mathbf{F}$ is the vector with ith element being $-\frac{B_{ij}}{\tau_{ij}^{-k}} L_j c_D^j$, j th element being $-\frac{B_{ij}}{\tau_{ij}^{-k}} L_j c_D^j$ and other elements being 0. Thus, the sign of $\partial (c_D^d)^{k+2} / \partial \tau_{ij}^{-k}$ depend on those two non-zero elements, determinant and the cofactors of matrix $\mathbf{B}$:

$$\partial (c_D^d)^{k+2} / \partial \tau_{ij}^{-k} = -\frac{1}{\mid B \mid} \left(C_{di} \frac{B_{ij}}{\tau_{ij}^{-k}} L_j (c_D^j)^{k+2} + C_{dj} \frac{B_{ij}}{\tau_{ij}^{-k}} L_j (c_D^j)^{k+2} \right) \tag{78}$$

where C_{di} is the di th element in the cofactor matrix of $\mathbf{B}$.

A.2.2. Proof of Proposition 2

The proof of Proposition 2 is similar to Proposition 1. Taking the derivative of Equation (74) with respect to κ_j, one can obtain J equations in the following form:

$$\sum_{h \in J} B_{ih} L_h \frac{\partial (c_D^h)^{k+2}}{\partial \kappa_j} + \frac{\partial B_{ij}}{\partial \kappa_j} L_j (c_D^j)^{k+2} = 0 \tag{79}$$

In the matrix form, (79) can be written as

$$\mathbf{BL}\frac{\partial \mathbf{c}_D^{k+2}}{\partial \kappa_j} = \mathbf{G} \tag{80}$$

where $\mathbf{G}$ is the vector with with ith element being $\frac{\partial B_{ij}}{\partial \kappa_j} L_j (c_D^j)^{k+2} > 0$.

Thus, the vector of partial derivatives can be computed as:

$$\frac{\partial (c_D^i)^{k+2}}{\partial \kappa_j} = -\frac{L_j (c_D^j)^{k+2}}{L_i \mid B \mid} \sum_{h \in J} \mid C_{ih} \mid \frac{\partial B_{hj}}{\partial \kappa_j} \tag{81}$$

The sign of $\frac{\partial (c_D^i)^{k+2}}{\partial \kappa_j}$ depends on the determinant of $\mathbf{B}$ as well as its cofactors. By the definition of $\mathbf{B}$, $\frac{\partial B_{hj}}{\partial \kappa_j} > 0$, $\forall\ h$. Therefore, $\exists\ \mathbf{B}$ such that $\frac{\partial (c_D^i)^{k+2}}{\partial \kappa_j} > 0$, $\forall\ i,\ j$.

A.2.3. Proof of Proposition 3

Taking the derivative of (79) with respect to τ_{ij} (τ_{ji}), one can obtain two sets of equations, if the origin country is i or j, the following holds:

$$\sum_{h \in j} B_{i(j)h} L_h \frac{\partial^2 (c_D^h)^{k+2}}{\partial \kappa_j \partial \tau_{ij}^{-k}} + L_j \frac{\partial B_{i(j)j}}{\partial \tau_{ij}^{-k}} \frac{\partial (c_D^j)^{k+2}}{\partial \kappa_j} + \frac{\partial^2 B_{i(j)j}}{\partial \kappa_j \partial \tau_{ij}^{-k}} L_j (c_D^j)^{k+2} + L_j \frac{\partial B_{i(j)j}}{\partial \kappa_j} \frac{\partial (c_D^j)^{k+2}}{\partial \tau_{ij}^{-k}} = 0 \tag{82}$$

where $\frac{\partial B_{ij}}{\partial \tau_{ij}^{-k}} > 0$. If the origin country is not i or j, the following shall hold:

$$\sum_{h \in J} B_{dh} L_h \frac{\partial^2 (c_D^h)^{k+2}}{\partial \kappa_j \partial \tau_{ij}^{-k}} + L_j \frac{\partial B_{dj}}{\partial \kappa_j} \frac{\partial (c_D^j)^{k+2}}{\partial \tau_{ij}^{-k}} = 0 \tag{83}$$

If $\frac{\partial (c_D^j)^{k+2}}{\partial \tau_{ij}^{-k}}$, $\frac{\partial (c_D^j)^{k+2}}{\partial \kappa_j} < 0$, $\exists\ \mathbf{B}$ such that $\frac{\partial^2 (c_D^h)^{k+2}}{\partial \kappa_j \partial \tau_{ij}^{-k}} < 0$.

From the above polynomial equations, the higher B_{dh}, the lower $\frac{\partial^2 (c_D^h)^{k+2}}{\partial \kappa_j \partial \tau_{ij}^{-k}}$, i.e. more like that $\frac{\partial^2 (c_D^h)^{k+2}}{\partial \kappa_j \partial \tau_{ij}^{-k}} < 0$.

A.3. Productivity Estimation

I construct the firm-level measures based on the ORBIS enterprise database of Bureau van Dijk (BvD). This dataset provides comprehensive information on listed and de-listed private companies around the world. I use the financial module of the database. It provides firm-level financial report items including total revenues, employment, total assets, and research and development (R&D) expenses.[50]

I follow long-established methods of estimating firm productivity as a residual of Cobb-Douglas production function. In this regard, both methodologies proposed by Olley and Pakes (1996b) (OP) and Levinsohn and Petrin (2003) (LP) are possible candidates given the current dataset. I choose to estimate firm productivity based on LP, because the LP approach relies on intermediate inputs as a proxy rather than on investment, whose level may be non-positive and depends on the assumption of the depreciation rate. On the other hand, it is common that firms record positive use of materials/energy so that I preserve as many observations as possible.[51]

I choose to download recent 10 years of financial data for each firm. The missing values exist. Thus, this is an unbalanced panel. The procedure to estimate productivity is as follow. First, gross output, capital and total inputs are proxied by total revenues, total assets, and Costs of Goods Sold (COGS), respectively. The cost of material/energy (in short, material, henceforth) is calculated by COGS minus total wage payable, by the accounting definition of COGS, if material cost is unavailable. Second, these values are deflated to obtain the quantity counterpart.[52] The number of employees are directly observable from the data. Given the observations on gross output, labor, material, and capital, I estimate the production function based on the Stata program *levpet* using as instruments current capital, lagged material, lagged labor, lagged two year material and lagged capital. Because industries can vary in their production technologies, the estimation is done separately for each 3-digit NAICS sector. inputencodinglatin1

[50]Data are downloaded in US dollars.

[51]I also use OP as a robustness check and estimated productivities are similar.

[52]The total sales revenues are deflated by Consumer Price Index (CPI), the total assets deflated by the index of fixed asset investment deflator, and the material normalized by Producer Price Index (PPI). Currently, I use the US CPI (Total All Items) and PPI (for All Commodities), and construct the index of fixed asset investment deflator from gross fixed investment flows. They are retrieved from the US Federal Reserve Bank of St. Louis website, https://fred.stlouisfed.org/.

B. Appendix to Chapter 2

B.1. Location-Specific Institution Investments

In this alternative setup, we extend the benchmark framework and allow multinational firms to build local informal institutions at home I_h and in the host country I_d, separately. Nonetheless, the level of informal institution that a firm builds at home still affects, to some extents, its operation fixed cost in the host country. In particular, firms choose $I_h^{D,*}$ to minimize the fixed cost of local production: $F^D = f^D(r_h, I_h) + k_h(I_h)$, and $I_h^{FDI,*}$ and $I_d^{FDI,*}$ to minimize the fixed cost of multinational production: $F^{FDI} = f^D(r_h, I_h) + f^{FDI}(r_d, I_h, I_d) + k_h(I_h) + k_d(I_d)$.

The first order conditions for $I_h^{FDI,*}$ and $I_d^{FDI,*}$ are, respectively:

$$\frac{\partial f^D(r_h, I_h^{FDI,*})}{\partial I_h} + \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_h} + k_h'(I_h^{FDI,*}) = 0, \tag{84}$$

$$\frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_d} + k_d'(I_d^{FDI,*}) = 0. \tag{85}$$

Define $F^{D,*}(r_h)$ and $F^{FDI,*}(r_h, r_d)$ as the respective minimal fixed cost of local production and FDI. We make similar assumptions on $f^D(r_h, I_h)$ as in the benchmark, i.e., $f^D(r_h, I_h)$ strictly increases in r_h; strictly decreases in I_h; and (28). Furthermore, assume that $f^{FDI}(r_d, I_h, I_d)$ strictly increases in r_d; strictly decreases in I_h and I_d; and

$$\frac{\partial}{\partial r_d}\left(\frac{\partial f^{FDI}(r_d, I_h, I_d)}{\partial I_h}\right) < 0; \qquad \frac{\partial}{\partial r_d}\left(\frac{\partial f^{FDI}(r_d, I_h, I_d)}{\partial I_d}\right) < 0. \tag{86}$$

We also simplify the following analysis by assuming the neutral scenario that

$$\frac{\partial^2 f^{FDI}(r_d, I_h, I_d)}{\partial I_h \partial I_d} = 0, \tag{87}$$

such that there are no reinforcing effects of r_h on the choice of I_d through I_h. We discuss the possibility of reinforcing effects at the end of this section. Basically, the proposed mechanism is further strengthened.

(i) The investment in informal institution at home will be higher for firms engaging in multinational production than for firms engaging only in local production: $I_h^{FDI,*}(r_h, r_d) > I_h^{D,*}(r_h)$; (ii) The total fixed cost of production will be higher for multinational production than for local production: $F^{FDI,*}(r_h, r_d) > F^{D,*}(r_h)$; (iii) The total fixed cost of multinational production will be higher in FDI destination of poorer institutions: $dF^{FDI,*}/dr_d > 0$; (iv) For a given FDI destination, the total fixed cost of multinational production will be higher for MNEs based in countries of poorer institutions: $dF^{FDI,*}/dr_h > 0$.

Proof. (i) Using similar rationales as in the benchmark, we have

$$\begin{aligned}\frac{\partial F^{FDI}}{\partial I_h}|_{I_h=I_h^{D,*}} &= \frac{\partial f^D(r_h, I_h^{D,*})}{\partial I_h} + \frac{\partial f^{FDI}(r_d, I_h^{D,*}, I_d)}{\partial I_h} + k_h'(I_h^{D,*}) \\ &= \frac{\partial f^{FDI}(r_d, I_h^{D,*}, I_d)}{\partial I_h} < 0,\end{aligned}$$

where the second equality follows by the FOC condition for $I_h^{D,*}$: $\frac{\partial f^D(r_h, I_h^{D,*})}{\partial I_h} + k_h'(I_h^{D,*}) = 0$, and the inequality follows by the assumption that $f^{FDI}(r_d, I_h, I_d)$ strictly decreases in I_h. The sign implies that $I_h^{FDI,*} > I_h^{D,*}$.

(ii) Similarly as in the benchmark model, we can write the difference in the fixed costs as:

$$\begin{aligned}F^{FDI,*} - F^{D,*} &= \left\{F^{FDI,*} - F^D(r_h, I_h^{FDI,*})\right\} + \left\{F^D(r_h, I_h^{FDI,*}) - F^{D,*}\right\} \\ &= \left\{f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*}) + k_d(I_d^{FDI,*})\right\} + \left\{F^D(r_h, I_h^{FDI,*}) - F^{D,*}\right\} > 0,\end{aligned}$$

where the second equality follows by the definition of F^D and F^{FDI}, and $\left\{F^D(r_h, I_h^{FDI,*}) - F^{D,*}\right\} > 0$ follows by the definition of $F^{D,*}$ and the fact that $I_h^{FDI,*} \neq I_h^{D,*}$.

(iii) Taking the derivative of $F^{FDI,*}$ with respect to r_d, we have:

$$\begin{aligned}\frac{dF^{FDI,*}}{dr_d} &= \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial r_d} \\ &\quad + \frac{\partial F^{FDI}(r_h, r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_h}\frac{\partial I_h^{FDI,*}}{\partial r_d} + \frac{\partial F^{FDI}(r_h, r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_d}\frac{\partial I_d^{FDI,*}}{\partial r_d}, \\ &= \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial r_d} > 0, \qquad (88)\end{aligned}$$

where the second equality follows by the FOCs for $I_h^{FDI,*}$ and $I_d^{FDI,*}$ in (84) and (85) and the sign follows by the assumption that $f^{FDI}(r_d, I_h, I_d)$ strictly increases in r_d.

(iv) Similarly, we have

$$\frac{dF^{FDI,*}}{dr_h} = \frac{\partial f^D(r_h, I_h^{FDI,*})}{\partial r_h} + \frac{\partial F^{FDI}(r_h, r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_h}\frac{\partial I_h^{FDI,*}}{\partial r_h},$$
$$= \frac{\partial f^D(r_h, I_h^{FDI,*})}{\partial r_h} > 0, \tag{89}$$

by the FOC for $I_h^{FDI,*}$ in (84) and by the assumption that $f^D(r_h, I_h)$ strictly increases in r_h. QED

Multinational firms headquartered in countries of poorer institutions will invest more in informal institution at home: $\frac{\partial I_h^{FDI,*}(r_h,r_d)}{\partial r_h} > 0$. As a corollary, multinational firms headquartered in countries of poorer institutions will be more effective at reducing its overhead fixed cost at a given FDI destination: $\frac{df^{FDI}(r_d,I_h^{FDI,*},I_d^{FDI,*})}{dr_h} < 0$.

Proof. Take total differentiation of (84) with respect to r_h and $I_h^{FDI,*}$, we have

$$\frac{\partial I_h^{FDI,*}}{\partial r_h} = -\frac{\frac{\partial^2 f^D(r_h,I_h^{FDI,*})}{\partial I_h \partial r_h}}{\frac{\partial^2 F^{FDI}}{\partial I_h^2}} > 0.$$

The inequality follows because the numerator is negative by (28) and because $\frac{\partial^2 F^{FDI}}{\partial I_h^2} > 0$ by the SOC for $I_h^{FDI,*}$. As a corollary,

$$\frac{df^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{dr_h} = \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_h}\frac{\partial I_h^{FDI,*}}{\partial r_h} < 0$$

by the assumption that $f^{FDI}(r_d, I_h, I_d)$ decreases in I_h and the previous result $\frac{\partial I_h^{FDI,*}}{\partial r_h} > 0$. QED

A firm's net profit of local production given the optimal choice of $I_h^{D,*}$ and net profit of FDI given the optimal choice of $I_h^{FDI,*}$ and $I_d^{FDI,*}$ are, respectively:

$$\Pi^{D,*} \equiv \pi^D - F^{D,*}(r_h) = B\tilde{\phi}\,(w_h)^{1-\sigma} - F^{D,*}(r_h), \tag{90}$$
$$\Pi^{FDI,*} \equiv \pi^{FDI} - F^{FDI,*}(r_h, r_d) = B\tilde{\phi}\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d). \tag{91}$$

Among possible destinations of FDI, firms trade off lower wages with higher fixed costs associated with poorer institutions, and choose r_d that maximizes (91). The FOC for the optimal choice r_d^* requires that at r_d^*:

$$\frac{\partial \pi^{FDI}}{\partial w_d}\omega'(r_d) - \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial r_d} = 0, \tag{92}$$

where $\partial F^{FDI,*}(r_h, r_d)/\partial r_d = \partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})/\partial r_d$ by the envelope theorem.

(i) ***(Complementarity of Institutional Qualities at Firm-level FDI)*** All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the poorer the institutional quality at home: $\frac{\partial r_d^*}{\partial r_h} > 0$; (ii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the more productive the firm is: $\frac{\partial r_d^*}{\partial \tilde{\phi}} > 0$; (iii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the larger the world demand for the sector is: $\frac{\partial r_d^*}{\partial B} > 0$; (iv) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the less headquarter-intensive the sector is: $\frac{\partial r_d^*}{\partial \eta} < 0$.

Proof. (i) Totally differentiate (92) with respect to r_d^* and r_h, we obtain

$$\frac{\partial r_d^*}{\partial r_h} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h}\omega'(r_d)\omega'(r_h) - \frac{\partial^2 f^{FDI}}{\partial I_h \partial r_d}\frac{\partial I_h^{FDI,*}(r_h,r_d)}{\partial r_h}}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} > 0. \tag{93}$$

The inequality holds by similar arguments as in the benchmark: $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h} > 0$ by the Cobb-Douglas functional form of π^{FDI}; $\frac{\partial^2 f^{FDI}}{\partial I_h \partial r_d} < 0$ by the assumption in (86); and $\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2} < 0$ by the SOC for r_d^*. (ii)–(iv) The proofs remain the same as in the benchmark. QED

In the remaining part of this section, we discuss the implications if I_h and I_d are complementary in lowering fixed cost of FDI at the destination. In other words, suppose that

$$\frac{\partial^2 f^{FDI}(r_d, I_h, I_d)}{\partial I_h \partial I_d} < 0. \tag{94}$$

In this case, $I_d^{FDI,*}$ is not determined by (85) alone, but is jointly determined with $I_h^{FDI,*}$ by (84) and (85). Take total differentiation of (84) and (85) with respect to r_h, $I_h^{FDI,*}$, and

$I_d^{FDI,*}$, we have:

$$\frac{\partial^2 f^D}{\partial r_h \partial I_h} dr_h \quad + \quad \frac{\partial^2 F^{FDI}}{\partial I_h^2} dI_h^{FDI,*} + \frac{\partial^2 f^{FDI}}{\partial I_d \partial I_h} dI_d^{FDI,*} = 0, \tag{95}$$

$$\frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d} dI_h^{FDI,*} + \frac{\partial^2 F^{FDI}}{\partial I_d^2} dI_d^{FDI,*} = 0. \tag{96}$$

Substituting (96) in (95) and collecting terms, we obtain

$$\frac{\partial I_h^{FDI,*}}{\partial r_h} = -\frac{\frac{\partial^2 f^D}{\partial r_h \partial I_h}}{\frac{\partial^2 F^{FDI}}{\partial I_h^2} - \left(\frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d}\right)^2 / \frac{\partial^2 F^{FDI}}{\partial I_d^2}} > 0, \tag{97}$$

which holds if the denominator is positive. In other words, it requires that

$$\left(\frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d}\right)^2 < \frac{\partial^2 F^{FDI}}{\partial I_h^2} \frac{\partial^2 F^{FDI}}{\partial I_d^2}. \tag{98}$$

This is basically a stability condition on the system that the complementarity effect between I_h and I_d on f^{FDI} is sufficiently weak to ensure that the solutions to I_h and I_d are not explosive. As a corollary, we have:

$$\frac{\partial I_d^{FDI,*}}{\partial r_h} = \left\{ -\frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d} / \frac{\partial^2 F^{FDI}}{\partial I_d^2} \right\} \frac{\partial I_h^{FDI,*}}{\partial r_h} > 0. \tag{99}$$

It follows that:

$$\frac{d f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{d r_h} = \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_h} \frac{\partial I_h^{FDI,*}}{\partial r_h} + \frac{\partial f^{FDI}(r_d, I_h^{FDI,*}, I_d^{FDI,*})}{\partial I_d} \frac{\partial I_d^{FDI,*}}{\partial r_h} < 0.$$

Thus, Proposition B.1 continues to hold and with the effects reinforced under the scenario (94).

In parallel to the analysis above, if we take total differentiation of (84) and (85) with respect to r_d, $I_h^{FDI,*}$, and $I_d^{FDI,*}$, we have:

$$\frac{\partial^2 f^{FDI}}{\partial r_d \partial I_h} dr_d \quad + \quad \frac{\partial^2 F^{FDI}}{\partial I_h^2} dI_h^{FDI,*} + \frac{\partial^2 f^{FDI}}{\partial I_d \partial I_h} dI_d^{FDI,*} = 0, \tag{100}$$

$$\frac{\partial^2 f^{FDI}}{\partial r_d \partial I_d} dr_d \quad + \quad \frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d} dI_h^{FDI,*} + \frac{\partial^2 F^{FDI}}{\partial I_d^2} dI_d^{FDI,*} = 0. \tag{101}$$

Substituting (101) in (100) and collecting terms, we obtain

$$\frac{\partial I_h^{FDI,*}}{\partial r_d} = -\frac{\frac{\partial^2 f^{FDI}}{\partial r_d \partial I_h} - \left(\frac{\partial^2 f^{FDI}}{\partial r_d \partial I_d} / \frac{\partial^2 F^{FDI}}{\partial I_d^2}\right) \frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d}}{\frac{\partial^2 F^{FDI}}{\partial I_h^2} - \left(\frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d} / \frac{\partial^2 F^{FDI}}{\partial I_d^2}\right) \frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d}} > 0, \tag{102}$$

and

$$\frac{\partial I_d^{FDI,*}}{\partial r_d} = -\frac{\frac{\partial^2 f^{FDI}}{\partial r_d \partial I_h} - \left(\frac{\partial^2 f^{FDI}}{\partial r_d \partial I_d} / \frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d}\right) \frac{\partial^2 F^{FDI}}{\partial I_h^2}}{\frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d} - \left(\frac{\partial^2 F^{FDI}}{\partial I_d^2} / \frac{\partial^2 f^{FDI}}{\partial I_h \partial I_d}\right) \frac{\partial^2 F^{FDI}}{\partial I_h^2}} > 0, \tag{103}$$

where the signs hold under conditions (86), (94), and (98).

Proposition B.1 remains to hold, with modifications to the proof for part (i) such that

$$\frac{\partial r_d^*}{\partial r_h} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h} \omega'(r_d)\omega'(r_h) - \left\{\frac{\partial^2 f^{FDI}}{\partial I_h \partial r_d} \frac{\partial I_h^{FDI,*}(r_h, r_d)}{\partial r_h} + \frac{\partial^2 f^{FDI}}{\partial I_d \partial r_d} \frac{\partial I_d^{FDI,*}(r_h, r_d)}{\partial r_h}\right\}}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} > 0. \tag{104}$$

In sum, we see that the overall mechanism is reinforced under scenario (94). Thus, the basic setup in (87) is a neutral assumption.

B.2. Horizontal FDI

This section extends the benchmark model to the case of horizontal FDI. Contrary to the vertical FDI scenario in the benchmark, where a firm chooses a country to produce the manufactured component and to serve the world market, a firm now chooses whether or not to enter a foreign market (in addition to the home market) and whether to enter the foreign market via exporting or horizontal FDI. Thus, the fixed costs of exporting or FDI specified below are paid on top of the fixed cost of serving the home market.

It is assumed that firms make location-specific investment in informal institution: I_h at home and I_d abroad in the destination of foreign sales. Investment in informal institution is assumed to be sequential: firms first choose the optimal level of investment I_h^* to minimize the fixed cost of producing for the home market: $F^D = f^D(r_h, I_h) + k_h(I_h)$. Given this, firms then choose between export and horizontal FDI to serve a foreign market. If a firm chooses to enter a foreign market by exporting, its fixed cost of serving the foreign market is: $F^E = f^E(r_d, I_h^*, I_d) + k_d(I_d)$. If it chooses to enter via FDI, the fixed cost of serving the foreign market is instead: $F^{FDI} = f^E(r_d, I_h^*, I_d) + f^P(r_d, I_h^*, I_d) + k_d(I_d)$. We could interpret f^E as the fixed cost of maintaining the distribution network in the destination (which needs to be incurred in either case of exporting and FDI), while f^P as the fixed cost of setting up an additional production plant in foreign countries. Firms choose $I_d^{E,*}$ and $I_d^{FDI,*}$ to minimize the fixed cost of foreign market entry in the case of exporting and FDI, respectively.

The first order conditions for I_h^*, $I_d^{E,*}$ and $I_d^{FDI,*}$ are, respectively:

$$\frac{\partial f^D(r_h, I_h^*)}{\partial I_h} + k_h'(I_h^*) = 0, \tag{105}$$

$$\frac{\partial f^E(r_d, I_h^*, I_d^{E,*})}{\partial I_d} + k_d'(I_d^{E,*}) = 0, \tag{106}$$

$$\frac{\partial f^E(r_d, I_h^*, I_d^{FDI,*})}{\partial I_d} + \frac{\partial f^P(r_d, I_h^*, I_d^{FDI,*})}{\partial I_d} + k_d'(I_d^{FDI,*}) = 0. \tag{107}$$

Define $F^{D,*}(r_h) \equiv F^D(r_h, I_h^*)$, $F^{E,*}(r_h, r_d) \equiv F^E(r_d, I_h^*, I_d^{E,*})$, $F^{FDI,*}(r_h, r_d) \equiv F^{FDI}(r_d, I_h^*, I_d^{FDI,*})$; i.e., they are the respective minimal fixed cost of serving the home market, exporting and horizontal FDI. We make similar assumptions on $f^D(r_h, I_h)$ as in the benchmark, i.e., $f^D(r_h, I_h)$ strictly increases in r_h; strictly decreases in I_h; and (28). Furthermore, assume that $f^S(r_d, I_h, I_d)$ strictly increases in r_d; strictly decreases in I_h and I_d; and

$$\frac{\partial}{\partial r_d}\left(\frac{\partial f^S(r_d, I_h, I_d)}{\partial I_h}\right) < 0; \quad \frac{\partial}{\partial r_d}\left(\frac{\partial f^S(r_d, I_h, I_d)}{\partial I_d}\right) < 0, \qquad \text{for } S \in \{E, P\}. \tag{108}$$

Given the discussions at the end of Section B.1, we make analogous neutral assumption that

$$\frac{\partial^2 f^S(r_d, I_h, I_d)}{\partial I_h \partial I_d} = 0, \qquad \text{for } S \in \{E, P\}, \tag{109}$$

such that there are no reinforcing effects of r_h on the choice of I_d through I_h. A firm incurs an iceberg trade cost τ_{hd} to export from home country h to the destination market d. In sum, the net profits of home market, export and FDI are, respectively:

$$\Pi^D \equiv \pi^D - F^{D,*}(r_h) = B_h\tilde{\phi}(w_h)^{1-\sigma} - F^{D,*}(r_h), \tag{110}$$

$$\Pi^E \equiv \pi^E - F^{E,*}(r_h, r_d) = B_d\tilde{\phi}(\tau_{hd}w_h)^{1-\sigma} - F^{E,*}(r_h, r_d), \tag{111}$$

$$\Pi^{FDI} \equiv \pi^{FDI} - F^{FDI,*}(r_h, r_d) = B_d\tilde{\phi}\left((\tau_{hd}w_h)^{\eta} w_d^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d), \tag{112}$$

where in the FDI mode, we allow the use of headquarter input that needs to be shipped to the foreign market (incurring trade cost) and combined with the manufactured component produced in the destination market. With trade cost, the market size B now refers to that of a national market indexed by h or d.

(i) The investment in informal institution will be higher for firms engaging in horizontal FDI than for firms entering the same market by exporting: $I^{FDI,*}(r_h, r_d) > I^{E,*}(r_h, r_d)$; (ii) The total fixed cost of production will be higher for horizontal FDI than for exporting: $F^{FDI,*}(r_h, r_d) > F^{E,*}(r_h, r_d)$; (iii) The total fixed cost of horizontal FDI will be higher in FDI destination of poorer institutions: $dF^{FDI,*}/dr_d > 0$; (iv) The total fixed cost of exporting will be higher in destination of poorer institutions: $dF^{E,*}/dr_d > 0$.

Proof. (i) Note that

$$\begin{aligned}\frac{\partial F^{FDI}(r_d, I_h^*, I_d)}{\partial I_d}\Big|_{I_d=I_d^{E,*}} &= \frac{\partial f^E(r_d, I_h^*, I_d^{E,*})}{\partial I_d} + \frac{\partial f^P(r_d, I_h^*, I_d^{E,*})}{\partial I_d} + k_d'(I_d^{E,*}) \\ &= \frac{\partial f^P(r_d, I_h^*, I_d^{E,*})}{\partial I_d} < 0,\end{aligned}$$

where the second equality follows by the FOC condition for $I_d^{E,*}$: $\frac{\partial f^E(r_d, I_h^*, I_d^{E,*})}{\partial I_d} + k_d'(I_d^{E,*}) = 0$, and the inequality follows by the assumption that $f^P(r_d, I_h, I_d)$ strictly decreases in I_d. The sign implies that $I_d^{E,*} < I_d^{FDI,*}$.

(ii) Using similar method as in the benchmark, we can write

$$\begin{aligned}F^{FDI,*} - F^{E,*} &= \Big\{F^{FDI,*} - F^E(r_d, I_h^*, I_d^{FDI,*})\Big\} + \Big\{F^E(r_d, I_h^*, I_d^{FDI,*}) - F^{E,*}\Big\} \\ &= f^P(r_d, I_h^*, I_d^{FDI,*}) + \Big\{F^E(r_d, I_h^*, I_d^{FDI,*}) - F^{E,*}\Big\} > 0,\end{aligned}$$

where the second equality follows by the definition of F^E and F^{FDI}, and $F^E(r_d, I_h^*, I_d^{FDI,*}) - F^{E,*} > 0$ follows by the definition of $F^{E,*}$ and the fact that $I_d^{FDI,*} \neq I_d^{E,*}$.

(iii) Note that

$$\frac{dF^{FDI,*}}{dr_d} = \frac{\partial f^E(r_d, I_h^*, I_d^{FDI,*})}{\partial r_d} + \frac{\partial f^P(r_d, I_h^*, I_d^{FDI,*})}{\partial r_d} + \frac{\partial F^{FDI}(r_d, I_h^*, I_d^{FDI,*})}{\partial I_d}\frac{\partial I_d^{FDI,*}}{\partial r_d} > 0, \tag{113}$$

where the sign follows by the assumption that $f^S(r_d, I_h, I_d)$ strictly increases in r_d for $S \in \{E, P\}$, and by the FOC for $I_d^{FDI,*}$ such that $\partial F^{FDI}(r_d, I_h^*, I_d^{FDI,*})/\partial I_d = 0$.

(iv) The proof is similar to (iii). We have

$$\frac{dF^{E,*}}{dr_d} = \frac{\partial f^E(r_d, I_h^*, I_d^{E,*})}{\partial r_d} + \frac{\partial F^E(r_d, I_h^*, I_d^{E,*})}{\partial I_d}\frac{\partial I_d^{E,*}}{\partial r_d} > 0, \tag{114}$$

where the sign follows by the assumption that $f^E(r_d, I_h, I_d)$ strictly increases in r_d and by the FOC for $I_d^{E,*}$ such that $\partial F^E(r_d, I_h^*, I_d^{E,*})/\partial I_d = 0$. QED

(i) Firms based in countries of poorer institutions will invest more in home informal institution: $\frac{\partial I^{h,*}(r_h)}{\partial r_h} > 0$. (ii) Firms exporting to countries of poorer institutions will invest more in destination informal institution: $\frac{\partial I_d^{E,*}(r_h,r_d)}{\partial r_d} > 0$. (iii) Multinational firms doing horizontal FDI in countries of poorer institutions will invest more in destination informal institution: $\frac{\partial I_d^{FDI,*}(r_h,r_d)}{\partial r_d} > 0$. (iv) As a corollary of (i), firms based in countries of poorer institutions and entering foreign markets will be more effective at reducing its overhead fixed cost in a given foreign market: $\frac{dF^E(r_d,I_h^*,I_d^{E,*})}{dr_h} < 0$ and $\frac{dF^{FDI}(r_d,I_h^*,I_d^{FDI,*})}{dr_h} < 0$.

Proof. (i) Take total differentiation of (105) with respect to r_h and I_h^*, we have

$$\frac{\partial I_h^*}{\partial r_h} = -\frac{\frac{\partial^2 f^D(r_h,I_h^*)}{\partial r_h \partial I_h}}{\frac{\partial^2 F^D}{\partial I_h^2}} > 0,$$

since the numerator is negative by (28) and since $\frac{\partial^2 F^D}{\partial I_h^2} > 0$ by the SOC for I_h^*.

(ii) Take total differentiation of (106) with respect to r_d and $I_d^{E,*}$, we have

$$\frac{\partial I_d^{E,*}}{\partial r_d} = -\frac{\frac{\partial^2 f^E(r_d,I_h^*,I_d^{E,*})}{\partial r_d \partial I_d}}{\frac{\partial^2 F^E}{\partial I_d^2}} > 0,$$

at $I_d^{E,*}$ by the SOC for $I_d^{E,*}$ and the assumption in (108).

(iii) Take total differentiation of (107) with respect to r_d and $I_d^{FDI,*}$, we have

$$\frac{\partial I_d^{FDI,*}}{\partial r_d} = -\frac{\frac{\partial^2 f^E(r_d,I_h^*,I_d^{FDI,*})}{\partial r_d \partial I_d} + \frac{\partial^2 f^P(r_d,I_h^*,I_d^{FDI,*})}{\partial r_d \partial I_d}}{\frac{\partial^2 F^{FDI}}{\partial I_d^2}} > 0,$$

at $I_d^{FDI,*}$ by the SOC for $I_d^{FDI,*}$ and the assumption in (108).

(iv) As a corollary,

$$\begin{aligned}\frac{dF^E(r_d, I_h^*, I_d^{E,*})}{dr_h} &= \frac{\partial f^E(r_d, I_h^*, I_d^{E,*})}{\partial I_h^*}\frac{\partial I_h^*}{\partial r_h} < 0,\\ \frac{dF^{FDI}(r_d, I_h^*, I_d^{FDI,*})}{dr_h} &= \frac{\partial f^E(r_d, I_h^*, I_d^{FDI,*})}{\partial I_h^*}\frac{\partial I_h^*}{\partial r_h} + \frac{\partial f^P(r_d, I_h^*, I_d^{FDI,*})}{\partial I_h^*}\frac{\partial I_h^*}{\partial r_h} < 0,\end{aligned}$$

by the assumption $f^S(r_d, I_h, I_d)$ strictly decreases in I_h for $S \in \{E, P\}$, and by (i) $\frac{\partial I_h^*}{\partial r_h} > 0$. QED

For each foreign market, firms choose the entry mode by comparing the difference in profits from horizontal FDI and exporting. Let Π^Δ denote the difference:

$$\Pi^\Delta = B_d\tilde{\phi}\left[(\tau_{hd}w_h)^{\eta(1-\sigma)}(w_d)^{(1-\eta)(1-\sigma)} - (\tau_{hd}w_h)^{1-\sigma}\right] - (F^{FDI,*} - F^{E,*}). \tag{115}$$

The difference varies with r_d according to:

$$\frac{\partial \Pi^\Delta}{\partial r_d} = (1-\eta)(1-\sigma)B_d\tilde{\phi}(\tau_{hd}w_h)^{\eta(1-\sigma)}w_d^{(1-\eta)(1-\sigma)-1}\omega'(r_d) - \left[\frac{dF^{FDI,*}}{dr_d} - \frac{dF^{E,*}}{dr_d}\right], \tag{116}$$

where the first term is positive because in destinations of higher r_d, wages are lower, which reduces the marginal cost of manufactured components in FDI mode but does not affect the exporting variable profits. Thus, the difference in variable profits increase with r_d. The sign of the second term depends on functional form assumptions about the importance of plant-level fixed cost f^P (incurred only under FDI) relative to distribution fixed cost f^E (incurred in both entry modes). We will discuss this further below. The cross derivative of the profit differential with respect to r_h is then:

$$\frac{\partial^2 \Pi^\Delta}{\partial r_h \partial r_d} = \eta(1-\eta)(1-\sigma)^2 B_d\tilde{\phi}(\tau_{hd})^{\eta(1-\sigma)}(w_h)^{\eta(1-\sigma)-1}w_d^{(1-\eta)(1-\sigma)-1}\omega'(r_h)\omega'(r_d) - \left[\frac{\partial^2 F^{FDI,*}}{\partial r_h \partial r_d} - \frac{\partial^2 F^{E,*}}{\partial r_h \partial r_d}\right], \tag{117}$$

where the first term is positive. Thus, the variable profit differential between FDI and exporting in destinations of higher r_d is larger for firms based in countries of higher r_h. This is mainly due to the complementarity between headquarter and manufactured components implied by the Cobb-Douglas production function. Assume the scenario in (109); we obtain

$$\begin{aligned}\frac{\partial^2 F^{FDI,*}}{\partial r_h \partial r_d} - \frac{\partial^2 F^{E,*}}{\partial r_h \partial r_d} \;=\; & \frac{\partial^2 f^E(r_d, I_h^*, I_d^{FDI,*})}{\partial I_h^* \partial r_d}\frac{\partial I_h^*}{\partial r_h} + \frac{\partial^2 f^P(r_d, I_h^*, I_d^{FDI,*})}{\partial I_h^* \partial r_d}\frac{\partial I_h^*}{\partial r_h} \\ & - \frac{\partial^2 f^E(r_d, I_h^*, I_d^{E,*})}{\partial I_h^* \partial r_d}\frac{\partial I_h^*}{\partial r_h} < 0,\end{aligned} \tag{118}$$

where the first and the third terms are independent of I_d and cancel each other (since there is no interaction between I_h and I_d in fixed cost function). This leaves the second term, which is negative because of the assumption in (108) and Proposition B.2(i). The result in

(118) reinforces the complementarity of r_h and r_d in variable profit difference of FDI and exporting in (117). Thus, we reach a similar proposition as in the benchmark vertical FDI model.

(i) ***(Complementarity of Institutional Qualities at Firm-level horizontal FDI)*** All else being equal, a firm will more likely choose to undertake horizontal FDI instead of exporting to serve a foreign market of poorer institutional qualities, the poorer the institutional quality at home: $\frac{\partial^2 \Pi^\Delta}{\partial r_h \partial r_d} > 0$; (ii) All else being equal, a firm will more likely choose to undertake horizontal FDI instead of exporting to serve a foreign market of poorer institutional qualities, the more productive the firm is: $\frac{\partial^2 \Pi^\Delta}{\partial \tilde{\phi} \partial r_d} > 0$; (iii) All else being equal, a firm will more likely choose to undertake horizontal FDI instead of exporting to serve a foreign market of poorer institutional qualities, the larger the destination market demand is: $\frac{\partial^2 \Pi^\Delta}{\partial B_d \partial r_d} > 0$; (iv) All else being equal, a firm will more likely choose to undertake horizontal FDI instead of exporting to serve a foreign market of poorer institutional qualities, the less headquarter-intensive the sector is: $\frac{\partial^2 \Pi^\Delta}{\partial \eta \partial r_d} < 0$.

Proof. (i) This follows from the derivations above, where in (117) the first term is positive and the second term is negative by (118).

(ii) Taking total differentiation of (116) with respect to $\tilde{\phi}$, we have

$$\frac{\partial^2 \Pi^\Delta}{\partial \tilde{\phi} \partial r_d} = (1-\eta)(1-\sigma) B_d (\tau_{hd} w_h)^{\eta(1-\sigma)} w_d^{(1-\sigma)(1-\eta)-1} \omega'(r_d) > 0, \tag{119}$$

because $\omega'(r) < 0$.

(iii) It is straightforward to see that B_d has an analogous (positive) effect as $\tilde{\phi}$ on $\frac{\partial \Pi^\Delta}{\partial r_d}$, because B_d and $\tilde{\phi}$ enter the profit function multiplicatively.

(iv) Finally, we have

$$\frac{\partial^2 \Pi^\Delta}{\partial \eta \partial r_d} = (1-\sigma) \left[(1-\eta)(1-\sigma) \ln \frac{\tau_{hd} w_h}{w_d} - 1 \right] (\pi^{FDI}/w_d) \omega'(r_d) < 0, \tag{120}$$

for $\left(\frac{\tau_{hd} w_h}{w_d}\right)^{(1-\eta)(1-\sigma)} < 1$, which is necessary if FDI is the chosen entry mode instead of exporting (because the FDI variable profit must be larger than exporting to compensate for the higher FDI fixed costs as shown in Proposition B.2(ii)). In other words, for firms based in a country of sufficiently high wage (relative to the FDI destination adjusted for trade cost), the wage saving of FDI (in destinations of higher r_d and thus lower w_d) relative to exporting becomes smaller when the headquarter intensity η is higher. QED

We now propose possible functional-form assumptions about f^E and f^P that satisfy our assumptions:

$$f^E = r_d \exp(-\Upsilon I_h) + r_d \exp(-I_d), \qquad \Upsilon > 0, \tag{121}$$
$$f^P = \Xi r_d \exp(-\Upsilon I_h) + \Xi r_d \exp(-I_d), \qquad \Xi > 0, \tag{122}$$

where both f^E and f^P increase with r_d, decrease with I_h and I_d, and satisfy assumption (108). They are also separable in the home and destination informal institutions, and thus satisfy assumption (109). The parameter Υ denotes the transnationality of informal institution at home in reducing destination fixed cost, while Ξ denotes the size of plant-level fixed cost relative to distribution fixed cost. Given this,

$$\frac{dF^{FDI,*}}{dr_d} - \frac{dF^{E,*}}{dr_d} = \Xi \exp(-\Upsilon I_h^*) + (\Xi + 1) \exp(-I_d^{FDI,*}) - \exp(-I_d^{E,*}), \tag{123}$$
$$\frac{\partial^2 F^{FDI,*}}{\partial r_h \partial r_d} - \frac{\partial^2 F^{E,*}}{\partial r_h \partial r_d} = -\Upsilon \Xi \exp(-\Upsilon I_h^*) \frac{\partial I_h^*}{\partial r_h} < 0, \tag{124}$$

where the sign of (123) depends on the parameter Ξ, so the first-order difference in fixed costs of FDI and exporting can increase or decrease with r_d. Nonetheless, the cross derivative of the fixed-cost difference with respect to r_h and r_d is negative. Thus, whatever the fixed-cost difference of FDI and exporting, the difference is smaller for firms based in countries of higher r_h when the foreign destination is of higher r_d.

B.3. Informal Institution and Variable Cost

In the benchmark model, we assume that informal institution affects only fixed costs. Here, we extend the model by allowing it to affect both variable and fixed costs. A firm's productivity is assumed to be determined by both an exogenous component ϕ and an endogenous part that increases with investment in informal institution. That is, informal institution helps to facilitate production process and reduces a firm's input requirement. In particular, the profit functions of domestic production and FDI are, respectively:

$$\Pi^D \equiv \pi^D - F^D(r_h, I) = B\tilde{\phi}\, \theta(I)\, (w_h)^{1-\sigma} - F^D(r_h, I), \tag{125}$$
$$\Pi^{FDI} \equiv \pi^{FDI} - F^{FDI}(r_h, r_d, I) = B\tilde{\phi}\, \theta(I) \left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} - F^{FDI}(r_h, r_d, I), \tag{126}$$

where $\theta'(I) > 0$. The fixed cost of domestic production and FDI are as in the benchmark model: $F^D(r_h, I) \equiv f(r_h, I) + k(I)$ and $F^{FDI}(r_h, r_d, I) \equiv f(r_h, I) + f(r_d, I) + k(I)$. The firms now choose $I^{D,*}$ that maximizes Π^D in the case of producing locally and $I^{FDI,*}$ that maximizes Π^{FDI} in the case of producing abroad. Define $F^{FDI,*} = F^{FDI}(r_h, r_d, I^{FDI,*})$ and $F^{D,*} = F^D(r_h, I^{D,*})$.

(i) The investment in informal institution will be higher for firms engaging in multinational production than for firms engaging only in local production: $I^{FDI,*}(r_h, r_d) > I^{D,*}(r_h)$; (ii) The total fixed cost of production will be higher for multinational production than for local production: $F^{FDI,*}(r_h, r_d) > F^{D,*}(r_h)$. (iii) The total fixed cost of multinational production will be higher in FDI destination of poorer institutions: $dF^{FDI,*}/dr_d > 0$; (iv) For a given FDI destination, the total fixed cost of multinational production will be higher for MNEs based in countries of poorer institutions: $dF^{FDI,*}/dr_h > 0$.

Proof. (i) The proof is similar to the benchmark, but with the net profit (instead of the total fixed cost) as the objective function:

$$\begin{aligned}
\frac{\partial \Pi^{FDI}}{\partial I}|_{I=I^{D,*}} &= \theta'(I^{D,*})B\tilde{\phi}\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} - \frac{\partial f(r_h, I^{D,*})}{\partial I} - \frac{\partial f(r_d, I^{D,*})}{\partial I} - k'(I^{D,*}) \\
&> \theta'(I^{D,*})B\tilde{\phi}\left(w_h\right)^{1-\sigma} - \frac{\partial f(r_h, I^{D,*})}{\partial I} - \frac{\partial f(r_d, I^{D,*})}{\partial I} - k'(I^{D,*}) \\
&= -\frac{\partial f(r_d, I^{D,*})}{\partial I} > 0,
\end{aligned}$$

where the first inequality follows because $w_h > w_d$ holds if firms engage in FDI, since higher variable profits are necessary to compensate for the higher fixed cost of FDI (as the next part shows). The second equality follows by the FOC for $I^{D,*}$ and the last inequality follows by the assumption that $f(r, I)$ strictly decreases in I. The sign implies that $I^{FDI,*} > I^{D,*}$.

(ii) We can write

$$\begin{aligned}
F^{FDI,*} - F^{D,*} &= \left\{F^{FDI,*} - F^D(r_h, I^{FDI,*})\right\} + \left\{F^D(r_h, I^{FDI,*}) - F^{D,*}\right\} \\
&= f(r_d, I^{FDI,*}) \\
&+ \left\{-\Pi^D(r_h, I^{FDI,*}) + \pi^D(r_h, I^{FDI,*})\right\} - \left\{-\Pi^D(r_h, I^{D,*}) + \pi^D(r_h, I^{D,*})\right\} > 0,
\end{aligned}$$

where the first equality follows by the definition of the fixed cost and profit functions. In the above expression, $\pi^D(r_h, I^{FDI,*}) = B\tilde{\phi}\theta(I^{FDI,*})\left(w_h\right)^{1-\sigma} > B\tilde{\phi}\theta(I^{D,*})\left(w_h\right)^{1-\sigma} = \pi^D(r_h, I^{D,*})$

holds because $\theta'(I) > 0$. In addition, $\Pi^D(r_h, I^{D,*}) > \Pi^D(r_h, I^{FDI,*})$ holds by the optimality of $I^{D,*}$ (in maximizing the net profit of local production) and by the fact that $I^{FDI,*} \neq I^{D,*}$.

(iii) The derivative of F^{FDI} with respect to r_d is

$$\frac{dF^{FDI,*}}{dr_d} = \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d} + \frac{\partial F^{FDI}(r_h, r_d, I^{FDI,*})}{\partial I}\frac{\partial I^{FDI,*}}{\partial r_d} > 0,$$

where the first term is positive by assumption, and $\frac{\partial I^{FDI,*}}{\partial r_d} > 0$ holds as shown in Proposition B.3. Next, note at $I^{FDI,*}$,

$$\frac{\partial \Pi^{FDI}}{\partial I}|_{I=I^{FDI,*}} \quad = \quad \frac{\partial \pi^{FDI}}{\partial I}|_{I=I^{FDI,*}} - \frac{\partial F^{FDI}(r_h, r_d, I^{FDI,*})}{\partial I} = 0, \tag{127}$$

where $\frac{\partial \pi^{FDI}}{\partial I} = \theta'(I)B\tilde{\phi}\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} > 0$ because $\theta'(I) > 0$. This implies that $\frac{\partial F^{FDI}(r_h,r_d,I^{FDI,*})}{\partial I} > 0$. The result thus follows.

(iv) The proof is similar to (iii), with

$$\frac{dF^{FDI,*}}{dr_h} = \frac{\partial f(r_h, I^{FDI,*})}{\partial r_h} + \frac{\partial F^{FDI}(r_h, r_d, I^{FDI,*})}{\partial I}\frac{\partial I^{FDI,*}}{\partial r_h} > 0,$$

where the first term is positive by assumption, $\frac{\partial I^{FDI,*}}{\partial r_h} > 0$ holds by Proposition B.3, and $\frac{\partial F^{FDI}(r_h,r_d,I^{FDI,*})}{\partial I} > 0$ as shown in (iii). QED

(i) Multinational firms headquartered in countries of poorer institutions will invest more in informal institution: $\frac{\partial I^{FDI,*}(r_h,r_d)}{\partial r_h} > 0$. As a corollary, multinational firms headquartered in countries of poorer institutions will be more effective at reducing its overhead fixed cost at a given FDI destination: $\frac{df(r_d,I^{FDI,*})}{dr_h} < 0$. (ii) Multinational firms will also invest more in informal institution when the FDI is located in countries of poorer institutions: $\frac{\partial I^{FDI,*}(r_h,r_d)}{\partial r_d} > 0$.

Proof. (i) Take total differentiation of (127) with respect to r_h and $I^{FDI,*}$, we have

$$\frac{\partial I^{FDI,*}}{\partial r_h} = -\frac{\eta(1-\sigma)\pi^{FDI}(\theta\, w_h)^{-1}\theta'(I)\omega'(r_h) - \frac{\partial^2 f(r_h,I)}{\partial I \partial r_h}}{\frac{\partial^2 \Pi}{\partial I^2}} > 0.$$

The inequality follows because $\frac{\partial^2 \Pi}{\partial I^2} < 0$ by the SOC for $I^{FDI,*}$, $\theta'(I) > 0 > \omega'(r_h)$ by the setup, and $\frac{\partial^2 f(r_h,I)}{\partial I \partial r_h} < 0$ by (28). As a corollary,

$$\frac{df(r_d, I^{FDI,*})}{dr_h} = \frac{\partial f(r_d, I^{FDI,*})}{\partial I}\frac{\partial I^{FDI,*}}{\partial r_h} < 0$$

by the assumption $f(r, I)$ decreases in I and the previous result $\frac{\partial I^{FDI,*}}{\partial r_h} > 0$.

(ii) Take total differentiation of (127) with respect to r_d and $I^{FDI,*}$, we have

$$\frac{\partial I^{FDI,*}}{\partial r_d} = -\frac{(1-\eta)(1-\sigma)\pi^{FDI}(\theta\, w_d)^{-1}\theta'(I)\omega'(r_d) - \frac{\partial^2 f(r_d,I)}{\partial I \partial r_d}}{\frac{\partial^2 \Pi}{\partial I^2}} > 0,$$

by similar arguments as in (i). QED

We now characterize firms' optimal choice of FDI destination. A firm's net profit of local production given the optimal choice of $I^{D,*}$ and net profit of FDI given the optimal choice of $I^{FDI,*}$ are, respectively:

$$\Pi^{D,*} \equiv \pi^{D,*} - F^{D,*}(r_h) = B\tilde{\phi}\,\theta(I^{D,*})\,(w_h)^{1-\sigma} - F^{D,*}(r_h), \tag{128}$$

$$\Pi^{FDI,*} \equiv \pi^{FDI,*} - F^{FDI,*}(r_h, r_d) = B\tilde{\phi}\,\theta(I^{FDI,*})\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d). \tag{129}$$

Among possible destinations of FDI, firms trade off lower wages with higher fixed costs associated with poorer institutions, and choose r_d that maximizes (129). The FOC for the optimal choice r_d^* requires that at r_d^*:

$$\frac{\partial \pi^{FDI,*}}{\partial w_d}\omega'(r_d) - \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d} = 0, \tag{130}$$

where we have used the fact that $\left\{\frac{\partial \pi^{FDI,*}}{\partial I} - \frac{\partial F^{FDI}}{\partial I}\right\}\frac{\partial I^{FDI,*}}{\partial r_d} = 0$ by the FOC for $I^{FDI,*}$.

(i) ***(Complementarity of Institutional Qualities at Firm-level FDI)*** All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the poorer the institutional quality at home: $\frac{\partial r_d^*}{\partial r_h} > 0$; (ii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the more productive the firm is: $\frac{\partial r_d^*}{\partial \tilde{\phi}} > 0$; (iii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the larger the world demand for the sector is: $\frac{\partial r_d^*}{\partial B} > 0$; (iv) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the less headquarter-intensive the sector is: $\frac{\partial r_d^*}{\partial \eta} < 0$.

Proof. (i) Totally differentiate (130) with respect to r_d^* and r_h, we have

$$\frac{\partial r_d^*}{\partial r_h} = -\frac{\frac{\partial^2 \pi^{FDI,*}}{\partial w_d \partial w_h}\omega'(r_d)\omega'(r_h) + \frac{\partial^2 \pi^{FDI,*}}{\partial w_d \partial \theta}\theta'(I^{FDI,*})\omega'(r_d)\frac{\partial I^{FDI,*}}{\partial r_h} - \frac{\partial^2 f}{\partial I \partial r_d}\frac{\partial I^{FDI,*}}{\partial r_h}}{\frac{\partial^2 \Pi^{FDI,*}}{\partial r_d^2}} > 0. \qquad (131)$$

The inequality holds because $\frac{\partial^2 \Pi^{FDI,*}}{\partial r_d^2} < 0$ by the SOC for r_d^*, and the numerator is positive by the facts that: (a) $\frac{\partial^2 \pi^{FDI,*}}{\partial w_d \partial w_h} = \eta(1-\eta)(1-\sigma)^2 \pi^{FDI,*}/(w_h w_d) > 0$; (b) $\frac{\partial^2 \pi^{FDI,*}}{\partial w_d \partial \theta} = (1-\eta)(1-\sigma)\pi^{FDI,*}/(\theta w_d) < 0$ and $\theta'(I) > 0 > \omega'(r)$; (c) $\frac{\partial^2 f}{\partial I \partial r_d} < 0$ by (28); and (d) $\frac{\partial I^{FDI,*}}{\partial r_h} > 0$ by Proposition B.3.

(ii)–(iv) The proofs are exactly the same as in the benchmark, except that the definition of $\pi^{FDI,*}$ now takes the alternative form in (129), i.e., $\pi^{FDI,*} \equiv B\tilde{\phi}\,\theta(I^{FDI,*})\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma}$. QED

B.4. Country/Sector Compositions

We use a merged data of fDi Market and Orbis. It should be acknowledged that sample selection bias can exist in these two datasets. For example, fDi Market data focus only on FDI transaction that appear in news sources. Orbis also have bias towards more developed countries. Therefore, it is important to check the post-merge composition of countries and industries.

Figure 11 and Figure 12 show the country composition patterns before and after matching. The country composition is computed as the ratio of parent firms a country has to the total number of firms in the sample across years. The comparison shows that the representation of parent firms from US in the whole sample drop significantly after merging. The representation of US parent firms decreased so that the distribution of firms across countries becomes more even after merging with Orbis. So, as a robust check, we drop parent firms from US and conduct the same regression as the baseline model. Table 22 shows that the coefficients on $G_o * G_d$ are still positive and significant.

Figure 13 shows the comparison of sectoral composition before (blue) and after (orange) merge. The vertical axis of Figure 13 is the percentage of a sector in the sample. The comparison shows that sector composition changes slightly after merging, with the largest decrease being less than 2%. Thus, the merging preserves the original sectoral comparison in the Greenfield FDI data.

B.5. Sector-Level Variables

The above studies focus on country-level analysis. However, according to Nunn (2007), countries with better institutional quality can have a comparative advantage in sectors that rely on formal institutions. In order to check whether the results differ across sectors, we add sectoral level variables in the specification. So we run the following specification:

$$\begin{aligned}\ln(FDI_{ftshdt}) &= \beta_1(G_{h,t-1} * G_{d,t-1}) + \beta_{1,1}(CI_s * G_{h,t-1} * G_{d,t-1}) \\ &+\beta_2 \ln(prod_{f,t-}) + \beta_3(\ln(prod_{f,t-1}) * G_{d,t-1}) \\ &+\beta_4 RD_{f,t-1} + \beta_5(RD_{f,t-1} * G_{d,t-1}) \\ &+\beta_6 \mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid +\gamma' X_{hd,t-1} \\ &+\chi_{ht} + \zeta_{dt} + \kappa_{ds} + \epsilon_{hdsft} \qquad (132)\end{aligned}$$

we add the sector-level contractual intesity, following Nunn (2007). Summary statistics are shown in Table 23. Country-level contractual environment is proxied by two variables: contract enforcement degree, from World Bank Doing Business Survey and legal system & property rights protection, from Economics Freedom Insex. Summary Statistics on country-level contractual enforcement and judical system is in Table (24). As is with institutional quality measures, FDI home countries generally have better countractual environments and better property rights protection. So, if $\beta_{1,1} > 0$, highly contractual intensive industries display stronger patterns of institutional complementarity. The results are shown as in Table 25, where $CI_s = 1$ if the firm falls into the industry of high contractual intensity (its intensity is above the median). The findings implies that the institutional complementarity is stronger in sectors of high CI.

B.6. Informal Institution

The mechanism through which complementarity in institutional quality works is the informal institution. We empirically check the higher informal institution investment leads to firms undertaking FDI in countries of poorer formal institutional quality. A problem is that informal institution investment for firms are not readily available, since this investment cannot be observed from firm-level financial data. So, we use country-level informal institution investment level. This data is compiled by Faccio (2006) by measuring the percentage of firms in the Worldscope that are closely connected to ministers and/or members in the parliament

(MP).[53]

The results support the hypothesis in the theory. In order to be robust, we use all 4 measures of connectiveness: (1) percentage of firms in a country that is connected with ministers; (2) percentage of firms in a country connected with ministers in a close relation; (3) percentage of top 50 firms connected; (4) percentage of market capitalization of those connected firms. From Table 26 to Table 29, the coefficients on average informal institution at home and governance at the destination country is negative. This result also supports the finding in Faccio (2006) that higher level regulations reduces average firms' connections with officials.

B.7. Other robustness Checks

To provide a more direct prediction, we include the firms that only have one destination country. The negative coefficient on productivity and destination institutional quality suggests that more productive firms are more likely to enter countries of poorer institutional quality. Additionally, more productive firms can enter more countries. So, the benchmark results can be counfounded by the choices of productive firms from countries of poorer institutional quality. We drop those set of firms that enter more than one destination countries so that the optimal choice of FDI destinations by the firms can be taken. Table 30 shows the results and the baseline results still hold.

We also add more bilateral variables to rule out other possibilities that leads to institutional complementarity. Specifically, we add cultural similarity (see Footnote 18), industrial structure similarity (see Footnote 17) and endowment similarity. Endowment similarity is measured as the (absolute) difference in capital-labor ratio between the home and host countries.[54] Table 31 displays the results. The coefficents of interest are robust to controlling more variables that reflects bilateral differences. In addition, coefficients on those three new variables are positive and significant. This implies that firms are more likely to invests in countries of different culture environments and different economic/resource conditions. So, the firms tend to be market and resource-seeking.

Another issue with the baseline result lies in the measure of firm-level productivity. Firstly, the revenue-based estimation can reflect the markup. Secondly, LP method also

[53]Formally, in Faccio (2006), if a company is connected with a politician, if: the company's large shareholders or top officer is: (a) a member of parliament (MP), (b) a minister or the head of state, or (c) closely related to a top official.

[54]We take the cross-country endowment in capital and labor endowment from Penn World Table.

received criticism since the imperfect competition in the output market can invalidate the invertibility condition so that its consistency is like to break down (Beveren, 2012). In order to deal with those issues, we apply more recent alternative methods to estimate firm-level TFP. Specifically, we use ACF, Wooldridge and Mollisi-Rovigatti. Those are based on value-added. [55] The results are robust to alternative productivity estimation methods, as shown in Table 32, 33 and 34.

Although the above six measures can reflect institutional quality, these measures do not shed light on the type of institution that matters in FDI decisions and exhibits complementarity across countries. The result that R&D intensity negatively affects FDI seems to suggest that contract and property right institutions are also important. We extend our results by adding more institutional related variables: contractual enforcement and judical system quality. [56] Table shows the summary statistics of these two variables, both for home and host countries. Table 35 shows such results. It's implied that institutional complementarity also exists in terms of contractual environment and property rights protection. This results to some extent is consistent with the negative effect of R&D intensity on FDI.

[55] It is available by Stata command *prodest*.

[56] Following Nunn (2007), contractual enforcement is obtained from World Bank Doing Business Survey. Judical quality and property rights protection data is from Index of Economic Freedowm, retrieved from https://www.heritage.org/index/.

Table 1: Price and Destination Country Population

	Dependent Variable: ln(*price*)			
	$\ln(p_{fhc})$		$\ln(p_{hc})$	
	(1)	(2)	(3)	(4)
(log) Population	0.035***	0.051***	0.208***	0.245***
	(0.000)	(0.000)	(0.001)	(0.001)
Country-level Controls	No	Yes	No	Yes
Firm FE	Yes	Yes	No	No
Product FE	Yes	Yes	Yes	Yes
Observations	11,224,467	11,038,879	449,135	440,783
R-Squred	0.697	0.698	0.763	0.780

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. The dependent variable in specifications (1)-(2) is the (log) price at the firm-HS8-country level, and in specifications (3)-(4) is the (log) price at the HS8-country level. Country-level other controls include GDP per capita and distance. All regressions include a constant term.

Table 2: Price and Revenue

	Dependent Variable: ln(*price*)			
	$\ln(p_{fhc})$		$\ln(p_{fh})$	
	(1)	(2)	(3)	(4)
$\ln(Revenue)$	0.154***	0.155***	0.206***	0.210***
	(0.000)	(0.000)	(0.000)	(0.000)
$\ln(Revenue) * RD\_Intensity$		0.048***		0.009
		(0.005)		(0.009)
Firm FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
Observations	12,476,096	11,070,256	4,146,176	3,660,845
R-Squred	0.696	0.695	0.722	0.725

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. The dependent variable in specifications (1)-(2) is the (log) price at the firm-HS8-country level, and in specifications (3)-(4) is the (log) price at the firm-HS8 level. $RD\_Intensity$ is compiled by Kroszner et al. (2007) at ISIC level, which can be converted to HS 6 codes. All regressions include a constant term.

Table 3: Price and Entry

	Dependent Variable: ln($price$)			
	ln(p_{fh})		$std.$(ln(p_{fh}))	
	(1)	(2)	(3)	(4)
Num_Destinations	0.007***	0.006***	0.006***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Num _Destinations*RD_Intensity		0.009***		0.015***
		(0.001)		(0.000)
Firm FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
Observations	11,622,117	10,314,550	9,069,247	8,065,339
R-Squred	0.681	0.680	0.459	0.463

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. The dependent variable in specifications (1)-(2) is the (log) price at the firm-HS8 level, and in specifications (3)-(4) is the standard deviation of (log) prices at the firm-HS8 level. $RD\_Intensity$ is compiled by Kroszner et al. (2007) at ISIC level, which can be converted to HS 6 codes. All regressions include a constant term.

Table 4: Description of HS 2-digit Industries and Number of Observations

HS 2	Obs	HS 2	Obs	HS 2	Obs	HS 2	Obs
2	30,707	24	6,503	51	1,780	73	27,812
3	58,406	30	28,032	52	3,047	74	6,489
4	27,854	32	3,420	54	900	76	3,604
6	2,998	33	58,712	55	1,928	82	31,914
7	53,205	34	30,956	57	29,694	83	6,406
8	53,451	35	3,713	58	500	84	47,596
9	36,534	36	1,750	59	1,035	85	91,988
10	3,848	37	902	61	234,282	87	21,361
11	4,079	38	15,284	62	265,844	88	1,515
15	13,055	39	31,740	63	74,382	89	8,254
16	29,784	40	16,135	64	66,311	90	31,572
17	11,371	42	59,404	65	14,244	91	29,964
18	12,387	43	3,802	66	6,506	92	16,893
19	39,318	44	12,643	67	4,578	93	3,776
20	76,252	46	6,690	68	1,477	94	61,268
21	34,332	48	46,325	69	16,443	95	52,143
22	47,661	49	31,867	70	19,589	96	46,185
23	2,307	50	395	71	22,075	97	11,678

Note: This table summarizes the number of bilateral trade transaction observations within each HS 2 sector. Raw Data source is from CEPII

Table 5: Summary of Importing Countries' Products

Country	Obs	Country	Obs	Country	Obs	Country	Obs	Country	Obs
AFG	902	CCK	86	GUY	935	MAR	1,194	STP	687
ALB	1,063	COL	1,103	HTI	780	MOZ	1,123	SAU	1,152
DZA	1,094	COM	797	HND	966	OMN	1,136	SEN	1,045
ASM	250	COG	1,064	HKG	1,195	NRU	364	SYC	868
AND	1,030	ZAR	998	HUN	1,171	NPL	1,010	SLE	701
AGO	1,127	COK	692	ISL	1,119	NLD	1,201	IND	1,107
ATG	992	CRI	1,108	IDN	1,148	ABW	1,085	SGP	1,184
AZE	1,096	HRV	1,157	IRN	945	NCL	1,094	SVK	1,177
ARG	1,036	CUB	863	IRQ	1,041	VUT	720	VNM	1,145
AUS	1,172	CYP	1,156	IRL	1,182	NZL	1,142	SVN	1,160
AUT	1,186	CZE	1,181	ISR	1,139	NIC	1,015	SOM	611
BHS	1,123	BEN	882	ITA	1,203	NER	821	ZAF	1,164
BHR	1,155	DNK	1,192	CIV	1,093	NGA	1,130	ZWE	1,054
BGD	931	DMA	488	JAM	1,082	NIU	299	ESP	1,209
ARM	1,019	DOM	1,132	JPN	1,214	NFK	289	SUR	958
BRB	1,141	ECU	1,016	KAZ	1,157	NOR	1,171	SWE	1,187
BEL	1,207	SLV	1,062	JOR	1,125	MNP	294	CHE	1,187
BMU	1,104	GNQ	827	KEN	1,085	FSM	596	SYR	823
BTN	246	ETH	1,020	PRK	747	MHL	306	TJK	743
BOL	969	ERI	302	KOR	1,180	PLW	707	THA	1,180
BIH	1,092	EST	1,163	KWT	1,149	PAK	1,014	TGO	896
BRA	1,128	FLK	382	KGZ	983	PAN	1,143	TKL	95
BLZ	897	FJI	1,038	LAO	733	PNG	948	TON	732
IOT	32	FIN	1,171	LBN	1,143	PRY	992	TTO	989
SLB	531	FRA	1,223	LVA	1,164	PER	1,071	ARE	1,187
VGB	630	PYF	1,066	LBR	741	PHL	1,213	TUN	1,076
BRN	1,076	ATF	164	LBY	1,021	PCN	21	TUR	1,143
BGR	1,165	DJI	796	LTU	1,160	POL	1,181	TKM	888
MMR	936	GAB	939	MAC	1,047	PRT	1,192	TCA	519
BDI	698	GEO	1,093	MDG	898	GNB	462	TUV	231
BLR	1,132	GMB	720	MWI	952	TMP	802	UGA	984
KHM	968	PAL	804	MYS	1,184	QAT	1,159	UKR	1,158
CMR	894	DEU	1,208	MDV	1,046	ROM	1,178	EGY	1,112
CAN	1,198	GHA	1,112	MLI	762	RUS	1,187	GBR	1,205
CPV	919	GIB	970	MLT	1,161	RWA	884	TZA	1,035
CYM	751	KIR	549	MRT	843	SHN	354	USA	1,238
CAF	343	GRC	1,184	MUS	1,120	KNA	501	BFA	854
LKA	1,047	GRL	1,000	MEX	1,168	AIA	314	URY	1,065
TCD	589	GRD	538	TWN	1,167	LCA	679	UZB	874
CHL	1,113	GUM	583	MNG	1,007	SPM	538	VEN	1,100
CHN	1,182	GTM	1,103	MDA	1,078	VCT	499	WLF	451
CXR	261	GIN	869	MSR	164	SMR	389	WSM	806
YEM	950	ZMB	1,063						

Note: This table summarizes the number of import transaction observations for each country. Raw Data source is from CEPII

Table 6: Summary of Exporting Countries' Products

Country	Obs	Country	Obs	Country	Obs	Country	Obs	Country	Obs
AFG	277	CCK	34	GUY	280	MAR	1,024	STP	53
ALB	622	COL	973	HTI	239	MOZ	360	SAU	888
DZA	296	COM	118	HND	635	OMN	706	SEN	588
ASM	128	COG	178	HKG	1,163	NRU	80	SYC	208
AND	387	ZAR	240	HUN	1,124	NPL	571	SLE	241
AGO	158	COK	67	ISL	626	NLD	1,212	IND	1,167
ATG	219	CRI	881	IDN	1,135	ABW	201	SGP	1,180
AZE	414	HRV	1,029	IRN	737	NCL	377	SVK	1,095
ARG	1,027	CUB	186	IRQ	198	VUT	106	VNM	1,105
AUS	1,190	CYP	923	IRL	1,150	NZL	1,145	SVN	1,092
AUT	1,168	CZE	1,173	ISR	1,004	NIC	497	SOM	75
BHS	301	BEN	230	ITA	1,231	NER	242	ZAF	1,186
BHR	839	DNK	1,185	CIV	564	NGA	608	ZWE	466
BGD	755	DMA	152	JAM	537	NIU	25	ESP	1,242
ARM	509	DOM	854	JPN	1,172	NFK	7	SUR	331
BRB	505	ECU	786	KAZ	743	NOR	1,090	SWE	1,167
BEL	1,204	SLV	765	JOR	804	MNP	110	CHE	1,120
BMU	130	GNQ	25	KEN	937	FSM	44	SYR	683
BTN	44	ETH	508	PRK	432	MHL	62	TJK	230
BOL	443	ERI	50	KOR	1,152	PLW	18	THA	1,179
BIH	801	EST	1,095	KWT	814	PAK	1,014	TGO	478
BRA	1,078	FLK	34	KGZ	492	PAN	960	TKL	146
BLZ	241	FJI	804	LAO	317	PNG	148	TON	84
IOT	33	FIN	1,086	LBN	1,002	PRY	417	TTO	507
SLB	47	FRA	1,254	LVA	1,119	PER	968	ARE	1,173
VGB	198	PYF	297	LBR	71	PHL	1,076	TUN	903
BRN	427	ATF	16	LBY	142	PCN	26	TUR	1,152
BGR	1,109	DJI	72	LTU	1,138	POL	1,177	TKM	141
MMR	508	GAB	213	MAC	633	PRT	1,195	TCA	129
BDI	115	GEO	670	MDG	613	GNB	33	TUV	27
BLR	949	GMB	163	MWI	274	TMP	69	UGA	627
KHM	616	PAL	428	MYS	1,156	QAT	484	UKR	998
CMR	421	DEU	1,226	MDV	153	ROM	1,096	EGY	1,015
CAN	1,186	GHA	645	MLI	252	RUS	1,147	GBR	1,218
CPV	141	GIB	85	MLT	660	RWA	303	TZA	640
CYM	76	KIR	34	MRT	167	SHN	40	USA	1,265
CAF	46	GRC	1,153	MUS	801	KNA	46	BFA	306
LKA	971	GRL	95	MEX	1,131	AIA	36	URY	656
TCD	33	GRD	80	TWN	1,106	LCA	88	UZB	371
CHL	1,036	GUM	353	MNG	292	SPM	81	VEN	573
CHN	1,267	GTM	933	MDA	650	VCT	69	WLF	10
CXR	43	GIN	216	MSR	17	SMR	184	WSM	176
YEM	323	ZMB	487						

Note: This table summarizes the number of export transaction observations for each country. Raw Data source is from CEPII

Table 7: Summary of Coefficients on Trade Cost Variables

(a) HS 2 - HS 49

HS	Contig	Comlang	Colony	Comcol	Curcol	Smctry	LnDist	RTA	Comcur
2	0.137***	0.050***	0.073***	0.113***	0.057	0.080**	-0.143***	0.121***	0.075***
3	0.065***	0.044***	0.119***	0.115***	0.003	0.009	-0.173***	0.063***	0.008
4	0.125***	0.075***	0.122***	0.127***	0.226***	0.045	-0.173***	0.142***	0.083***
6	0.287***	0.079**	0.223***	-0.038	0.340	-0.145	-0.205***	0.198***	0.002
7	0.068***	0.061***	0.179***	0.124***	0.090	-0.011	-0.207***	0.180***	0.028
8	0.071***	0.071***	0.162***	0.157***	0.008	-0.022	-0.190***	0.121***	-0.006
9	0.091***	0.116***	0.189***	0.055**	0.289*	0.094**	-0.186***	0.114***	0.024
10	0.204***	-0.006	0.111**	0.133***	0.257	0.034	-0.175***	0.187***	0.201***
11	0.202***	0.067*	0.181***	0.304***	0.154	-0.063	-0.217***	0.131***	0.000
15	0.117***	0.093***	0.165***	0.098***	0.083	0.044	-0.207***	0.139***	0.097***
16	0.105***	0.093***	0.185***	0.165***	0.368***	0.027	-0.148***	0.119***	0.009
17	-0.010	0.065***	0.186***	0.142***	0.070	-0.047	-0.247***	0.133***	0.131***
18	0.002	0.076***	0.247***	0.163***	-0.126	-0.015	-0.264***	0.136***	0.049
19	0.027	0.145***	0.176***	0.162***	0.078	0.027	-0.249***	0.109***	-0.016
20	0.056***	0.120***	0.191***	0.194***	-0.044	0.033	-0.181***	0.125***	-0.068***
21	0.019	0.123***	0.164***	0.118***	0.219	0.043	-0.216***	0.118***	-0.009
22	0.077***	0.114***	0.124***	0.228***	0.152*	0.082***	-0.177***	0.160***	-0.067***
23	0.076**	0.100***	0.078**	0.056	0.288	-0.070	-0.206***	0.107***	-0.066**
24	0.001	0.036	0.073**	0.093***	0.039	-0.001	-0.196***	0.190***	0.130***
30	-0.037**	0.160***	0.097***	0.175***	-0.022	-0.007	-0.161***	0.095***	-0.011
32	0.235***	0.058*	0.197***	0.201***	0.269	-0.043	-0.199***	0.056**	-0.014
33	-0.006	0.138***	0.129***	0.139***	0.035	0.027	-0.230***	0.128***	-0.006
34	0.007	0.141***	0.178***	0.119***	0.037	0.052	-0.283***	0.143***	0.050*
35	0.044	0.084***	0.225***	0.274***	0.363**	-0.075	-0.248***	0.112***	0.052
36	0.199***	0.031	-0.040	0.210***	0.235	0.197***	-0.051**	0.085**	0.156**
37	0.051	0.035	0.144**	-0.091	0.513	0.213**	-0.054*	0.195***	0.013
38	0.036	0.054***	0.093***	0.094***	0.317**	-0.019	-0.193***	0.093***	0.061**
39	0.045**	0.136***	0.137***	0.142***	0.119	0.068*	-0.224***	0.131***	-0.036
40	0.085***	0.093***	0.210***	0.067**	0.386**	-0.025	-0.197***	0.048	-0.023
42	0.037	0.095***	0.178***	0.017	0.173	0.065	-0.206***	0.077***	-0.064***
43	0.129***	0.114***	0.099**	0.073	0.671***	-0.159*	-0.161***	-0.004	-0.031
44	0.110***	0.143***	0.216***	0.061	0.315*	-0.002	-0.203***	0.060***	-0.008
46	0.139***	0.136***	0.128***	0.025	0.538**	0.007	-0.230***	0.036	0.072*
48	0.016	0.146***	0.106***	0.175***	-0.029	-0.021	-0.270***	0.131***	-0.014
49	-0.010	0.317***	0.215***	0.151***	0.085	0.071*	-0.247***	0.115***	-0.025

Note: This table summarizes the estimated coefficients on proxy variables of trade costs, for sectors HS 2 to HS 49. Contig =
1 of the both are contiguous; Comlang =1 if both share the same language; Colony =1 if ever had colonial relation; Comcol
.5 =1 if having common colonizer; Curcol =1 if currently in colonial relation; Smctry =1 if were/are the same country; RTA =1
if having regional trade agreement; Comcur =1 if using the same currency. ***, **, * denotes significance at 1%, 5% and 10%
respectively.

(b) HS 50 - HS 97

HS	Contig	Comlang	Colony	Comcol	Curcol	Smctry	LnDist	RTA	Comcur
50	0.020	0.120	0.074	-0.026	-0.053	0.188	-0.163***	-0.032	0.171
51	0.134*	0.082	0.128**	0.392**	-0.298	-0.047	-0.155***	0.125***	0.080
52	0.133***	0.001	0.082	-0.048	-0.184	-0.037	-0.214***	0.075**	0.112*
54	0.160**	0.056	0.114	0.188		-0.202	-0.173	-0.052***	-0.007
55	0.132***	0.154***	-0.032	0.026	-0.498*	0.107	-0.181***	0.113**	0.009
57	0.050*	0.097***	0.155***	0.123***	-0.053	-0.061	-0.216***	0.108***	-0.013
58	0.104	0.157	0.164	-0.248	-0.227	0.089	-0.131***	-0.028	-0.002
59	0.059	0.146**	0.050	0.004	-0.622*	-0.017	-0.143***	0.071	0.087
61	0.046**	0.119***	0.144***	0.059***	0.120	0.016	-0.197***	0.098***	-0.003
62	0.043*	0.136***	0.160***	0.041**	0.135	0.010	-0.200***	0.081***	-0.029
63	0.063***	0.135***	0.177***	0.084***	0.056	0.022	-0.219***	0.128***	-0.002
64	0.088***	0.110***	0.150***	0.102***	0.125	-0.014	-0.217***	0.087***	0.022
65	0.077***	0.111***	0.232***	0.110***	0.405**	-0.048	-0.205***	0.096***	0.027
66	0.129***	0.097***	0.185***	0.078	0.451**	0.001	-0.228***	0.109***	0.063*
68	0.132**	0.077	-0.052	-0.100	1.140**	-0.076	-0.178***	0.017	0.129*
69	0.110***	0.122***	0.186***	0.124***	0.531**	-0.006	-0.184***	0.107***	-0.079***
70	0.090***	0.119***	0.110***	0.153***	0.346	-0.049	-0.193***	0.098***	0.012
71	0.011	0.140***	0.242***	0.108***	0.070	0.084	-0.176***	0.109***	0.001
74	0.066**	0.101***	0.208***	0.273***	-0.168	0.047	-0.223***	0.130***	-0.084**
76	0.149***	0.074***	0.232***	0.182***	0.242	-0.016	-0.235***	0.144***	0.047
82	0.051*	0.122***	0.166***	0.060*	0.104	0.034	-0.196***	0.094***	0.011
83	0.139***	0.120***	0.269***	-0.038	0.155	-0.081	-0.187***	0.079***	-0.044
84	0.044**	0.094***	0.111***	0.122***	0.359*	0.055	-0.193***	0.104***	-0.017
85	0.019	0.135***	0.133***	0.135***	0.094	0.013	-0.185***	0.109***	0.016
87	0.161***	0.070***	0.143***	0.159***	0.457***	0.005	-0.142***	0.126***	0.026
88	0.051	0.079*	-0.147***	-0.106	-1.882***	0.124*	-0.046**	0.057	-0.049
89	0.091***	0.025	0.116***	0.203***	-0.330**	0.029	-0.133***	0.067***	-0.052*
90	0.058**	0.065***	0.137***	0.141***	0.223	-0.009	-0.135***	0.075***	-0.044*
91	0.036	0.086***	0.180***	0.177***	0.330***	0.038	-0.170***	0.029	0.089 ***
92	0.089***	0.068***	0.091***	0.206***	0.721***	0.064	-0.137***	0.049**	0.016
93	0.060*	0.099***	0.063*	0.342***	-0.180	0.127*	-0.077***	0.045	0.031
94	0.034	0.167***	0.127***	0.078***	0.139	0.062	-0.231***	0.098***	-0.074***
95	0.074***	0.110***	0.193***	0.059**	0.480***	-0.025	-0.176***	0.065***	-0.013
96	0.064**	0.101***	0.186***	0.092***	0.660***	0.032	-0.206***	0.104***	-0.027
97	0.040	0.110***	0.099***	0.026	0.358**	0.127**	-0.102***	0.056***	-0.102***

.5 Note: This table summarizes the estimated coefficients on proxy variables of trade costs, for sectors HS 50 to HS 97. Contig = 1 of the both are contiguous; Comlang =1 if both share the same language; Colony =1 if ever had colonial relation; Comcol =1 if having common colonizer; Curcol =1 if currently in colonial relation; Smctry =1 if were/are the same country; RTA =1 if having regional trade agreement; Comcur =1 if using the same currency. ***, **, * denotes significance at 1%, 5% and 10% respectively.

Table 8: Estimated Preference for Quality

HS	Obs	Mean	Std.Dev	Min	Max	HS	Obs	Mean	Std.Dev	Min	Max
2	165	22.246	19.613	0.467	120.217	54	165	11.385	13.524	1.000	89.390
3	165	16.230	12.954	0.642	99.572	55	165	11.407	12.325	1.000	70.688
4	165	21.944	19.275	0.023	95.676	58	165	5.814	7.687	1.000	39.734
6	165	15.513	16.725	1.000	102.454	59	165	13.130	14.915	1.000	87.704
7	165	16.686	13.018	1.000	91.702	61	165	19.649	18.534	1.000	98.075
8	165	19.338	17.456	1.000	93.673	62	165	20.201	19.074	1.000	100.413
9	165	21.288	19.457	1.000	96.457	63	165	21.464	18.519	1.000	90.493
10	165	21.508	20.186	1.000	132.176	64	165	17.749	13.834	1.000	77.016
11	165	20.349	20.691	1.000	148.433	65	165	17.903	15.941	1.000	79.300
15	165	21.821	21.960	1.000	170.171	66	165	19.995	20.808	1.000	136.851
16	165	20.542	18.605	1.000	91.212	67	165	15.871	14.654	1.000	79.738
17	165	21.330	20.083	1.000	120.062	68	165	13.762	13.674	1.000	69.466
18	165	23.452	24.309	1.000	154.248	69	165	19.893	21.115	1.000	174.533
19	165	19.730	17.928	1.000	87.576	70	165	26.733	31.433	1.000	166.876
20	165	13.773	9.373	1.000	42.538	71	165	17.061	16.126	0.876	97.138
21	165	21.046	18.647	1.000	89.231	73	165	20.877	18.926	1.000	115.750
23	165	22.211	39.912	1.000	417.558	74	165	17.933	16.758	1.000	87.612
24	165	19.376	17.441	1.000	93.222	77	165	19.266	16.757	1.000	81.233
30	165	17.782	15.580	1.000	88.500	82	165	21.521	21.301	1.000	153.153
32	165	16.370	15.530	1.000	78.624	85	165	9.549	56.190	0.978	590.516
34	165	15.013	11.013	0.000	54.480	87	165	21.242	19.659	1.000	121.543
35	165	16.151	23.239	1.000	252.413	88	165	8.442	8.623	0.000	47.360
36	165	18.633	21.963	1.000	143.656	89	165	21.767	25.082	1.000	164.926
37	165	7.529	9.940	1.000	73.404	90	165	19.339	17.718	1.000	87.486
38	165	25.404	29.797	1.000	178.241	91	165	19.110	18.261	1.000	98.730
39	165	21.551	19.905	1.000	149.762	92	165	20.431	22.115	1.000	154.758
40	165	19.242	17.163	0.609	79.498	93	165	14.949	13.256	0.000	71.716
42	165	19.754	17.691	1.000	87.856	94	165	20.294	18.134	1.000	87.038
49	165	20.422	18.574	1.000	90.914	95	165	19.526	17.907	1.000	84.246
50	165	4.876	6.636	1.000	38.863	96	165	23.772	26.979	1.000	191.981
51	165	8.913	9.538	0.000	44.815	97	165	18.996	20.996	1.000	174.981
52	165	15.120	15.745	1.000	89.140						

Note: This table summarizes estimated preference for quality ($\kappa_{i,s}$) across all countries i within each sector s.

Table 9: Estimated Marginal Cost of Quality

HS	Obs	Mean	Std.Dev	Min	Max	HS	Obs	Mean	Std.Dev	Min	Max
2	165	5.098	3.600	0.000	18.030	54	165	1.948	1.847	0.000	13.054
3	165	3.650	2.453	0.000	24.217	55	165	1.637	2.557	0.000	31.159
4	165	5.912	6.072	0.000	67.456	58	165	1.385	1.097	0.000	9.063
6	165	3.938	8.218	0.000	102.771	59	165	2.252	2.422	0.000	12.221
7	165	3.871	1.716	0.000	8.806	61	165	2.742	1.486	0.000	10.675
8	165	4.242	2.156	0.000	16.841	62	165	3.051	1.714	0.000	14.742
9	165	4.271	3.949	0.000	47.431	63	165	5.839	3.079	0.000	21.517
10	165	4.413	3.849	0.000	31.479	64	165	4.525	3.065	0.000	30.028
11	165	3.126	3.263	0.000	27.200	65	165	2.413	1.688	0.000	9.500
15	165	3.524	2.351	0.000	13.085	66	165	2.196	2.542	0.000	24.453
16	165	3.553	2.603	0.000	21.460	67	165	1.988	1.576	0.000	10.410
17	165	3.284	2.201	0.000	16.038	68	165	1.816	1.683	0.000	9.698
18	165	3.512	2.380	0.000	12.900	69	165	2.756	1.681	0.000	10.819
19	165	2.469	1.931	0.000	15.552	70	165	3.908	2.803	0.000	14.830
20	165	3.956	1.884	0.000	12.288	71	165	3.625	2.377	0.000	17.847
21	165	4.053	2.107	0.000	17.662	73	165	3.714	2.075	0.000	11.556
23	165	1.843	3.430	0.000	38.749	74	165	2.301	1.510	0.000	7.564
24	165	4.121	2.994	0.000	18.264	77	165	2.951	2.109	0.000	16.693
30	165	3.648	1.906	0.000	9.800	82	165	3.261	1.908	0.000	9.653
32	165	1.966	1.857	0.000	11.108	85	165	5.292	45.482	0.247	585.700
34	165	4.615	2.607	0.000	16.672	87	165	3.965	2.265	0.000	10.860
35	165	3.204	3.066	0.000	21.819	88	165	1.664	1.817	0.000	20.027
36	165	1.765	1.771	0.000	10.764	89	165	3.404	2.598	0.000	18.004
37	165	1.275	0.879	0.000	6.082	90	165	3.089	2.180	0.000	16.907
38	165	3.278	4.996	0.000	52.698	91	165	2.967	2.330	0.000	14.631
39	165	5.994	2.513	0.000	12.972	92	165	2.533	1.790	0.000	10.225
40	165	2.759	2.512	0.000	24.370	93	165	2.431	2.326	0.000	12.901
42	165	3.930	1.835	0.000	13.093	94	165	3.932	1.809	0.000	11.029
49	165	3.972	2.692	0.000	24.601	95	165	3.248	2.012	0.000	20.826
50	165	1.134	0.630	0.000	4.231	96	165	3.588	2.238	0.000	17.202
51	165	2.859	2.968	0.000	18.538	97	165	3.853	1.848	0.000	11.709
52	165	1.764	1.545	0.000	9.746						

Note: This table summarizes estimated cost for quality ($\mu_{i,s}$) across all countries i within each sector s.

Table 10: Preference for Quality and GDP Per Capita

HS	Coefficients	HS	Coefficients	HS	Coefficients	HS	Coefficients
2	1.879*	23	1.438	54	3.506***	74	2.561***
3	1.238*	24	1.613*	55	2.989***	76	2.044**
4	2.067**	30	0.867	58	2.163***	82	1.692
6	4.128***	32	2.431***	59	3.903***	85	1.231
7	0.062	34	0.040	61	2.009**	87	1.319
8	1.518*	35	-0.207	62	1.960**	88	1.852***
9	0.985	36	2.228*	63	1.314	89	3.152**
10	1.451	37	3.016***	64	0.240	90	2.128**
11	3.033***	38	2.144	65	1.917**	91	2.698***
15	2.623**	39	0.328	66	2.082*	92	2.889**
16	2.029**	40	1.568*	67	1.955**	93	2.025***
17	1.656	42	2.062**	68	2.993***	94	1.649*
18	2.106	49	1.891*	69	2.422**	95	1.800*
19	1.733*	50	2.032***	70	2.857*	96	2.146
20	0.186	51	2.090***	71	2.679***	97	3.422***
21	1.692*	52	2.829***	73	1.580		

Note: This table the estimated coefficients on (log) GDP per capita with dependent variable being the κ_i for each sector s. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively

Table 11: Cost of Quality and GDP Per Capita

HS	Coefficients	HS	Coefficients	HS	Coefficients	HS	Coefficients
2	0.494***	23	0.264	54	0.395***	74	0.246***
3	0.219*	24	0.210	55	0.278**	77	0.115
4	0.521	30	-0.028	58	0.186***	82	0.209**
6	0.338	32	0.169*	59	0.715***	85	1.208
7	0.044	34	0.151	61	-0.205***	87	-0.247**
8	-0.146	35	0.404***	62	-0.076	88	0.425***
9	-0.055	36	-0.076	63	0.279*	89	0.166
10	0.192	37	0.163***	64	-0.199	90	0.060
11	0.337*	38	-0.184	65	-0.063	91	-0.139
15	0.312**	39	0.453***	66	0.157	92	0.120
16	0.185	40	0.187	67	0.070	93	0.584***
17	0.053	42	0.121	68	0.427***	94	0.046
18	0.328***	49	0.147	69	-0.150	95	0.077
19	-0.176*	50	0.053	70	0.156	96	0.208*
20	0.110	51	0.767***	71	-0.105	97	-0.128
21	-0.113	52	0.191**	73	0.155		

Note: This table the estimated coefficients on (log) GDP per capita with dependent variable being the μ_i for each sector s. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively

Table 12: Summary of Exogenous Competitiveness

(a) HS 2 - HS 51

HS	Obs	Mean	Std.Dev	Min	Max
2	150	24.900	30.751	10.451	308.543
3	138	1.609	4.517	0.674	49.741
4	148	0.577	1.377	0.221	16.706
6	129	5.67E+03	5.83E+03	1.55E+03	3.96E+04
7	155	1.989	1.036	1.290	8.073
8	148	136.358	64.449	71.293	398.349
9	150	0.529	0.369	0.336	3.782
10	152	1.442	1.383	0.395	4.362
11	157	0.197	0.057	0.121	0.581
15	154	0.824	0.822	0.251	3.487
16	151	0.685	0.463	0.367	3.840
17	156	0.361	0.272	0.197	2.481
18	158	0.050	0.021	0.028	0.117
19	163	0.060	0.025	0.037	0.226
20	142	0.429	0.242	0.297	2.184
21	155	0.057	0.034	0.038	0.337
23	160	0.011	0.002	0.007	0.023
24	147	0.004	0.001	0.002	0.008
30	158	0.325	0.625	0.168	7.216
32	159	9.104	2.486	7.390	33.174
34	145	6251.746	3636.260	4089.427	40193.020
35	152	0.060	0.024	0.029	0.183
36	153	436.416	30.690	404.460	637.010
37	143	3.28E+07	2.19E+06	3.10E+07	4.92E+07
38	159	0.060	0.063	0.029	0.437
39	147	0.015	0.061	0.004	0.662
40	158	0.361	0.475	0.161	5.763
42	158	12.000	64.131	4.345	792.150
49	164	0.117	0.159	0.048	0.682
50	107	4.01E+12	7.98E+11	3.32E+12	1.13E+13
51	95	0.442	0.305	0.151	1.777

Note: This table summarizes the estimated exogenous competitiveness from quality model for industries from HS 2 to HS 51

(b) HS 52 - HS 96

HS	Obs	Mean	Std.Dev	Min	Max
52	154	0.354	0.245	0.229	3.183
54	122	9051.833	1944.386	7409.059	27034.280
55	149	0.474	0.070	0.361	0.904
58	149	1.407	0.154	1.155	2.506
59	116	0.781	0.261	0.345	1.080
61	156	3.372	1.820	2.151	19.650
62	155	1.013	0.408	0.679	3.317
63	157	1.537	1.890	0.846	21.568
64	148	0.550	0.372	0.323	2.306
65	153	4.423	5.596	2.232	38.725
66	157	80.861	25.629	50.781	334.302
67	148	6.701	9.744	2.679	75.814
68	143	10.399	3.691	6.252	41.790
69	161	107.424	1266.542	5.332	16078.190
70	158	11.084	10.113	4.999	117.903
71	146	1.06E+05	3.95E+05	2.86E+03	1.85E+06
73	159	0.384	0.244	0.240	2.430
74	154	59.894	20.527	43.466	234.731
76	158	0.077	0.029	0.042	0.223
82	159	24.072	15.373	14.861	171.604
85	162	5242.618	2099.089	4312.667	27509.740
87	158	2.802	0.958	2.006	6.494
88	133	524.241	19.825	501.511	644.742
89	150	14.529	10.022	7.053	87.736
90	161	3.463	25.910	0.802	329.955
91	159	9.40E+04	2.33E+04	7.56E+04	2.71E+05
92	150	5.985	2.880	3.919	21.810
93	135	2769.903	6592.229	1639.503	78574.520
94	164	0.218	0.081	0.153	0.619
95	154	3.116	3.515	1.331	37.424
96	157	0.197	0.083	0.127	0.558

Note: Note: This table summarizes the estimated exogenous competitiveness from quality model for industries HS 52 to HS 96

Table 13: Summary of Cutoffs — Quality Model

HS	Obs	Mean	Std.Dev	Min	Max	HS	Obs	Mean	Std.Dev	Min	Max
2	150	3.193	2.258	-3.773	8.843						
3	138	1.097	2.869	-10.654	7.451	52	154	0.527	2.504	-6.717	10.367
4	148	1.008	1.617	-7.744	4.466	54	104	2.720	2.819	-4.052	17.634
6	128	7.627	2.840	-1.662	14.552	55	148	0.321	3.007	-7.431	7.327
7	154	2.160	2.769	-8.700	10.649	58	144	-4.662	3.801	-12.224	14.796
8	147	3.079	2.453	-9.172	13.662	59	116	1.582	1.895	-6.410	4.840
9	150	1.271	1.890	-6.190	4.611	61	154	0.670	3.494	-7.308	9.192
10	152	0.793	2.024	-5.359	5.373	62	155	-0.568	3.570	-8.134	7.563
11	157	0.293	2.377	-11.553	12.827	63	157	1.753	3.012	-8.383	10.598
15	154	1.069	1.622	-6.561	4.172	64	148	0.235	3.075	-7.296	7.520
16	151	0.788	1.743	-6.752	4.771	65	153	1.883	2.421	-3.978	9.374
17	156	1.478	1.650	-5.644	5.916	66	157	1.921	2.542	-3.859	14.613
18	158	0.264	1.434	-3.614	5.453	67	141	0.923	3.630	-9.452	7.234
19	163	-0.456	1.475	-5.850	6.520	68	141	3.829	2.277	-5.093	7.577
20	142	-0.012	2.088	-13.366	11.607	69	161	2.516	2.881	-5.794	13.437
21	155	-0.772	1.703	-7.983	10.165	70	158	2.477	2.091	-3.990	7.993
23	160	-2.093	1.907	-7.440	2.399	71	122	6.911	3.253	-0.570	15.437
24	146	-5.573	3.395	-19.292	3.481	73	159	1.360	1.467	-3.445	4.580
30	156	-0.648	2.535	-6.231	9.380	74	153	0.526	2.202	-5.759	18.850
32	158	-0.210	2.195	-7.951	12.375	76	158	0.590	1.368	-4.148	5.923
34	138	0.856	2.276	-6.754	17.849	82	159	2.959	2.190	-2.797	8.213
35	152	-0.364	2.131	-12.268	5.465	87	156	1.713	2.887	-7.842	13.780
36	141	2.766	3.501	-4.758	14.432	88	123	0.098	3.029	-6.952	15.822
37	84	7.881	2.917	1.732	25.094	89	149	2.490	2.154	-4.532	8.526
38	159	-0.886	1.577	-4.756	6.580	90	156	0.835	1.440	-2.976	4.344
39	147	-1.963	2.057	-9.644	3.091	91	98	5.958	3.803	-2.000	25.677
40	158	0.287	1.675	-5.473	9.903	92	146	1.197	3.382	-7.977	8.698
42	154	0.914	2.770	-8.523	8.218	93	105	6.577	2.748	-3.537	18.500
49	163	0.449	1.914	-4.101	9.980	94	164	0.662	2.157	-10.345	8.008
50	106	22.518	3.090	15.606	38.232	95	153	0.347	2.618	-7.854	11.375
51	94	0.590	3.265	-14.942	5.291	96	157	-0.042	2.060	-5.586	4.974

Note: This table summarizes the estimated exogenous competitiveness c_M^i across countries within each sector s from quality model

Table 14: Summary of Cutoffs —Melitz and Ottaviano Model

HS	Obs	Mean	Std.Dev	Min	Max	HS	Obs	Mean	Std.Dev	Min	Max
2	150	3.011	2.214	-3.992	8.409						
3	138	1.249	2.645	-8.513	6.687	52	154	0.495	2.501	-6.882	7.866
4	148	0.868	1.228	-2.975	4.239	54	104	1.041	2.077	-4.777	5.708
6	128	7.710	2.764	-0.780	15.091	55	148	0.065	2.562	-6.670	4.982
7	154	1.216	1.979	-4.815	7.150	58	144	1.049	2.572	-5.458	13.692
8	147	2.261	2.126	-2.952	12.880	59	116	1.700	1.351	-2.378	4.444
9	150	0.654	1.684	-4.379	3.718	61	154	0.792	3.299	-6.633	10.001
10	152	0.997	1.848	-5.317	5.391	62	155	-0.611	3.498	-8.208	8.613
11	157	0.436	1.352	-4.034	3.497	63	157	1.879	2.569	-4.476	7.188
15	154	1.047	1.439	-2.104	4.277	64	148	0.124	2.744	-6.358	8.317
16	151	0.849	1.620	-6.824	4.562	65	153	2.020	2.333	-3.684	9.270
17	156	1.341	1.236	-2.432	5.477	66	157	1.943	2.580	-4.759	14.359
18	158	0.404	1.234	-2.701	4.046	67	141	1.217	3.488	-6.993	7.586
19	163	-0.273	1.013	-2.728	2.819	68	141	3.971	1.908	-1.216	7.532
20	142	0.173	1.198	-2.071	2.534	69	161	2.326	2.653	-5.742	8.726
21	155	-0.625	1.104	-2.981	1.894	70	158	2.570	2.003	-3.190	8.366
23	160	-2.125	1.851	-7.661	1.200	71	122	6.987	3.883	-5.886	15.516
24	146	-5.581	3.025	-15.509	2.437	73	159	1.500	1.253	-2.480	4.756
30	156	-0.443	2.427	-5.975	4.664	74	153	0.488	1.452	-4.534	6.413
32	158	-0.225	1.452	-4.578	3.050	76	158	0.557	1.131	-4.030	4.030
34	138	-0.095	1.354	-5.192	3.013	82	159	1.858	2.116	-3.206	5.999
35	152	-0.751	1.718	-6.521	2.556	87	156	1.902	2.518	-5.229	7.500
36	141	2.621	3.361	-7.049	10.561	88	123	-0.144	1.899	-5.253	5.816
37	84	2.459	2.584	-4.488	7.855	89	149	2.773	2.055	-2.797	10.367
38	159	-0.736	1.397	-3.502	6.090	90	156	0.969	1.361	-2.965	4.320
39	147	-1.879	1.561	-7.064	3.002	91	98	6.833	3.035	2.149	21.273
40	158	0.401	1.295	-5.337	5.052	92	146	1.443	3.264	-6.880	8.791
42	154	0.815	2.659	-7.365	9.969	93	105	7.317	2.357	-2.368	17.926
49	163	0.303	1.433	-3.599	5.719	94	164	1.006	1.677	-4.750	5.649
50	106	1.955	2.781	-6.967	7.527	95	153	0.268	2.484	-7.657	5.498
51	94	1.768	2.238	-5.315	7.984	96	157	0.107	2.070	-4.670	5.063

Note: This table summarizes the estimated exogenous competitiveness c^i_M across countries within each sector s from Melitz and Ottaviano (2008) model

Table 15: International Trade Cost Increase

HS	Mean	Std.Dev	Min	Max	HS	Mean	Std.Dev	Min	Max
2	2.801	2.284	-0.003	9.085					
3	1.983	3.815	-0.327	30.816	52	1.935	1.768	-0.085	6.716
4	0.944	1.178	-0.302	4.733	54	13.115	6.858	0.000	39.165
6	3.914	4.133	-0.038	24.256	55	1.217	1.876	-0.353	15.144
7	1.248	1.236	-0.383	3.983	58	5.617	3.677	-0.053	15.358
8	3.591	3.468	-0.348	15.524	59	0.752	1.322	-0.602	8.314
9	1.411	1.341	-0.200	7.070	61	3.032	4.738	-0.220	18.739
10	3.196	3.037	-0.001	24.547	62	2.988	6.235	-0.179	45.542
11	0.731	0.837	-0.244	5.103	63	1.520	2.268	-0.452	12.386
15	1.002	1.428	-0.433	8.380	64	1.173	2.023	-0.294	9.771
16	1.277	1.521	-0.255	6.770	65	1.856	1.703	-0.095	10.980
17	1.973	1.369	0.212	6.722	66	3.150	2.721	-0.032	14.317
18	1.362	1.105	-0.296	5.531	67	3.587	5.030	-0.466	23.328
19	0.986	1.816	-0.398	12.198	68	0.839	1.219	-0.439	6.521
20	1.298	1.960	-0.505	13.862	69	2.108	2.579	-0.254	13.567
21	0.583	1.015	-0.247	8.883	70	2.675	2.609	-0.302	12.418
23	0.900	1.212	-0.261	5.901	71	5.430	3.946	0.033	15.622
24	2.055	2.091	-0.006	14.665	73	2.160	1.785	-0.249	7.655
30	2.829	2.432	-0.263	12.214	74	3.756	3.876	-0.023	22.587
32	4.943	4.259	-0.022	30.004	76	0.148	0.388	-0.505	1.933
34	28.687	13.970	-0.074	71.330	82	2.988	3.571	-0.027	17.884
35	0.276	0.407	-0.184	2.016	87	1.815	1.789	-0.712	7.665
36	12.454	9.820	0.216	45.854	88	8.191	4.952	-0.054	22.213
37	14.389	5.979	-0.053	36.342	89	1.434	1.475	-0.113	8.867
38	0.662	0.893	-0.174	3.920	90	3.195	2.180	0.030	10.248
39	0.596	0.981	-0.526	4.460	91	8.818	6.094	-0.065	24.584
40	1.112	1.552	-0.368	8.873	92	2.605	3.745	-0.320	22.862
42	8.844	6.304	0.023	28.939	93	3.810	2.954	-0.278	10.813
49	0.311	0.429	-0.114	3.005	94	1.109	2.610	-0.709	17.924
50	7.222	5.252	-0.017	23.817	95	3.633	3.020	0.040	16.968
51	1.071	2.407	-0.309	16.746	96	1.074	1.305	-0.088	5.768

Note: This table summarizes the effects on cutoffs (endogenous competitiveness) of a 5% increase in international trade costs under quality model

Table 16: International Trade Cost Increase–MO

HS	Mean	Std. Dev.	Min	Max	HS	Mean	Std. Dev.	Min	Max
2	1.047	1.272	-0.293	7.608					
3	0.586	1.051	-0.158	7.937	52	0.607	0.931	-0.010	6.390
4	0.446	0.787	-0.661	5.415	54	0.646	1.266	-0.399	9.755
6	2.593	3.507	-0.452	27.547	55	0.597	1.095	-0.370	7.856
7	0.663	1.209	-0.107	11.402	58	1.168	1.486	-0.130	7.156
8	1.616	1.636	-0.137	8.661	59	0.543	0.847	-0.399	4.301
9	0.389	0.565	-0.138	2.651	61	1.189	1.491	-0.031	7.398
10	0.497	0.697	-0.526	5.233	62	1.363	1.891	-0.061	10.884
11	0.381	0.725	-0.150	7.001	63	0.633	0.750	-0.508	3.724
15	0.449	0.662	-0.034	4.073	64	0.695	0.876	-0.075	4.262
16	0.659	1.185	-0.463	8.025	65	0.791	2.017	-0.125	22.371
17	0.364	0.561	-0.010	3.607	66	2.033	2.519	-0.131	19.504
18	0.232	0.320	-0.009	1.939	67	4.231	4.888	-0.462	19.710
19	0.327	0.420	-0.010	2.236	68	0.727	1.212	-0.159	8.095
20	0.407	0.533	-0.361	2.586	69	1.127	1.502	-0.173	8.505
21	0.412	0.670	-0.013	4.640	70	0.518	0.886	-0.394	5.239
23	0.481	0.764	-0.012	4.653	71	3.212	4.667	-0.223	24.524
24	0.923	1.302	-0.292	10.050	73	0.457	0.665	-0.036	4.666
30	0.731	0.952	-0.179	4.721	74	0.336	0.673	-0.031	4.304
32	0.400	0.613	-0.253	3.211	76	0.240	0.422	-0.104	3.735
34	0.419	0.636	-0.006	3.691	82	0.858	1.104	-0.362	5.341
35	0.525	0.824	-0.009	5.677	87	0.766	1.347	-0.749	6.729
36	7.257	6.698	0.096	36.632	88	1.041	1.260	-0.185	8.286
37	2.159	1.844	-0.065	8.031	89	4.455	3.799	-0.039	17.700
38	0.330	0.518	-0.084	3.462	90	0.339	0.426	-0.378	2.027
39	0.284	0.562	-0.013	4.220	91	9.938	5.588	-0.051	36.798
40	0.401	0.740	-0.023	5.858	92	2.672	4.312	-0.399	24.148
42	0.952	1.652	-0.084	13.658	93	8.151	4.063	1.295	18.768
49	0.300	0.418	-0.217	2.798	94	0.488	0.711	-0.368	5.283
50	0.792	1.732	-0.020	13.111	95	0.649	0.984	-0.273	6.777
51	0.840	1.897	-0.131	12.506	96	0.644	0.762	-0.107	3.713

Note: This table summarizes the effects on cutoffs (endogenous competitiveness) of a 5% increase in international trade costs under Melitz and Ottaviano (2008) model

Table 17: Summary of Cutoff Changes

(a) Summary of Cutoff Changes

Country	Δ	Country	Δ	Country	Δ	Country	Δ
ABW	0	DMA	0	BOL	-92.825249	GTM	-142.23793
AFG	0	DNK	-114.35749	BRA	-88.041534	GUM	0
AGO	-5.9250102	DOM	-290.53134	BRB	0	GUY	0
AIA	0	DZA	-211.93385	BRN	-105.61481	HKG	0
ALB	0	ECU	-150.62788	BTN	-30.520798	HND	-71.087296
AND	0	EGY	-139.12598	CAF	-6.0313959	HRV	-35.601143
ARE	110.83006	ERI	0	CAN	-134.60129	HTI	10.083085
ARG	-172.65367	ESP	-3.0844131	CCK	0	HUN	-71.353348
ARM	-83.855202	EST	-137.4808	CHE	-221.01123	IDN	-61.682568
ASM	0	ETH	-14.915351	CHL	148.51651	IND	-79.18856
ATF	0	FIN	-139.43924	CHN	-18.930056	IOT	0
ATG	0	FJI	-1.2493064	CIV	-566.53101	IRL	-159.63408
AUS	-85.625969	FLK	0	CMR	20.903	IRN	125.87421
AUT	-35.475746	FRA	-48.415028	COG	9.3548021	IRQ	-94.298141
AZE	-88.898872	FSM	0	COK	0	ISL	-217.56667
BDI	197.47388	GAB	-317.1246	COL	-32.865913	ISR	-117.73706
BEL	4.9142151	GBR	-89.882896	COM	0	ITA	-4.3799672
BEN	340.07468	GEO	-77.644836	CPV	0	JAM	-181.83876
BFA	-499.91898	GHA	313.25208	CRI	-150.97874	JOR	-117.16895
BGD	-52.478401	GIB	0	CUB	0	JPN	-34.355942
BGR	-193.67613	GIN	-221.29001	CXR	0	KAZ	-3.359056
BHR	0	GMB	-127.25304	CYM	0	KEN	114.01509
BHS	-313.15955	GNB	425.91129	CYP	-286.89645	KGZ	-32.405098
BIH	-70.668152	GNQ	164.41464	CZE	-132.38187	KHM	-155.89485
BLR	9.4817276	GRC	-42.363346	DEU	-97.001007	KIR	0
BLZ	-127.64666	GRD	0	DJI	-76.750755	KNA	0
BMU	0	GRL	0				

Note: This table summarizes the changes in endogenous cutoffs following an increase in preference for quality

(b) Summary of Cutoff Changes (continue)

Country	Δ	Country	Δ	Country	Δ	Country	Δ
KOR	-35.787136	QAT	-219.32658	MYS	-158.87752	TKM	-52.555267
KWT	-460.9559	ROM	0	NCL	0	TMP	0
LAO	-436.81769	RUS	-98.661285	NER	-230.2971	TON	0
LBN	20.976509	RWA	-396.1434	NFK	0	TTO	-104.69793
LBR	292.86221	SAU	-45.471489	NGA	-42.240189	TUN	-165.00168
LBY	0	SEN	-349.76016	NIC	74.577103	TUR	-73.441292
LCA	0	SGP	0	NIU	0	TUV	0
LKA	-184.27283	SHN	0	NLD	-138.3261	TWN	-55.560108
LTU	-159.97792	SLB	0	NOR	-83.566177	TZA	-234.38101
LVA	-20.440449	SLE	194.28214	NPL	-314.22827	UGA	-58.329792
MAC	0	SLV	-65.059845	NRU	0	UKR	-150.4944
MAR	-100.28398	SMR	0	NZL	-180.14423	URY	-185.035
MDA	-37.104824	SOM	0	OMN	-0.6131459	USA	-83.864113
MDG	-21.992657	SPM	0	PAK	-30.568909	UZB	110.60154
MDV	0	STP	0	PAL	0	VCT	0
MEX	-26.129211	SUR	-325.828	PAN	-197.16428	VEN	-17.546169
MHL	0	SVK	-167.24568	PCN	0	VGB	0
MLI	7.2255492	SVN	-107.09841	PER	-114.9763	VNM	-68.709572
MLT	0	SWE	-112.68818	PHL	-77.56852	VUT	0
MMR	-69.190582	SYC	0	PLW	0	WLF	0
MNG	-217.73524	SYR	-77.680817	PNG	0	WSM	0
MNP	0	TCA	0	POL	-64.078629	YEM	-515.06506
MOZ	-138.54242	TCD	105.06513	PRK	0	ZAF	-143.84947
MRT	179.3062	TGO	301.63589	PRT	-181.69063	ZAR	0
MSR	0	THA	-39.003437	PRY	-254.91846	ZMB	-184.53088
MUS	0	TJK	-232.86932	PYF	0	ZWE	150.78076
MWI	37.507915	TKL	0				

Note: This table summarizes the changes in endogenous cutoffs following an increase in preference for quality

Table 18: Gains from Preference Shock and Country Characteristics

Dependent Variable:	Changes in Cost Cutoff		
	(1)	(2)	(3)
(log) Population	-6.188**	-8.510***	-8.929***
	(3.139)	(2.044)	(3.299)
Initial Preference		-0.795	-0.634
		(0.606)	(0.700)
(log) GDP per capita			-13.617
			(9.317)
Number of Observations	168	168	160

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. The dependent variable in specifications (1)-(3) is the level of aggregate cutoff change at the country-level. Country-level control variables are the initial preferences for quality and (log) GDP per capita.

Table 19: Summary Statistics on Firm-Level Variables

	Obs	Mean	Standard Deviation	Min	Max
2009–2016:					
FDI capital investment (in million USD)	32,403	35.9	302.19	0	18,500
Lagged:					
Productivity (in log)	19,322	3.35	4.81	-17.62	17.26
R&D Intensity (= R&D expenses / Operating revenues)	13,621	0.1	3.4	0	259.34
Operating revenues (in log, thousand USD), real	26,765	12.75	3.47	-4.5	20
No of employees (in log)	24,247	7.27	3.24	0	13.78
Total assets (in log, thousand USD), real	27,458	12.71	3.69	-6.76	19.97
Material costs (in log, thousand USD), real	21,476	11.67	3.93	-6.87	20.28

Note: The GDP deflator is used to normalize the current and material costs, before they are used in the productivity estimations.

Table 20: Summary Statistics on Institutional Quality

	Obs	Mean	Standard Deviation	Min	Max
Home country					
VA (Voice and Accountability)	37,062	1.14	0.5	-1.83	1.77
PV (Political Stability and Absence of Violence)	37,073	0.6	0.54	-2.81	1.57
GE (Government Effectiveness)	37,073	1.4	0.53	-1.5	2.43
RQ (Regulatory Quality)	37,073	1.32	0.53	-2.14	2.26
RL (Rule of Law)	37,073	1.4	0.57	-1.99	2.12
CC (Control of Corruption)	37,073	1.38	0.73	-1.42	2.53
Destination country					
VA (Voice and Accountability)	37,064	0.35	1.02	-2.24	1.77
PV (Political Stability and Absence of Violence)	37,065	0.15	0.8	-3.06	1.57
GE (Government Effectiveness)	37,053	0.78	0.86	-2.22	2.43
RQ (Regulatory Quality)	37,053	0.72	0.87	-2.45	2.26
RL (Rule of Law)	37,063	0.65	0.97	-2.45	2.12
CC (Control of Corruption)	37,054	0.58	1.04	-1.84	2.53

Note: Statistics refer to institutional quality lagged by one year before the year of FDI.

Table 21: Firm-level FDI's dependence on institutional quality

FDI capital investment	VA	PV	GE	RQ	RL	CC
$G_{h,t01} * G_{d,t-1}$	0.592***	1.022***	0.753***	0.766***	0.801***	0.501***
	(0.0757)	(0.126)	(0.132)	(0.145)	(0.120)	(0.0855)
$\ln(prod_{f,t-1})$	-0.0414	-0.0567	0.0288	0.0248	-0.0218	-0.0221
	(0.0352)	(0.0365)	(0.0544)	(0.0417)	(0.0503)	(0.0396)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0983***	-0.0389	-0.114**	-0.148***	-0.0463	-0.1000***
	(0.0259)	(0.0483)	(0.0476)	(0.0415)	(0.0443)	(0.0354)
$RD_{f,t-1}$	-0.482**	-0.0505***	-3.105***	-1.550***	-2.568***	-0.656***
	(0.209)	(0.00971)	(0.300)	(0.104)	(0.319)	(0.0908)
$RD_{f,t-1} * G_{d,t-1}$	0.328**	0.0390***	1.953***	0.946***	1.512***	0.360***
	(0.153)	(0.0151)	(0.192)	(0.0652)	(0.190)	(0.0526)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.822***	0.979***	1.068***	1.116***	1.303***	1.107***
	(0.166)	(0.153)	(0.173)	(0.175)	(0.184)	(0.184)
$\ln(distance_{hd})$	-0.189	-0.272**	-0.219*	-0.198*	-0.133	-0.200*
	(0.118)	(0.108)	(0.113)	(0.113)	(0.111)	(0.112)
$contig_{hd}$	0.638***	0.592***	0.808***	0.747***	0.812***	0.809***
	(0.208)	(0.219)	(0.222)	(0.219)	(0.212)	(0.218)
$comlang_{hd}$	0.381**	0.481***	0.666***	0.701***	0.611***	0.621***
	(0.188)	(0.165)	(0.174)	(0.172)	(0.169)	(0.171)
$colony_{hd}$	-0.208	-0.117	-0.467**	-0.502**	-0.450**	-0.399**
	(0.209)	(0.192)	(0.199)	(0.204)	(0.199)	(0.193)
$comcol_{hd}$	0.0373	0.275	0.240	0.122	0.141	0.0926
	(0.528)	(0.426)	(0.411)	(0.425)	(0.459)	(0.423)
$smctry_{hd}$	-1.356***	-1.538***	-1.015***	-0.913**	-0.073***	-1.244***
	(0.355)	(0.356)	(0.407)	(0.378)	(0.380)	(0.369)
$rta_{hd,t-1}$	-0.140	0.184	-0.0399	-0.0620	0.0955	0.0963
	(0.213)	(0.194)	(0.217)	(0.218)	(0.203)	(0.207)
$comcur_{hd,t-1}$	0.528**	0.379	0.405*	0.490**	0.464**	0.431*
	(0.246)	(0.232)	(0.233)	(0.236)	(0.232)	(0.235)
$bit_{hd,t-1}$	-0.220	-0.385*	-0.285*	-0.250	-0.179	-0.225
	(0.186)	(0.170)	(0.172)	(0.173)	(0.174)	(0.175)
$constant$	-8.024***	-24.83***	-37.55***	-21.39***	-18.85***	-25.22***
	(1.607)	(1.893)	(2.440)	(1.790)	(1.794)	(1.940)
$Observations$	9252	9252	9252	9252	9252	9252
R^2	0.454	0.438	0.487	0.482	0.493	0.472
$Origin-yearFE$	Y	Y	Y	Y	Y	Y
$Destination-yearFE$	Y	Y	Y	Y	Y	Y
$Sector-DestinationFE$	Y	Y	Y	Y	Y	Y

Note: PPML estimation of equation (16). Robust standard errors clustered by country-pairs are reported in the parenthesis. Productivity estimates based on the LP method and operating revenues. The entry , and indicates statistical significance at the 1%, 5% and 10% level, respectively.

Table 22: Firm-Level FDI Dependence on Institutional Quality without US

FDI capital investment	**VA**	**PV**	**GE**	**RQ**	**RL**	**CC**
$G_{h,t-1} * G_{d,t-1}$	0.619***	1.014***	0.778***	0.833***	0.815***	0.532***
	(0.0797)	(0.124)	(0.135)	(0.147)	(0.126)	(0.0882)
$\ln(prod_{f,t-1})$	-0.0314	-0.0491	0.0305	0.0252	-0.0166	-0.0165
	(0.0355)	(0.0374)	(0.0543)	(0.0418)	(0.0497)	(0.0396)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0870***	-0.0311	-0.105**	-0.134***	-0.0351	-0.0924**
	(0.0265)	(0.0487)	(0.0487)	(0.0423)	(0.0451)	(0.0364)
$RD_{f,t-1}$	-0.853	-1.602	-4.049**	-3.885**	-2.012	-1.481
	(1.109)	(1.047)	(1.799)	(1.511)	(1.582)	(1.450)
$RD_{f,t-1} * G_{d,t-1}$	0.500	3.212**	2.868**	3.081***	1.263	1.034
	(0.943)	(1.545)	(1.197)	(1.117)	(0.956)	(1.056)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.856***	1.019***	1.113***	1.202***	1.332***	1.171***
	(0.171)	(0.158)	(0.179)	(0.181)	(0.192)	(0.192)
$\ln(distance_{hd})$	-0.160	-0.230**	-0.191*	-0.146	-0.110	-0.173
	(0.126)	(0.110)	(0.115)	(0.116)	(0.114)	(0.113)
$contig_{hd}$	0.538**	0.498**	0.712***	0.656***	0.704***	0.714***
	(0.209)	(0.220)	(0.223)	(0.221)	(0.215)	(0.220)
$comlang_{hd}$	0.313	0.400**	0.580***	0.607***	0.537***	0.533***
	(0.202)	(0.174)	(0.185)	(0.182)	(0.181)	(0.182)
$colony_{hd}$	-0.142	-0.0607	-0.409**	-0.444**	-0.383*	-0.337*
	(0.216)	(0.196)	(0.204)	(0.209)	(0.206)	(0.198)
$comcol_{hd}$	-0.0815	0.154	0.130	0.0459	0.00929	0.00210
	(0.540)	(0.430)	(0.415)	(0.422)	(0.463)	(0.425)
$smctry_{hd}$	-1.352***	-1.478***	-0.972**	-0.872**	-1.026***	-1.213***
	(0.362)	(0.360)	(0.385)	(0.384)	(0.382)	(0.370)
$rta_{hd,t-1}$	-0.198	0.167	-0.0578	-0.0753	0.0657	0.0805
	(0.221)	(0.202)	(0.224)	(0.226)	(0.211)	(0.213)
$comcur_{hd,t-1}$	0.623**	0.477**	0.479**	0.584**	0.540**	0.527**
	(0.250)	(0.234)	(0.235)	(0.238)	(0.236)	(0.239)
$bit_{hd,t-1}$	-0.481**	-0.632***	-0.527***	-0.507***	-0.430**	-0.472**
	(0.193)	(0.182)	(0.183)	(0.185)	(0.184)	(0.187)
constant	-15.35***	-16.53***	-11.07***	-11.14***	-13.01***	-11.12***
	(1.803)	(1.740)	(1.854)	(1.861)	(1.889)	(1.863)
Observations	7132	7132	7132	7132	7132	7132
R^2	0.801	0.802	0.799	0.804	0.798	0.801
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. The regressions does not include US parent firms.

Table 23: Sectoral Level Contractual Intensity

Sectors	CI
Beverages	0.73
Food & Tobacco	0.34
Textiles	0.67
Wood Products	0.56
Paper, Printing & Packaging	0.54
Biotechnology	0.52
Alternative/Renewable energy	0.52
Chemicals	0.52
Pharmaceuticals	0.52
Rubber	0.6
Plastics	0.45
Ceramics & Glass	0.44
Building & Construction Materials	0.44
Metals	0.34
Business Machines & Equipment	0.84
Engines & Turbines	0.84
Industrial Machinery, Equipment & Tools	0.84
Space & Defence	0.84
Communications	0.82
Consumer Electronics	0.82
Electronic Components	0.82
Medical Devices	0.82
Semiconductors	0.82
Aerospace	0.89
Automotive OEM	0.89
Automotive Components	0.89
Non-Automotive Transport OEM	0.89

The table shows the contractual intensity across sectors in greenfield data.
Source: Desboras and Wei (2017)

Table 24: Contractual Enforcement and Judical System of Home and Host Countries

	Obs	Mean	Std. Dev.	Min	Max
Home country					
Contract	36,822	69.067	11.200	20.820	93.360
legal	38,472	7.301	1.096	1.349	9.138
Destination country					
Contract	36,732	65.237	13.733	20.820	93.360
legal	37,550	6.351	1.352	1.349	9.138

The table shows contractual enforcement, from World Bank Doing Business Survey and legal system & property rights protection, from Economics Freedom Index Database.

Table 25: Sectoral Variation in Complementarity Pattern

	VA	**PV**	**GE**	**RQ**	**RL**	**CC**	**Contract**	**Legal**
FDI capital investment								
$G_{h,t-1} * G_{d,t-1}$	0.267**	0.334**	0.455***	-0.100	0.396***	-0.0156	0.000264	0.146***
	(0.114)	(0.152)	(0.159)	(0.198)	(0.142)	(0.0998)	(0.000404)	(0.0525)
$CI_s * G_{h,t-1} * G_{d,t-1}$	0.677***	1.126***	0.354**	0.905***	0.691***	0.450***	0.000961***	-0.0183
	(0.194)	(0.282)	(0.168)	(0.161)	(0.166)	(0.128)	(0.000133)	(0.0230)
$\ln(prod_{f,t-1})$	-0.0362	-0.0494	0.0292	0.0219	-0.0183	-0.00831	0.118	0.0320
	(0.0381)	(0.0381)	(0.0673)	(0.0515)	(0.0547)	(0.0456)	(0.157)	(0.196)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0688*	-0.113**	-0.0989*	-0.102**	-0.0260	-0.0749*	-0.00240	-0.0126
	(0.0358)	(0.0523)	(0.0576)	(0.0486)	(0.0480)	(0.0398)	(0.00245)	(0.0286)
$RD_{f,t-1}$	-0.200	-0.0297***	-2.054***	-1.090***	-1.659***	-0.464***	-0.0357	-3.358***
	(0.210)	(0.0102)	(0.323)	(0.1000)	(0.325)	(0.0882)	(0.0476)	(0.626)
$RD_{f,t-1} * G_{d,t-1}$	0.125	0.00352	1.290***	0.665***	0.974***	0.252***	0.000134	0.422***
	(0.153)	(0.0149)	(0.206)	(0.0628)	(0.194)	(0.0509)	(0.000649)	(0.0794)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.319***	0.343***	0.382***	0.0936	0.600***	0.158	0.0536	0.321***
	(0.115)	(0.113)	(0.136)	(0.159)	(0.156)	(0.134)	(0.0962)	(0.116)
$\ln(distance_{hd})$	-0.401***	-0.364***	-0.381***	-0.344***	-0.345***	-0.348***	-0.388***	-0.349***
	(0.118)	(0.116)	(0.114)	(0.111)	(0.113)	(0.113)	(0.113)	(0.119)
$contig_{hd}$	0.615***	0.770***	0.853***	0.897***	0.798***	0.881***	0.862***	0.906***
	(0.185)	(0.185)	(0.187)	(0.192)	(0.184)	(0.190)	(0.202)	(0.198)
$comlang_{hd}$	0.329*	0.372**	0.439**	0.471**	0.395**	0.443**	0.478***	0.362**
	(0.192)	(0.183)	(0.181)	(0.184)	(0.187)	(0.184)	(0.185)	(0.183)
$colony_{hd}$	-0.293	-0.259	-0.369*	-0.380*	-0.351*	-0.347*	-0.324	-0.309
	(0.207)	(0.204)	(0.199)	(0.200)	(0.209)	(0.202)	(0.209)	(0.209)
$comcol_{hd}$	0.276	0.372	0.431	0.111	0.252	0.126	0.259	0.197
	(0.549)	(0.578)	(0.591)	(0.560)	(0.559)	(0.551)	(0.571)	(0.574)
$smctry_{hd}$	-2.303***	-1.686***	-1.624***	-1.587***	-1.865***	-1.678***	-1.837***	-1.722***
	(0.386)	(0.373)	(0.388)	(0.380)	(0.375)	(0.369)	(0.375)	(0.401)
$rta_{hd,t-1}$	-0.0905	0.0794	-0.0846	-0.111	0.0844	-0.0110	0.0152	0.180
	(0.200)	(0.195)	(0.201)	(0.200)	(0.197)	(0.194)	(0.201)	(0.204)
$comcur_{hd,t-1}$	0.122	0.0303	0.108	0.0227	0.0751	0.0160	0.0320	0.116
	(0.249)	(0.242)	(0.251)	(0.260)	(0.248)	(0.258)	(0.265)	(0.260)
$bit_{hd,t-1}$	-0.0284	-0.000320	0.0271	-0.0378	0.0335	-0.00262	-0.0446	-0.0524
	(0.209)	(0.198)	(0.198)	(0.195)	(0.200)	(0.193)	(0.210)	(0.222)
constant	-12.46***	-13.13***	-12.48***	-12.34***	-13.59***	-12.51***	-12.74***	-17.81***
	(1.746)	(1.733)	(1.733)	(1.740)	(1.758)	(1.739)	(2.021)	(2.948)
Observations	5616	5616	5616	5616	5616	5616	5605	5596
R^2	0.711	0.712	0.710	0.711	0.712	0.709	0.708	0.706
Origin-Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. $CI_s = 1$ if industry s has the contractual intensity above the median.

Table 26: Informal Institution

	VA	PV	GE	RQ	RL	CC
FDI capital investment						
$I_h * G_{dt}$	-0.0137	-0.119***	-0.129***	-0.124***	-0.105***	-0.0756***
	(0.0186)	(0.0217)	(0.0218)	(0.0199)	(0.0190)	(0.0166)
$\ln(prod_{f,t-1})$	-0.0217	-0.0224	0.0446	0.0527	-0.00426	0.00202
	(0.0342)	(0.0376)	(0.0575)	(0.0430)	(0.0503)	(0.0405)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0860***	-0.0313	-0.101**	-0.140***	-0.0316	-0.0763**
	(0.0252)	(0.0503)	(0.0509)	(0.0411)	(0.0464)	(0.0354)
$RD_{f,t-1}$	-0.652***	-0.0425***	-2.297***	-1.148***	-1.813***	-0.484***
	(0.192)	(0.00953)	(0.286)	(0.0948)	(0.283)	(0.0844)
$RD_{f,t-1} * G_{d,t-1}$	0.450***	0.0192	1.443***	0.698***	1.064***	0.261***
	(0.140)	(0.0145)	(0.183)	(0.0597)	(0.169)	(0.0488)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.736***	0.739***	0.681***	0.699***	0.696***	0.697***
	(0.161)	(0.159)	(0.153)	(0.155)	(0.156)	(0.157)
$\ln(distance_{hd})$	-0.433***	-0.384***	-0.354***	-0.401***	-0.360***	-0.380***
	(0.103)	(0.101)	(0.102)	(0.102)	(0.101)	(0.101)
$contig_{hd}$	0.595***	0.608***	0.611***	0.545***	0.600***	0.637***
	(0.186)	(0.182)	(0.178)	(0.179)	(0.179)	(0.180)
$comlang_{hd}$	0.820***	0.804***	0.876***	0.909***	0.905***	0.881***
	(0.183)	(0.181)	(0.184)	(0.183)	(0.183)	(0.181)
$colony_{hd}$	-0.786***	-0.729***	-0.719***	-0.749***	-0.642***	-0.726***
	(0.191)	(0.190)	(0.174)	(0.177)	(0.176)	(0.178)
$comcol_{hd}$	-0.677	-0.406	-0.313	-0.312	-0.476	-0.452
	(0.527)	(0.540)	(0.503)	(0.507)	(0.507)	(0.513)
$smctry_{hd}$	-1.231***	-1.459***	-1.301***	-1.204***	-1.424***	-1.323***
	(0.345)	(0.360)	(0.341)	(0.350)	(0.362)	(0.352)
$rta_{hd,t-1}$	-0.224	-0.219	-0.246	-0.292	-0.177	-0.275
	(0.203)	(0.193)	(0.191)	(0.195)	(0.192)	(0.191)
$comcur_{hd,t-1}$	0.133	0.0489	0.0742	0.0609	0.0381	0.0473
	(0.247)	(0.239)	(0.241)	(0.242)	(0.242)	(0.243)
$bit_{hd,t-1}$	-0.0678	-0.232	-0.187	-0.175	-0.254	-0.167
	(0.200)	(0.191)	(0.190)	(0.191)	(0.192)	(0.190)
constant	7.505***	6.211**	14.52***	14.61***	16.19***	5.516**
	(2.623)	(2.676)	(2.451)	(2.111)	(2.358)	(2.705)
Observations	7216	7216	7216	7216	7216	7216
R^2	0.818	0.822	0.826	0.828	0.825	0.822
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. I_h measures the average informal institution investment at the country level. It is proxied by the percentage of firms connected with a minister or MP in the Worldscope

Table 27: Informal Institution

FDI capital investment	VA	PV	GE	RQ	RL	CC
$I_h * G_{dt}$	-0.0317*	-0.0943***	-0.135***	-0.138***	-0.116***	-0.0845***
	(0.0165)	(0.0198)	(0.0218)	(0.0187)	(0.0187)	(0.0161)
$\ln(prod_{f,t-1})$	-0.0206	-0.0205	0.0432	0.0508	-0.00410	0.00162
	(0.0339)	(0.0376)	(0.0578)	(0.0433)	(0.0502)	(0.0405)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0873***	-0.0275	-0.102**	-0.141***	-0.0335	-0.0773**
	(0.0249)	(0.0503)	(0.0511)	(0.0413)	(0.0463)	(0.0354)
$RD_{f,t-1}$	-0.500**	-0.0464***	-2.246***	-1.114***	-1.764***	-0.464***
	(0.194)	(0.00952)	(0.284)	(0.0945)	(0.282)	(0.0843)
$RD_{f,t-1} * G_{d,t-1}$	0.339**	0.0257*	1.410***	0.677***	1.034***	0.249***
	(0.142)	(0.0145)	(0.182)	(0.0595)	(0.169)	(0.0488)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.745***	0.745***	0.672***	0.690***	0.698***	0.701***
	(0.164)	(0.161)	(0.158)	(0.160)	(0.159)	(0.162)
$\ln(distance_{hd})$	-0.417***	-0.391***	-0.339***	-0.386***	-0.345***	-0.366***
	(0.104)	(0.102)	(0.103)	(0.104)	(0.102)	(0.102)
$contig_{hd}$	0.619***	0.609***	0.628***	0.555***	0.609***	0.649***
	(0.187)	(0.185)	(0.180)	(0.180)	(0.180)	(0.181)
$comlang_{hd}$	0.799***	0.785***	0.873***	0.918***	0.897***	0.870***
	(0.184)	(0.182)	(0.185)	(0.185)	(0.184)	(0.182)
$colony_{hd}$	-0.747***	-0.718***	-0.704***	-0.730***	-0.609***	-0.697***
	(0.190)	(0.189)	(0.175)	(0.179)	(0.178)	(0.178)
$comcol_{hd}$	-0.582	-0.667	-0.312	-0.307	-0.394	-0.405
	(0.537)	(0.543)	(0.498)	(0.500)	(0.507)	(0.511)
$smctry_{hd}$	-1.180***	-1.492***	-1.286***	-1.206***	-1.406***	-1.302***
	(0.350)	(0.366)	(0.345)	(0.355)	(0.363)	(0.354)
$rta_{hd,t-1}$	-0.226	-0.209	-0.247	-0.297	-0.186	-0.282
	(0.204)	(0.194)	(0.192)	(0.195)	(0.191)	(0.191)
$comcur_{hd,t-1}$	0.128	0.0689	0.0994	0.0829	0.0684	0.0691
	(0.245)	(0.239)	(0.240)	(0.241)	(0.240)	(0.242)
$bit_{hd,t-1}$	-0.0757	-0.180	-0.147	-0.144	-0.219	-0.142
	(0.198)	(0.193)	(0.193)	(0.192)	(0.193)	(0.191)
constant	5.628**	4.370	-2.920	14.61***	-0.494	1.817
	(2.796)	(2.722)	(3.034)	(2.125)	(2.922)	(2.817)
Observations	7216	7216	7216	7216	7216	7216
R^2	0.819	0.821	0.827	0.829	0.826	0.822
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors are in parentheses. I_h measures the average informal institution investment at the country level. It is proxied by the percentage of firms connected with a minister or MP, or a close relationshipin the Worldscope

Table 28: Informal Institution

FDI capital investment	VA	PV	GE	RQ	RL	CC
$I_h * G_{dt}$	-0.00185	-0.0118***	-0.0196***	-0.0168***	-0.0159***	-0.0105***
	(0.00394)	(0.00401)	(0.00423)	(0.00406)	(0.00368)	(0.00351)
$\ln(prod_{f,t-1})$	-0.0222	-0.0238	0.0431	0.0495	-0.00929	-0.00172
	(0.0343)	(0.0381)	(0.0581)	(0.0438)	(0.0511)	(0.0409)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0855***	-0.0246	-0.103**	-0.141***	-0.0296	-0.0747**
	(0.0254)	(0.0508)	(0.0511)	(0.0413)	(0.0469)	(0.0356)
$RD_{f,t-1}$	-0.716***	-0.0576***	-2.845***	-1.375***	-2.277***	-0.603***
	(0.194)	(0.00963)	(0.289)	(0.0965)	(0.290)	(0.0861)
$RD_{f,t-1} * G_{d,t-1}$	0.497***	0.0450***	1.790***	0.839***	1.340***	0.330***
	(0.141)	(0.0147)	(0.185)	(0.0608)	(0.173)	(0.0498)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.734***	0.721***	0.681***	0.697***	0.702***	0.697***
	(0.162)	(0.162)	(0.161)	(0.162)	(0.162)	(0.163)
$\ln(distance_{hd})$	-0.440***	-0.434***	-0.427***	-0.455***	-0.428***	-0.436***
	(0.103)	(0.103)	(0.104)	(0.104)	(0.104)	(0.103)
$contig_{hd}$	0.588***	0.609***	0.555***	0.524***	0.550***	0.604***
	(0.187)	(0.187)	(0.186)	(0.184)	(0.187)	(0.185)
$comlang_{hd}$	0.825***	0.809***	0.895***	0.897***	0.895***	0.879***
	(0.183)	(0.182)	(0.189)	(0.186)	(0.187)	(0.184)
$colony_{hd}$	-0.783***	-0.713***	-0.611***	-0.673***	-0.548***	-0.679***
	(0.194)	(0.196)	(0.185)	(0.187)	(0.188)	(0.188)
$comcol_{hd}$	-0.658	-0.547	-0.357	-0.336	-0.488	-0.483
	(0.530)	(0.543)	(0.524)	(0.535)	(0.528)	(0.532)
$smctry_{hd}$	-1.248***	-1.585***	-1.425***	-1.279***	-1.565***	-1.433***
	(0.344)	(0.356)	(0.341)	(0.348)	(0.362)	(0.351)
$rta_{hd,t-1}$	-0.227	-0.212	-0.277	-0.302	-0.208	-0.295
	(0.203)	(0.196)	(0.194)	(0.196)	(0.196)	(0.194)
$comcur_{hd,t-1}$	0.135	0.0544	0.0282	0.0500	0.0190	0.0275
	(0.247)	(0.244)	(0.246)	(0.245)	(0.245)	(0.245)
$bit_{hd,t-1}$	-0.0455	-0.0733	-0.0497	-0.0152	-0.109	-0.0454
	(0.200)	(0.195)	(0.196)	(0.195)	(0.198)	(0.194)
constant	14.65***	15.68***	13.71***	3.473	4.625*	5.590**
	(1.929)	(2.213)	(2.561)	(2.756)	(2.797)	(2.763)
Observations	7216	7216	7216	7216	7216	7216
R^2	0.818	0.817	0.820	0.821	0.818	0.817
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors are in parentheses. I_h measures the average informal institution investment at the country level. It is proxied by percentage of top 50 firms connected with a minister or MP, or a close relationship

Table 29: Informal Institution

	VA	PV	GE	RQ	RL	CC
FDI capital investmet						
$I_h * G_{dt}$	-0.00259	-0.0157***	-0.0223***	-0.0187***	-0.0181***	-0.0128***
	(0.00442)	(0.00466)	(0.00486)	(0.00464)	(0.00423)	(0.00402)
$\ln(prod_{f,t-1})$	-0.0219	-0.0262	0.0445	0.0478	-0.00904	-0.00197
	(0.0342)	(0.0376)	(0.0577)	(0.0435)	(0.0509)	(0.0407)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0859***	-0.0267	-0.109**	-0.144***	-0.0341	-0.0782**
	(0.0255)	(0.0506)	(0.0511)	(0.0414)	(0.0470)	(0.0357)
$RD_{f,t-1}$	-0.704***	-0.0560***	-2.785***	-1.363***	-2.196***	-0.586***
	(0.194)	(0.00964)	(0.293)	(0.0967)	(0.291)	(0.0861)
$RD_{f,t-1} * G_{d,t-1}$	0.488***	0.0423***	1.752***	0.832***	1.292***	0.320***
	(0.141)	(0.0147)	(0.187)	(0.0609)	(0.174)	(0.0498)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.735***	0.733***	0.721***	0.728***	0.734***	0.718***
	(0.162)	(0.162)	(0.161)	(0.161)	(0.162)	(0.163)
$\ln(distance_{hd})$	-0.437***	-0.430***	-0.424***	-0.446***	-0.417***	-0.434***
	(0.103)	(0.102)	(0.103)	(0.103)	(0.103)	(0.102)
$contig_{hd}$	0.595***	0.609***	0.572***	0.557***	0.577***	0.615***
	(0.187)	(0.186)	(0.185)	(0.184)	(0.187)	(0.185)
$comlang_{hd}$	0.828***	0.810***	0.888***	0.888***	0.883***	0.878***
	(0.183)	(0.182)	(0.188)	(0.184)	(0.186)	(0.184)
$colony_{hd}$	-0.780***	-0.702***	-0.603***	-0.673***	-0.543***	-0.669***
	(0.193)	(0.195)	(0.182)	(0.185)	(0.185)	(0.186)
$comcol_{hd}$	-0.665	-0.477	-0.349	-0.335	-0.484	-0.471
	(0.528)	(0.553)	(0.534)	(0.543)	(0.535)	(0.539)
$smctry_{hd}$	-1.263***	-1.620***	-1.464***	-1.321***	-1.601***	-1.467***
	(0.343)	(0.353)	(0.339)	(0.346)	(0.357)	(0.348)
$rta_{hd,t-1}$	-0.222	-0.187	-0.256	-0.290	-0.166	-0.272
	(0.204)	(0.194)	(0.192)	(0.196)	(0.192)	(0.192)
$comcur_{hd,t-1}$	0.140	0.0519	0.0627	0.0799	0.0549	0.0542
	(0.246)	(0.242)	(0.245)	(0.244)	(0.243)	(0.243)
$bit_{hd,t-1}$	-0.0442	-0.0856	-0.0665	-0.0253	-0.111	-0.0545
	(0.200)	(0.195)	(0.197)	(0.196)	(0.197)	(0.194)
constant	7.486***	6.837**	4.021	13.61***	5.417*	14.25***
	(2.652)	(2.701)	(2.851)	(2.115)	(2.766)	(2.227)
Observations	7216	7216	7216	7216	7216	7216
R^2	0.818	0.817	0.820	0.821	0.819	0.817
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. I_h measures the average informal institution investment at the country level. It is proxied by the percentage of market capitalization of connected firms

Table 30: Firms with One Host Countries

	VA	**PV**	**GE**	**RQ**	**RL**	**CC**
$G_{h,t-1} * G_{d,t-1}$	0.406***	0.902***	0.892***	0.223	0.818***	0.720***
	(0.126)	(0.204)	(0.199)	(0.211)	(0.179)	(0.127)
$\ln(prod_{f,t-1})$	0.0550	0.0377	-0.0411	-0.000659	-0.00244	-0.00237
	(0.0747)	(0.0557)	(0.0930)	(0.0857)	(0.0972)	(0.0778)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.0468	0.351***	0.0732	0.0380	0.0867	0.0723
	(0.0501)	(0.100)	(0.0931)	(0.0850)	(0.0884)	(0.0751)
$RD_{f,t-1}$	-0.549	-4.027***	-5.601*	-3.703	-2.704	-3.468
	(1.111)	(1.182)	(2.995)	(2.636)	(3.008)	(2.358)
$RD_{f,t-1} * G_{d,t-1}$	-0.839	4.530***	2.789	1.729	1.327	1.735
	(1.028)	(1.368)	(1.728)	(1.624)	(1.784)	(1.434)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	-0.500***	-0.173	-0.169	-0.678***	-0.143	0.000827
	(0.158)	(0.155)	(0.192)	(0.208)	(0.222)	(0.202)
$\ln(distance_{hd})$	0.302**	0.436***	0.367***	0.303**	0.395***	0.522***
	(0.138)	(0.132)	(0.136)	(0.137)	(0.142)	(0.139)
$contig_{hd}$	0.677**	1.056***	1.037***	1.025***	0.953***	0.930***
	(0.319)	(0.320)	(0.324)	(0.318)	(0.330)	(0.319)
$comlang_{hd}$	0.470	0.649**	0.566*	0.609**	0.518*	0.607**
	(0.293)	(0.292)	(0.293)	(0.283)	(0.292)	(0.292)
$colony_{hd}$	-0.481	-0.424	-0.508	-0.541	-0.526	-0.447
	(0.329)	(0.329)	(0.339)	(0.330)	(0.334)	(0.339)
$comcol_{hd}$	-1.263**	0.201	-0.970*	-1.642***	-1.290**	-1.024*
	(0.496)	(0.522)	(0.533)	(0.519)	(0.522)	(0.533)
$smctry_{hd}$	0.290	0.592*	0.758**	0.340	0.574	0.848**
	(0.348)	(0.355)	(0.366)	(0.373)	(0.382)	(0.383)
$rta_{hd,t-1}$	0.0484	0.0121	-0.176	-0.195	0.117	0.216
	(0.204)	(0.202)	(0.197)	(0.206)	(0.206)	(0.211)
$comcur_{hd,t-1}$	0.871*	0.645	0.845*	0.797*	0.699	0.772
	(0.475)	(0.479)	(0.482)	(0.476)	(0.480)	(0.479)
$bit_{hd,t-1}$	0.317	-0.167	-0.00931	0.0348	0.125	0.196
	(0.293)	(0.291)	(0.283)	(0.299)	(0.292)	(0.284)
$constant$	-10.80***	-12.67***	-11.35***	-10.69***	-16.48***	-17.55***
	(1.569)	(1.339)	(1.401)	(1.665)	(1.402)	(1.607)
$Observations$	1313	1313	1313	1313	1313	1313
R^2	0.971	0.972	0.972	0.972	0.972	0.971
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. The regression sample only includes firms with only one host country.

Table 31: Adding Endowment, Cultural and Industrial Differences

	VA	PV	GE	RQ	RL	CC
FDI capital investment						
$G_{h,t-1} * G_{d,t-1}$	0.949***	1.096***	1.321***	1.584***	1.429***	0.842***
	(0.102)	(0.158)	(0.206)	(0.208)	(0.208)	(0.112)
$\ln(prod_{f,t-1})$	-0.0210	-0.0463	0.0608	0.0411	-0.00950	-0.0183
	(0.0383)	(0.0475)	(0.0679)	(0.0563)	(0.0635)	(0.0490)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.130***	-0.0649	-0.148**	-0.168***	-0.0674	-0.110***
	(0.0285)	(0.0547)	(0.0593)	(0.0576)	(0.0547)	(0.0418)
$RD_{f,t-1}$	-0.766***	-0.0221**	-2.154***	-1.088***	-2.450***	-0.399***
	(0.201)	(0.00927)	(0.299)	(0.100)	(0.327)	(0.0872)
$RD_{f,t-1} * G_{d,t-1}$	0.532***	-0.0150	1.349***	0.661***	1.442***	0.212***
	(0.147)	(0.0149)	(0.191)	(0.0628)	(0.195)	(0.0506)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	1.047***	1.677***	2.107***	2.091***	2.345***	2.391***
	(0.232)	(0.256)	(0.294)	(0.270)	(0.270)	(0.287)
$\ln(distance_{hd})$	-0.102	0.00923	0.0413	0.00256	0.126	0.0162
	(0.125)	(0.134)	(0.143)	(0.139)	(0.130)	(0.132)
$contig_{hd}$	0.777***	1.144***	1.342***	1.171***	1.134***	1.089***
	(0.259)	(0.283)	(0.283)	(0.266)	(0.252)	(0.259)
$comlang_{hd}$	-0.167	0.101	0.270	0.270	0.141	0.325*
	(0.185)	(0.178)	(0.177)	(0.183)	(0.184)	(0.183)
$colony_{hd}$	-0.0266	-0.220	-0.646***	-0.666***	-0.538***	-0.502***
	(0.188)	(0.192)	(0.204)	(0.211)	(0.203)	(0.193)
$comcol_{hd}$	-2.264**	-0.468	0.213	0.215	-1.304	-0.642
	(1.011)	(0.732)	(0.695)	(0.725)	(0.830)	(0.718)
$smctry_{hd}$	-2.938***	-2.641***	-2.350***	-2.492***	-2.775***	-2.923***
	(0.485)	(0.517)	(0.606)	(0.590)	(0.554)	(0.527)
$rta_{hd,t-1}$	-0.613***	-0.482**	-0.812***	-0.798***	-0.529**	-0.547**
	(0.205)	(0.218)	(0.230)	(0.234)	(0.206)	(0.219)
$comcur_{hd,t-1}$	0.581*	0.245	0.367	0.478*	0.464*	0.305
	(0.299)	(0.281)	(0.290)	(0.287)	(0.279)	(0.280)
$bit_{hd,t-1}$	-0.309	-0.392*	-0.279	-0.157	-0.252	-0.196
	(0.241)	(0.225)	(0.222)	(0.227)	(0.218)	(0.226)
$\mid K/L_{ot} - K/L_{dt} \mid$	1.502***	0.468	0.620*	0.819**	0.998***	0.192
	(0.363)	(0.359)	(0.364)	(0.345)	(0.368)	(0.344)
$\mid ind_{ot} - ind_{dt} \mid$	25.51***	27.60***	27.68***	26.10***	28.36***	25.19***
	(3.822)	(3.813)	(4.068)	(4.060)	(4.029)	(3.996)
$\mid religion_{ot} - religion_{dt} \mid$	3.414**	6.243***	8.113***	6.701***	8.183***	7.704***
	(1.425)	(1.410)	(1.481)	(1.429)	(1.451)	(1.423)
constant	-37.13***	-44.79***	-46.79***	-44.10***	-48.25***	-44.09***
	(4.515)	(4.384)	(4.697)	(4.647)	(4.549)	(4.576)
Observations	5133	5133	5133	5133	5133	5133
R^2	0.856	0.849	0.855	0.857	0.858	0.854
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. K/L_{ot} and K/L_{dt} are capital-labor ratio at home and host countries. ind_{ot} and ind_{dt} are industrial structure at home and host countries. $religion_{ot}$ and $religion_{dt}$ are religion compositions of home and host countries.

Table 32: Alternative TFP Measure — ACF

	VA	PV	GE	RQ	RL	CC
FDI capital investment						
$G_{h,t-1} * G_{d,t-1}$	0.667***	0.889***	0.716***	0.742***	0.826***	0.540***
	(0.0908)	(0.129)	(0.140)	(0.145)	(0.125)	(0.0893)
$\ln(prod_{f,t-1})$	0.297***	0.222***	0.208**	0.219***	0.257***	0.235***
	(0.0848)	(0.0669)	(0.0842)	(0.0783)	(0.0829)	(0.0680)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.189**	0.00693	-0.00966	-0.0235	-0.0830	-0.0530
	(0.0783)	(0.0704)	(0.0759)	(0.0629)	(0.0599)	(0.0580)
$RD_{f,t-1}$	-0.136	-1.500	-5.020**	-3.924**	-2.807*	-2.194
	(1.161)	(1.018)	(2.106)	(1.712)	(1.577)	(1.412)
$RD_{f,t-1} * G_{d,t-1}$	1.378	7.461***	5.113***	5.155***	3.403***	3.466***
	(1.196)	(1.456)	(1.453)	(1.310)	(1.091)	(1.085)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.728***	0.851***	0.950***	1.003***	1.204***	1.010***
	(0.146)	(0.142)	(0.151)	(0.161)	(0.162)	(0.164)
$\ln(distance_{hd})$	-0.235**	-0.304***	-0.266**	-0.239**	-0.188*	-0.236**
	(0.119)	(0.108)	(0.112)	(0.110)	(0.110)	(0.110)
$contig_{hd}$	0.806***	0.685***	0.884***	0.856***	0.897***	0.855***
	(0.178)	(0.176)	(0.182)	(0.181)	(0.177)	(0.178)
$comlang_{hd}$	0.567***	0.630***	0.706***	0.784***	0.757***	0.714***
	(0.182)	(0.166)	(0.173)	(0.172)	(0.172)	(0.169)
$colony_{hd}$	-0.495**	-0.436**	-0.677***	-0.746***	-0.788***	-0.653***
	(0.193)	(0.179)	(0.184)	(0.188)	(0.186)	(0.181)
$comcol_{hd}$	0.200	0.256	0.277	0.247	0.288	0.240
	(0.584)	(0.396)	(0.427)	(0.450)	(0.493)	(0.429)
$smctry_{hd}$	-2.087***	-1.835***	-1.497***	-1.527***	-1.302***	-1.614***
	(0.380)	(0.328)	(0.364)	(0.374)	(0.361)	(0.347)
$rta_{hd,t-1}$	-0.319	0.0835	-0.0557	-0.0931	-0.0232	0.0602
	(0.227)	(0.200)	(0.224)	(0.221)	(0.215)	(0.211)
$comcur_{hd,t-1}$	0.357	0.324	0.340	0.386*	0.406*	0.396*
	(0.225)	(0.217)	(0.224)	(0.222)	(0.223)	(0.224)
$bit_{hd,t-1}$	-0.0878	-0.356**	-0.290*	-0.252	-0.110	-0.0885
	(0.180)	(0.171)	(0.175)	(0.177)	(0.177)	(0.171)
constant	1.198	-7.751***	-0.227	-0.0585	-2.243	-2.284
	(1.843)	(2.058)	(1.767)	(1.776)	(1.856)	(1.823)
Observations	7795	7795	7795	7795	7795	7795
R^2	0.835	0.838	0.835	0.835	0.837	0.836
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. TFP is estimated using Ackerberg-Caves-Frazer (ACF) .

Table 33: Alternative TFP Measure — Wooldridge

	VA	**PV**	**GE**	**RQ**	**RL**	**CC**
FDI capital investment						
$G_{h,t-1} * G_{d,t-1}$	0.650***	0.889***	0.733***	0.795***	0.849***	0.567***
	(0.0894)	(0.126)	(0.144)	(0.146)	(0.126)	(0.0930)
$\ln(prod_{f,t-1})$	-0.191	-0.201*	-0.246*	-0.224*	-0.207	-0.211*
	(0.121)	(0.104)	(0.140)	(0.127)	(0.127)	(0.112)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.134	-0.131	0.0313	-0.0302	-0.0391	-0.0593
	(0.105)	(0.104)	(0.107)	(0.0989)	(0.0898)	(0.0846)
$RD_{f,t-1}$	-0.117	-1.725*	-5.103**	-3.958**	-2.727*	-2.175
	(1.224)	(1.030)	(2.086)	(1.747)	(1.643)	(1.462)
$RD_{f,t-1} * G_{d,t-1}$	1.292	6.991***	4.911***	4.896***	3.188***	3.239***
	(1.261)	(1.461)	(1.464)	(1.345)	(1.135)	(1.122)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.662***	0.846***	0.931***	1.016***	1.184***	1.023***
	(0.143)	(0.142)	(0.152)	(0.162)	(0.161)	(0.164)
$\ln(distance_{hd})$	-0.221*	-0.321***	-0.287***	-0.254**	-0.190*	-0.241**
	(0.118)	(0.109)	(0.110)	(0.110)	(0.109)	(0.109)
$contig_{hd}$	0.784***	0.684***	0.864***	0.835***	0.877***	0.879***
	(0.177)	(0.180)	(0.182)	(0.182)	(0.176)	(0.178)
$comlang_{hd}$	0.636***	0.708***	0.787***	0.865***	0.831***	0.778***
	(0.183)	(0.169)	(0.174)	(0.174)	(0.173)	(0.171)
$colony_{hd}$	-0.565***	-0.508***	-0.780***	-0.848***	-0.878***	-0.736***
	(0.192)	(0.179)	(0.183)	(0.186)	(0.184)	(0.178)
$comcol_{hd}$	0.693	0.588	0.696	0.731	0.782	0.706*
	(0.541)	(0.399)	(0.429)	(0.446)	(0.490)	(0.428)
$smctry_{hd}$	-2.008***	-1.769***	-1.432***	-1.428***	-1.223***	-1.531***
	(0.364)	(0.325)	(0.366)	(0.376)	(0.354)	(0.339)
$rta_{hd,t-1}$	-0.418*	-0.0441	-0.175	-0.230	-0.134	-0.0632
	(0.220)	(0.202)	(0.227)	(0.224)	(0.212)	(0.209)
$comcur_{hd,t-1}$	0.348	0.276	0.291	0.353	0.380*	0.377*
	(0.220)	(0.215)	(0.220)	(0.217)	(0.218)	(0.219)
$bit_{hd,t-1}$	-0.0757	-0.324*	-0.253	-0.211	-0.0678	-0.0729
	(0.182)	(0.172)	(0.177)	(0.179)	(0.177)	(0.172)
constant	-10.66***	0.252	-10.77***	-1.383	-3.493*	-1.979
	(2.247)	(1.781)	(2.107)	(1.858)	(1.845)	(1.807)
Observations	7795	7795	7795	7795	7795	7795
R^2	0.828	0.831	0.830	0.830	0.831	0.831
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors are in parentheses. TFP is estimated using Wooldridge.

Table 34: Alternative TFP Measure — Mollisi-Rovigatti

FDI capital investment	**VA**	**PV**	**GE**	**RQ**	**RL**	**CC**
$G_{h,t-1} * G_{d,t-1}$	0.651***	0.886***	0.731***	0.793***	0.847***	0.565***
	(0.0893)	(0.126)	(0.144)	(0.146)	(0.126)	(0.0930)
$\ln(prod_{f,t-1})$	-0.191	-0.199*	-0.248*	-0.220*	-0.209*	-0.210*
	(0.121)	(0.105)	(0.139)	(0.124)	(0.126)	(0.112)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.143	-0.134	0.0375	-0.0328	-0.0330	-0.0556
	(0.106)	(0.105)	(0.107)	(0.0985)	(0.0891)	(0.0858)
$RD_{f,t-1}$	-0.105	-1.713*	-5.104**	-3.970**	-2.729*	-2.165
	(1.228)	(1.025)	(2.083)	(1.739)	(1.637)	(1.460)
$RD_{f,t-1} * G_{d,t-1}$	1.281	6.915***	4.914***	4.903***	3.188***	3.233***
	(1.265)	(1.456)	(1.460)	(1.339)	(1.131)	(1.122)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.662***	0.823***	0.930***	1.015***	1.183***	1.021***
	(0.143)	(0.142)	(0.151)	(0.162)	(0.160)	(0.164)
$\ln(distance_{hd})$	-0.217*	-0.321***	-0.286***	-0.252**	-0.191*	-0.241**
	(0.117)	(0.108)	(0.110)	(0.110)	(0.109)	(0.109)
$contig_{hd}$	0.787***	0.653***	0.863***	0.836***	0.875***	0.878***
	(0.177)	(0.179)	(0.182)	(0.182)	(0.176)	(0.178)
$comlang_{hd}$	0.632***	0.730***	0.783***	0.865***	0.829***	0.775***
	(0.184)	(0.168)	(0.174)	(0.173)	(0.174)	(0.171)
$colony_{hd}$	-0.564***	-0.533***	-0.779***	-0.849***	-0.877***	-0.735***
	(0.192)	(0.178)	(0.183)	(0.186)	(0.184)	(0.178)
$comcol_{hd}$	0.702	0.555	0.696	0.720	0.782	0.704
	(0.545)	(0.395)	(0.430)	(0.444)	(0.491)	(0.428)
$smctry_{hd}$	-2.007***	-1.766***	-1.433***	-1.432***	-1.227***	-1.535***
	(0.364)	(0.325)	(0.366)	(0.375)	(0.354)	(0.339)
$rta_{hd,t-1}$	-0.413*	-0.0420	-0.169	-0.223	-0.130	-0.0582
	(0.220)	(0.200)	(0.227)	(0.223)	(0.212)	(0.208)
$comcur_{hd,t-1}$	0.356	0.265	0.294	0.355	0.384*	0.380*
	(0.220)	(0.215)	(0.220)	(0.218)	(0.218)	(0.219)
$bit_{hd,t-1}$	-0.0744	-0.307*	-0.248	-0.209	-0.0649	-0.0699
	(0.182)	(0.172)	(0.177)	(0.179)	(0.178)	(0.172)
constant	-19.68***	-1.219	-1.592	-1.405	-3.528*	-2.016
	(2.843)	(1.789)	(1.821)	(1.878)	(1.854)	(1.817)
Observations	7795	7795	7795	7795	7795	7795
R^2	0.828	0.830	0.830	0.830	0.831	0.831
Origin-Year FE	Y	Y	Y	Y	Y	Y
Destination-Year FE	Y	Y	Y	Y	Y	Y
Sector-Destination fe	Y	Y	Y	Y	Y	Y

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are in parentheses. TFP is estimated using Mollisi-Rovigatti.

Table 35: Other Instutution Measures

FDI capital investment	**Contract**	**Legal**
$G_{h,t-1} * G_{d,t-1}$	0.000800**	0.237***
	(0.000317)	(0.0492)
$\ln(prod_{f,t-1})$	0.0609	0.0724
	(0.180)	(0.169)
$\ln(prod_{f,t-1}) * G_{d,t-1}$	-0.00157	-0.0208
	(0.00273)	(0.0249)
$RD_{f,t-1}$	-0.104**	-4.674***
	(0.0476)	(0.635)
$RD_{f,t-1} * G_{d,t-1}$	0.000999	0.588***
	(0.000653)	(0.0806)
$\mid \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \mid$	0.621***	0.955***
	(0.156)	(0.170)
$\ln(distance_{hd})$	-0.251**	-0.120
	(0.116)	(0.113)
$contig_{hd}$	0.779***	0.877***
	(0.236)	(0.231)
$comlang_{hd}$	0.675***	0.564***
	(0.181)	(0.177)
$colony_{hd}$	-0.367*	-0.339*
	(0.206)	(0.206)
$comcol_{hd}$	-0.0178	0.219
	(0.463)	(0.451)
$smctry_{hd}$	-1.467***	-1.032***
	(0.372)	(0.383)
$rta_{hd,t-1}$	0.00527	0.210
	(0.219)	(0.196)
$comcur_{hd,t-1}$	0.301	0.437*
	(0.250)	(0.239)
$bit_{hd,t-1}$	-0.341*	-0.271
	(0.178)	(0.181)
constant	-10.04***	-10.55***
	(1.803)	(2.246)
Observations	7506	7487
R^2	0.798	0.796
Origin-Year FE	Y	Y
Destination-Year FE	Y	Y
Sector-Destination fe	Y	Y

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors are in parentheses. The institutional quality measure is contractual enforcement and judical system.

Table 36: Summary Statistics

Variable	Mean	Std. Dev.	N
management	3.017	0.667	8735
monitor	3.315	0.793	8734
target	2.975	0.791	8735
people	2.833	0.674	8735
(log) employment	6.003	0.969	8735
export	31.941	33.475	3427
employment rigidity	23.384	18.778	8665
PPP-adjusted-GDP	3781.658	4347.875	8735

This reports summary statistics of major variables in the empirical study.

Table 37: Summary Statistics—Financial Development

Variable		Mean	Std. Dev.	Min.	Max.	N
Credit to GDP	Overall	99.758	56.909	9.774	237.5804	222
	Between		52.88	15.40233	187.7943	20
	Within		20.634	38.137	187.9127	11

This table reports the financial development across countries and years.

Table 38: Summary Statistics—External Financial Dependence

Variable		Mean	Std. Dev.	Min.	Max.	N
Ext.Dep	Overall	1.178	118.73	-2512.778	12755.67	130689
	Between		33.0732	-243.7717	1046.855	1244
	Within		113.576	-2267.828	11709.99	10.507

This table reports the financial vulnerability variables across countries, years and industries.

Table 39: Baseline Results

Dependent variable	(1) management	(2) management	(3) target	(4) target	(5) people	(6) people
Credit-to-GDP	-0.00166*	-0.00277*	-0.00230	-0.00390	-0.000946	-0.00162
	(0.000800)	(0.00151)	(0.00138)	(0.00223)	(0.000851)	(0.00131)
FinDev*Ext.Dep	-0.000168**	-0.000152**	-0.000322**	-0.000321**	-0.000128	-0.000115
	(6.58e-05)	(6.27e-05)	(0.000113)	(0.000118)	(8.55e-05)	(0.000124)
export		0.000305		0.000128		0.000296
		(0.000462)		(0.000583)		(0.000282)
Employment Rigidity		0.0212*		0.0295*		0.0122
		(0.0110)		(0.0136)		(0.00742)
PPP-adjusted-GDP		2.62e-05		1.64e-05		1.03e-05
		(1.65e-05)		(2.53e-05)		(2.79e-05)
Observations	5,365	5,325	5,365	5,325	5,365	5,325
R-squared	0.196	0.198	0.162	0.165	0.158	0.158

*** p<0.01, ** p<0.05, * p<0.1 This Table reports the panel OLS estimates of equation 22. The dependent variables measure different aspects of managerial efforts: management measures the average score across all 18 managerial survey questions; target measures the average score in questions related to "the clarity of target" and people measures the average score in questions related to "talent retaining/rewarding". All regressions control for industry, year, MNC, and country fixed effects. The robust standard errors (clustered at year industry and country levels) are reported in the parenthesis.

Table 40: Baseline Results with Larger Firms

Dependent variable	(1) management	(2) management	(3) target	(4) target	(5) people	(6) people
Credit-to-GDP	-8.79e-05	-0.000223	-0.00160	-0.00203	0.00138	0.000895
	(0.00155)	(0.00202)	(0.00213)	(0.00228)	(0.00134)	(0.00206)
FinDev*Ext.Dep	-0.000179	-7.92e-05	-3.34e-05	0.000101	3.80e-05	2.46e-05
	(0.000163)	(0.000203)	(0.000182)	(0.000235)	(0.000111)	(0.000162)
export		-9.90e-05		-0.000794*		0.000489
		(0.000470)		(0.000405)		(0.000673)
Employment Rigidity		0.00153		0.00280		0.00307
		(0.0146)		(0.0105)		(0.0138)
PPP-adjusted-GDP		7.20e-05**		8.46e-05**		5.65e-06
		(2.53e-05)		(2.65e-05)		(2.28e-05)
Observations	1,187	1,171	1,187	1,171	1,187	1,171
R-squared	0.296	0.303	0.235	0.244	0.263	0.268

*** p<0.01, ** p<0.05, * p<0.1 This Table reports the panel OLS estimates of equation 22. It uses samples of firms with (log) employment larger than 7. The dependent variables measure different aspects of managerial efforts: management measures the average score across all 18 managerial survey questions; target measures the average score in questions related to "the clarity of target" and people measures the average score in questions related to "talent retaining/rewarding". All regressions control for industry, year, MNC, and country fixed effects. The robust standard errors (clustered at year industry and country levels) are reported in the parenthesis.

Table 41: Robustness Check: Alternative Cutoff

Dependent variable	(1) management	(2) management	(3) target	(4) target	(5) people	(6) people
Credit-to-GDP	-0.00159**	-0.00252*	-0.00228*	-0.00374*	-0.000856	-0.00139
	(0.000620)	(0.00120)	(0.00121)	(0.00196)	(0.000663)	(0.00108)
FinDev*Ext.Dep	-0.000161**	-0.000136**	-0.000273**	-0.000265**	-0.000103***	-8.29e-05
	(5.83e-05)	(5.92e-05)	(0.000109)	(0.000108)	(1.51e-05)	(4.63e-05)
export		0.000451		0.000113		0.000390
		(0.000451)		(0.000551)		(0.000374)
Employment Rigidity		0.0207*		0.0287*		0.0110
		(0.00979)		(0.0132)		(0.00676)
PPP-adjusted-GDP		3.57e-05**		2.43e-05		1.78e-05
		(1.24e-05)		(2.04e-05)		(1.98e-05)
Observations	5,927	5,885	5,927	5,885	5,927	5,885
R-squared	0.196	0.199	0.162	0.165	0.158	0.158

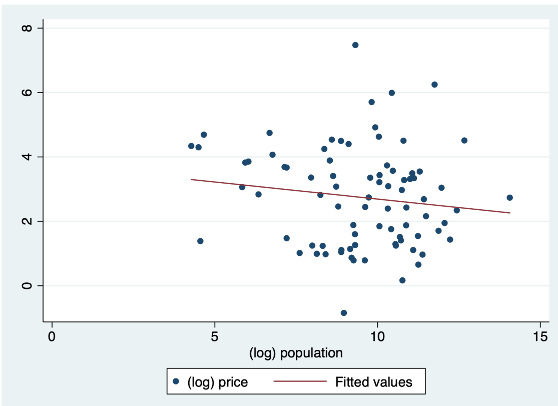
*** p<0.01, ** p<0.05, * p<0.1 This Table reports the panel OLS estimates of equation 22. The dependent variables measure different aspects of managerial efforts: management measures the average score across all 18 managerial survey questions; target measures the average score in questions related to "the clarity of target" and people measures the average score in questions related to "talent retaining/rewarding". All regressions control for industry, year, MNC, and country fixed effects. The robust standard errors (clustered at year industry and country levels) are reported in the parenthesis.

Table 42: Robustness Check: Alternative Cutoff

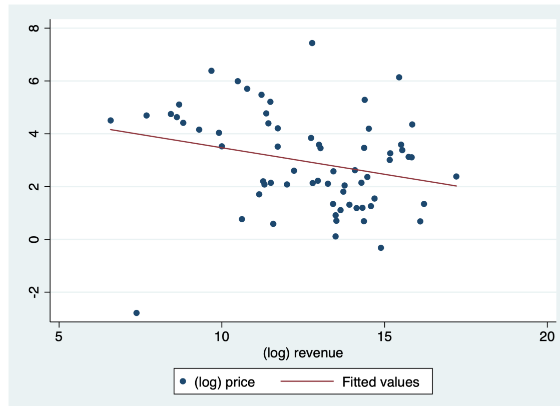
Dependent variable	(1) management	(2) management	(3) target	(4) target	(5) people	(6) people
Credit-to-GDP	-0.00237***	-0.00386***	-0.00314**	-0.00504**	-0.00145*	-0.00221*
	(0.000533)	(0.00116)	(0.00113)	(0.00192)	(0.000736)	(0.00114)
FinDev*Ext.Dep	-0.000224*	-0.000207	-0.000297*	-0.000282*	-0.000187	-0.000182
	(0.000120)	(0.000120)	(0.000152)	(0.000153)	(0.000124)	(0.000192)
export		0.000485		0.000275		0.000223
		(0.000384)		(0.000565)		(0.000260)
Employment Rigidity		0.0256**		0.0334**		0.0138*
		(0.0104)		(0.0142)		(0.00625)
PPP-adjusted-GDP		1.75e-05		1.32e-05		1.12e-05
		(2.64e-05)		(5.44e-05)		(2.03e-05)
Observations	4,617	4,586	4,617	4,586	4,617	4,586
R-squared	0.195	0.199	0.167	0.170	0.155	0.156

*** p<0.01, ** p<0.05, * p<0.1 This Table reports the panel OLS estimates of equation 22. The dependent variables measure different aspects of managerial efforts: management measures the average score across all 18 managerial survey questions; target measures the average score in questions related to "the clarity of target" and people measures the average score in questions related to "talent retaining/rewarding". All regressions control for industry, year, MNC, and country fixed effects. The robust standard errors (clustered at year industry and country levels) are reported in the parenthesis.

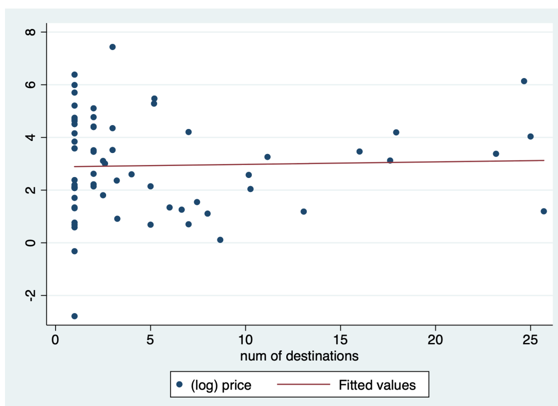
Figure 1: Price, Revenue and Destination Market Characteristics HS 24



(a) Price and Market Size: HS 24



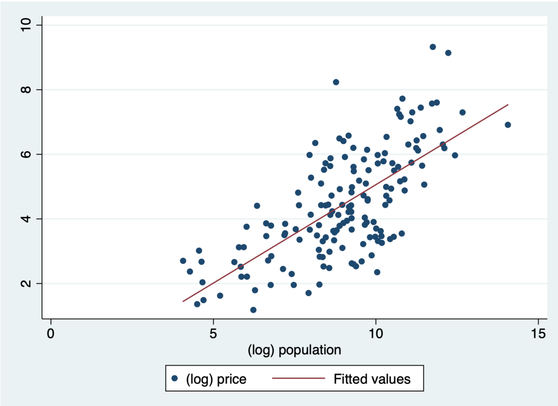
(b) Price and Revenue: HS 24



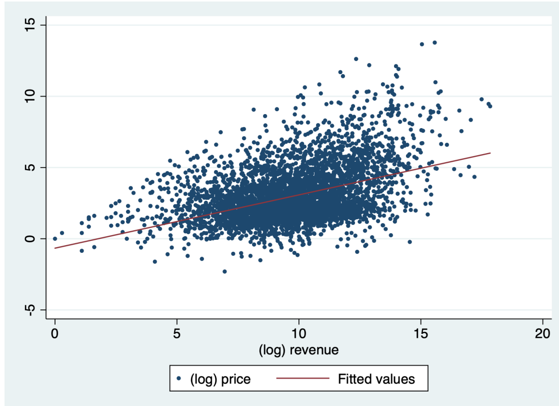
(c) Price and Market Entry: HS 24

Note: The three figures show the correlation between average (log) price across firms exporting to a destination and destination market size (Panel a), average (log) price and average (log) revenue across destinations of each firm (Panel b), and average (log) price of a firm across destinations and average number of markets a firm enters (Panel c), of firms in sector HS 24 (Tobacco). Market size is proxied by population size and the data is from Penn World Table.

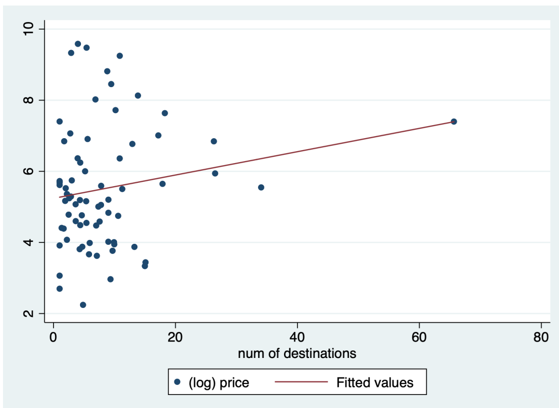
Figure 2: Price and Destination Market Size



(a) Price and Market Size: HS 30



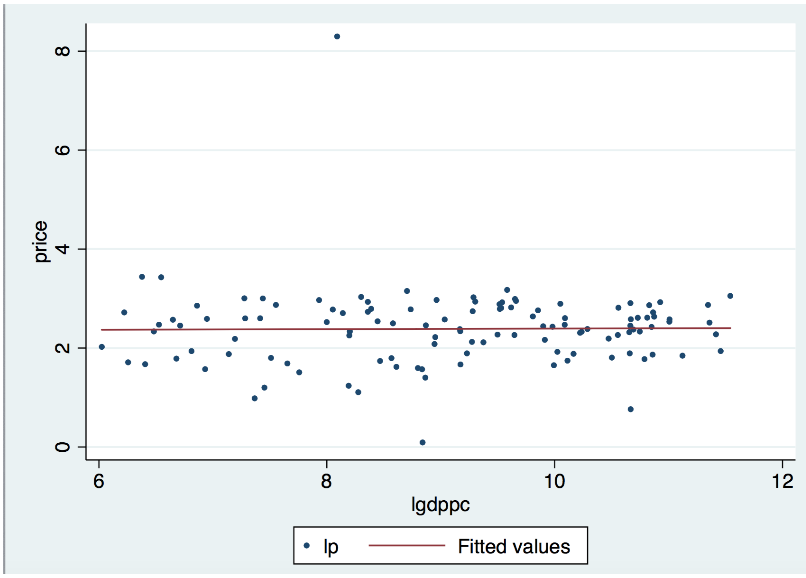
(b) Price and Revenue: HS 30



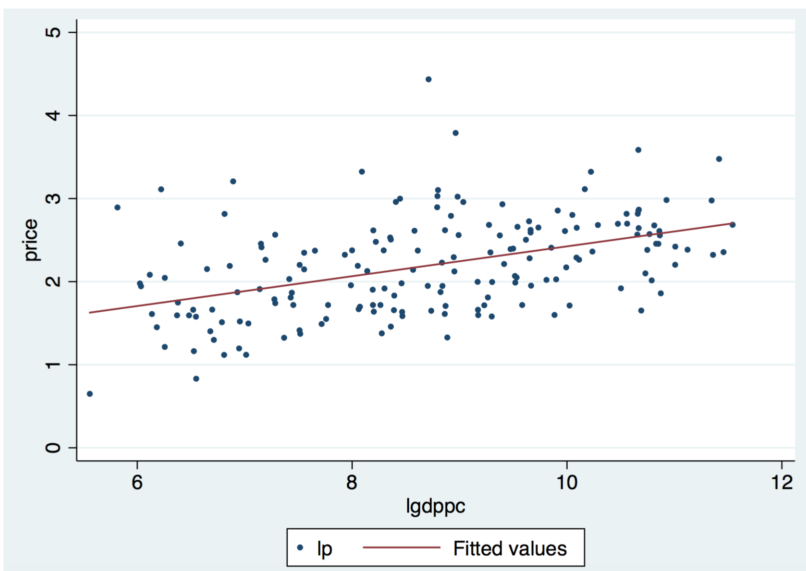
(c) Price and Market Entry: HS 30

Note: The three figures show the correlation between average (log) price across firms exporting to a destination and destination market size (Panel a), average (log) price and average (log) revenue across destinations of each firm (Panel b), and average (log) price of a firm across destinations and average number of markets a firm enters (Panel c), of firms in sector HS 30 (Pharmaceutical). Market size is proxied by population size and the data is from Penn World Table.

Figure 3: The Correlation between Price and Destination Income



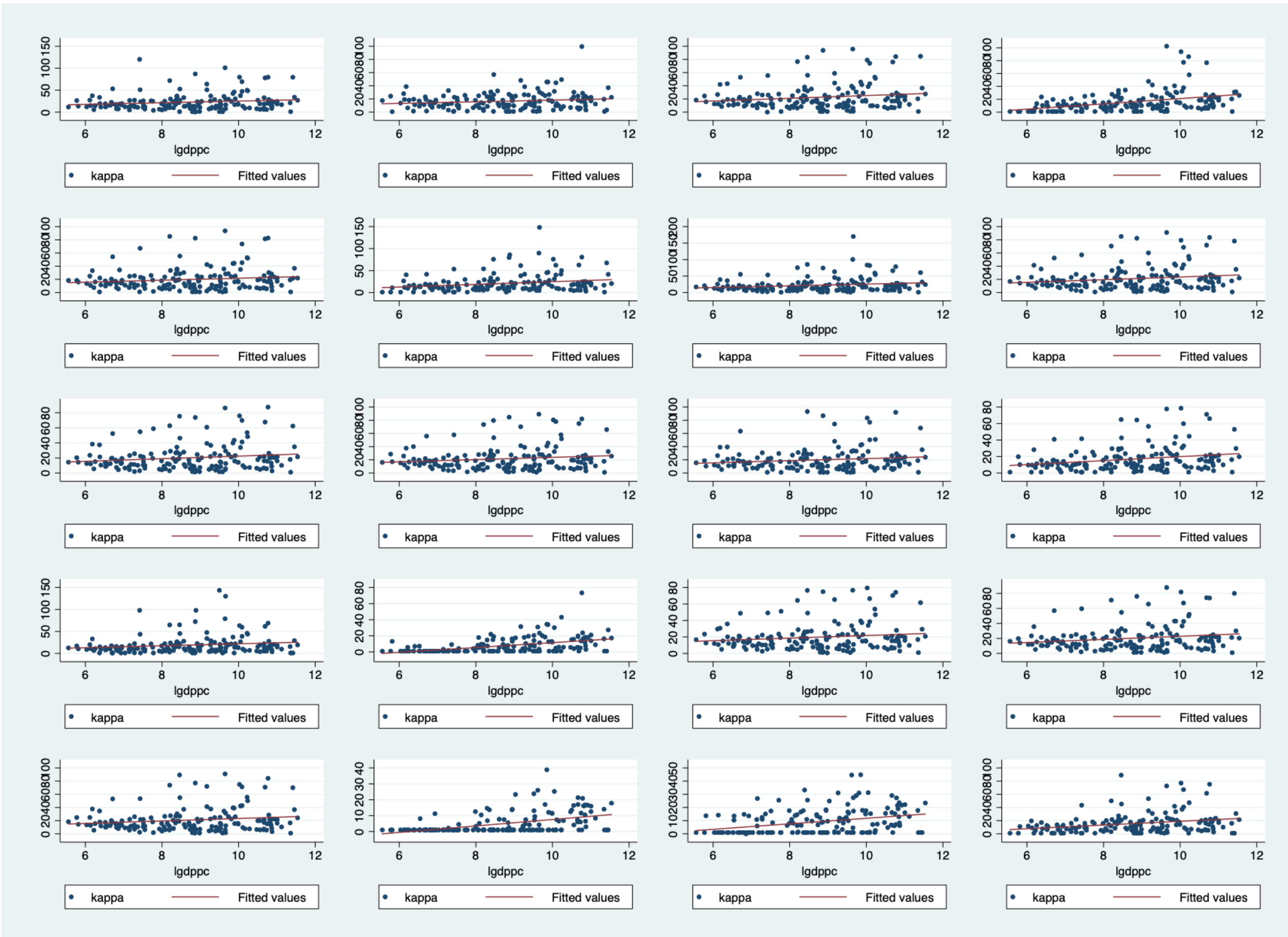
(a) Unit Value and GDP Per Capita: HS 20422



(b) Unit Value and GDP Per Capita: HS 940169

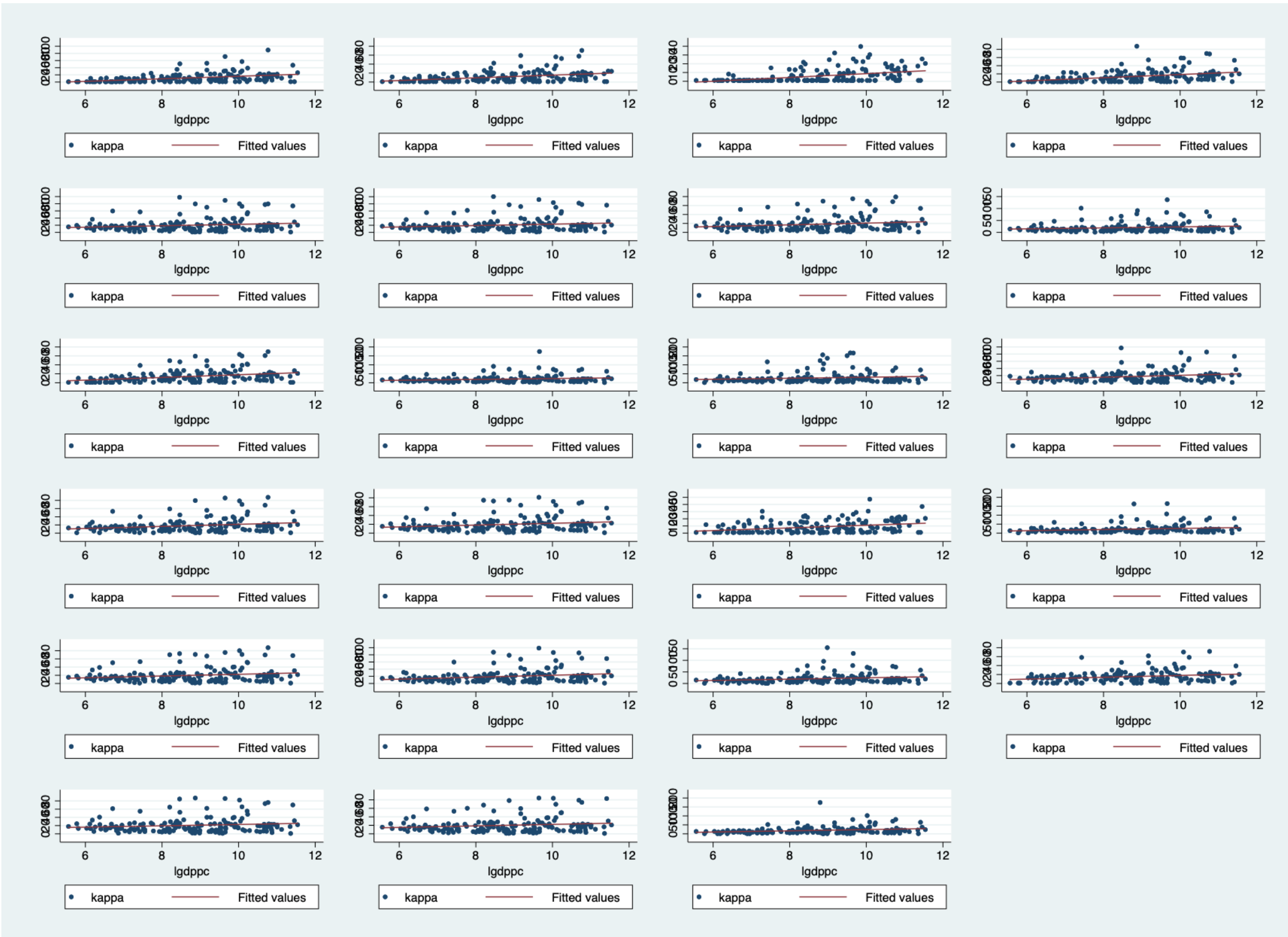
Note: The two figures show the correlation between price and destination GDP per capita for two sectors: (a) HS 20422 (Meat sheep or goats; (b) fresh, chilled or frozen) and HS 940169 (Seats)

Figure 4: Preference for Quality and Income, HS 2 - HS 51



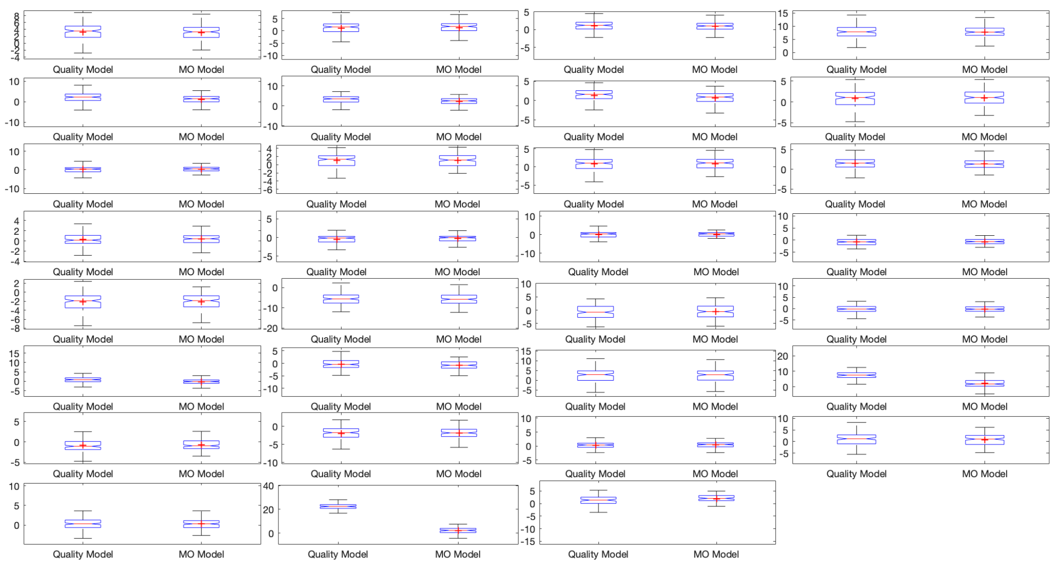
Note: The figures show positive correlations between income and quality preferences for sectors: HS 2, HS 3, HS 4, HS 6, HS 8, HS 11, HS 15, HS 16, HS 19, HS 21, HS 24, HS 32, HS 36, HS 37, HS 40, HS 42, HS 49, HS 50, HS 51

Figure 4: Preference for Quality and Income, HS 52 - HS 97



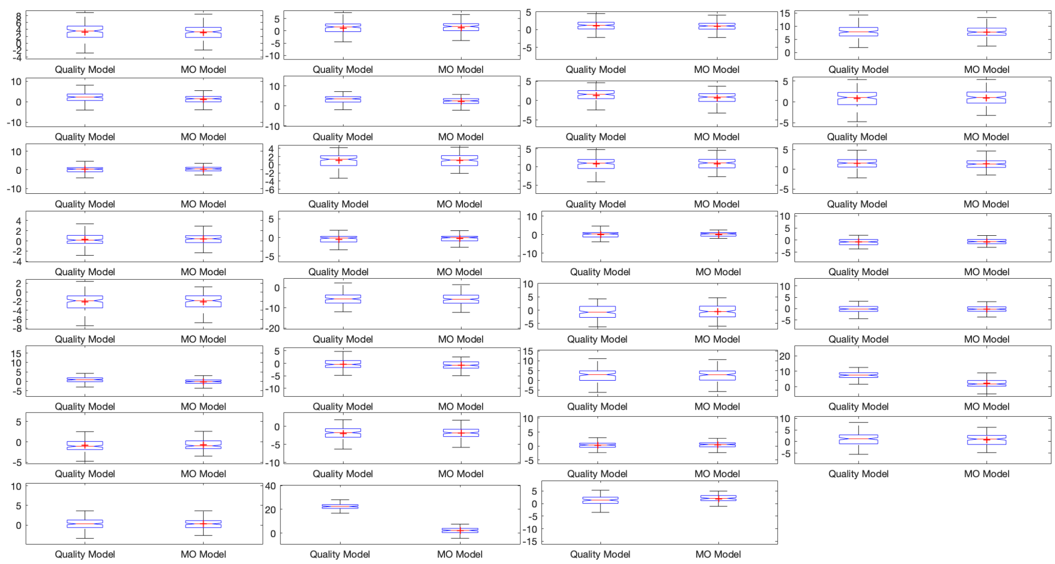
Note: The figures show positive correlations between income and quality preferences for sectors: HS 54, HS 55, HS 58, HS 59, HS 61, HS 62, HS 65, HS 66, HS 68, HS 69, HS 70, HS 71, HS 74, HS 76, HS 87, HS 88, HS 89, HS 90, HS 91, HS 92, HS 93, HS 94, HS 96

Figure 5: Distribution of Cutoffs, HS 2 - HS 51



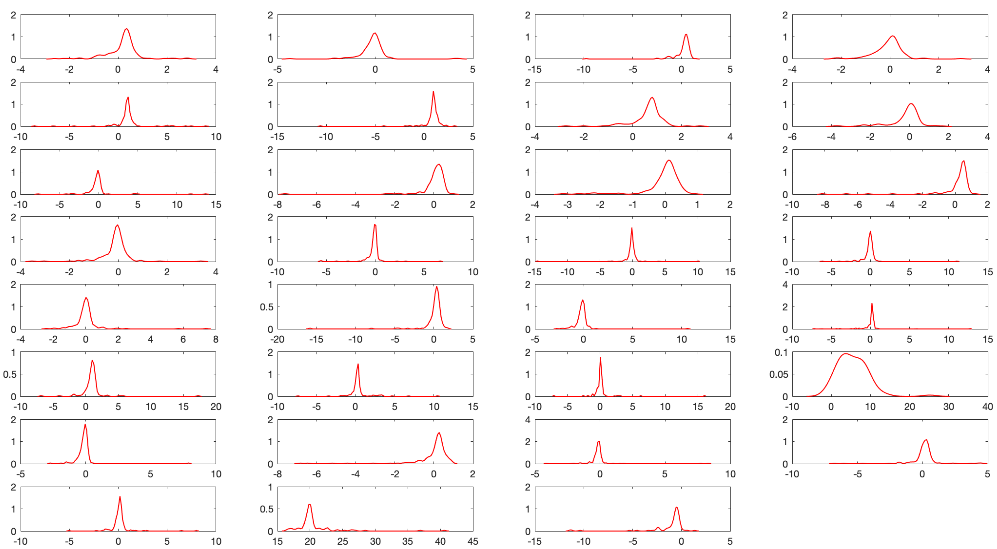
Note: The figures show differences in distribution of cutoffs between the model in this paper (right) and Melitz and Ottaviano (left): HS 2, HS 3, HS 4, HS 6, HS 7, HS 8, HS 9, HS 10, HS 11, HS 15, HS 16, HS 17, HS 18, HS 19, HS 20, HS 21, HS 23, HS 24, HS 30, HS 32, HS 34, HS 35, HS 36, HS 37, HS 38, HS 39, HS 40, HS 42, HS 49, HS 50, HS 51

Figure 5: Distribution of Cutoffs, HS 52 - HS 97



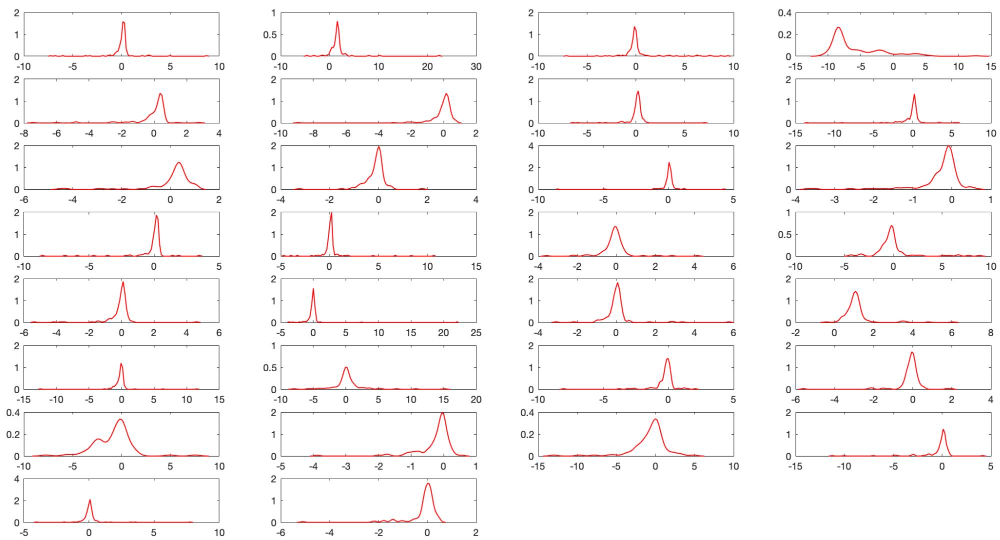
Note: The figures show differences in distribution of cutoffs between the model in this paper (right) and Melitz and Ottaviano (left): HS 52, HS 54, HS 55, HS 58, HS 59, HS 61, HS 62, HS 63, HS 64, HS 65, HS 66, HS 67, HS 68, HS 69, HS 70, HS 71, HS 73, HS 74, HS 76, HS 82, HS 87, HS 88, HS 89, HS 90, HS 91, HS 92, HS 93, HS 94, HS 95, HS 96

Figure 6: Distribution of Differences Cutoffs, HS 2 - HS 51



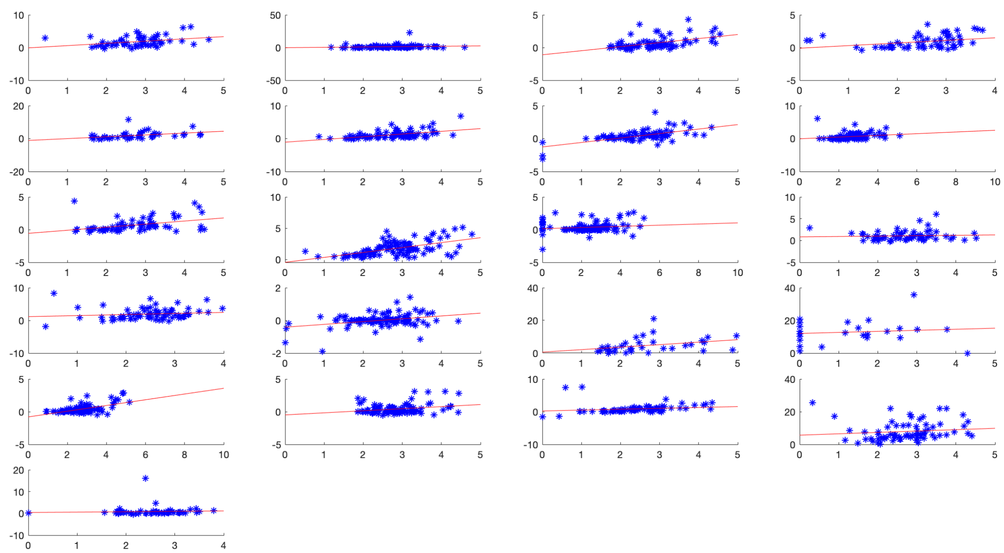
Note: The figures show distribution of differences in cutoffs predicted by model in this paper and Melitz and Ottaviano for sectors: HS 2, HS 3, HS 4, HS 6, HS 7, HS 8, HS 9, HS 10, HS 11, HS 15, HS 16, HS 17, HS 18, HS 19, HS 20, HS 21, HS 23, HS 24, HS 30, HS 32, HS 34, HS 35, HS 36, HS 37, HS 38, HS 39, HS 40, HS 42, HS 49, HS 50, HS 51

Figure 6: Distribution of Differences in Cutoffs, HS 52 - HS 97



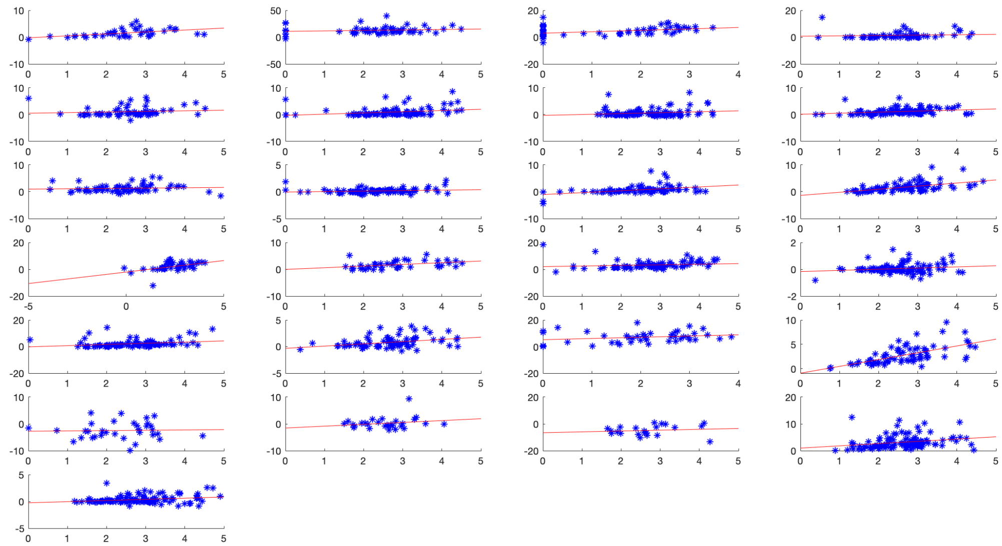
Note: The figures show distribution of differences in cutoffs predicted by model in this paper and Melitz and Ottaviano for sectors: HS 52, HS 54, HS 55, HS 58, HS 59, HS 61, HS 62, HS 63, HS 64, HS 65, HS 66, HS 67, HS 68, HS 69, HS 70, HS 71, HS 73, HS 74, HS 76, HS 81, HS 86, HS 87, HS 88, HS 89, HS 90, HS 91, HS 92, HS 93, HS 94, HS 95

Figure 7: Change in Cutoffs and Quality Preferences, HS 2 - HS 51



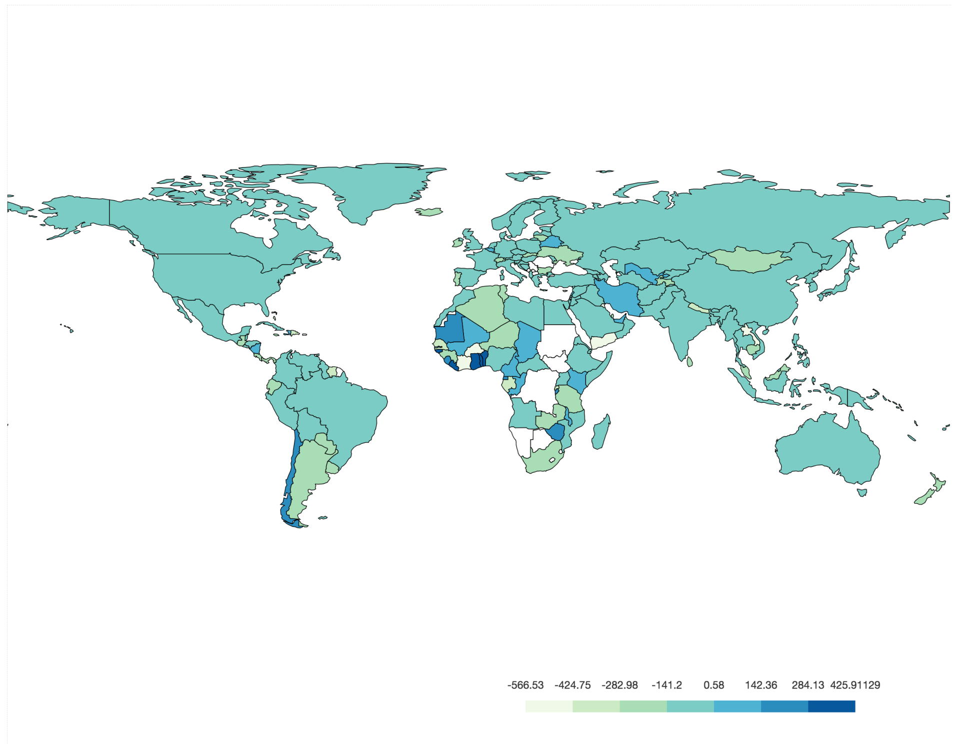
Note: The figures show positive correlations between quality preferences and difference in loss from trade barrier between the model in this paper and Melitz and Ottaviano for sectors: HS 2, HS 3, HS 4, HS 7, HS 8, HS 9, HS 11, HS 15, HS 16, HS 17, HS 23, HS 24, HS 30, HS 35, HS 36, HS 37, HS 38, HS 39, HS 40, HS 42, HS 51

Figure 7: Change in Cutoffs and Quality Preferences, HS 52 - HS 97



Note: The figures show positive correlations between quality preferences and difference in loss from trade barrier between the model in this paper and Melitz and Ottaviano: HS 52, HS 54, HS 58, HS 61, HS 62, HS 63, HS 64, HS 65, HS 66, HS 68, HS 69, HS 70, HS 71, HS 73, HS 74, HS 76, HS 82, HS 87, HS 88, HS 90, HS 91, HS 92, HS 93, HS 95, HS 96

Figure 8: Changes in Cutoffs Across Countries



The figure illustrates the distribution of rise/fall in endogenous competitiveness across countries

Figure 9: Profit Functions of FDI

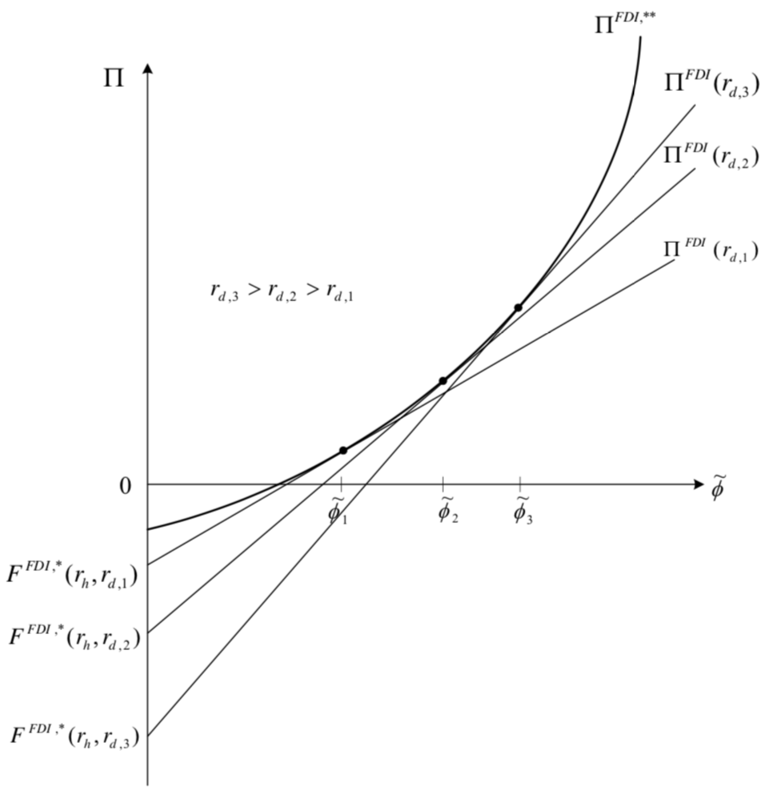


Figure 10: Sorting of Firms

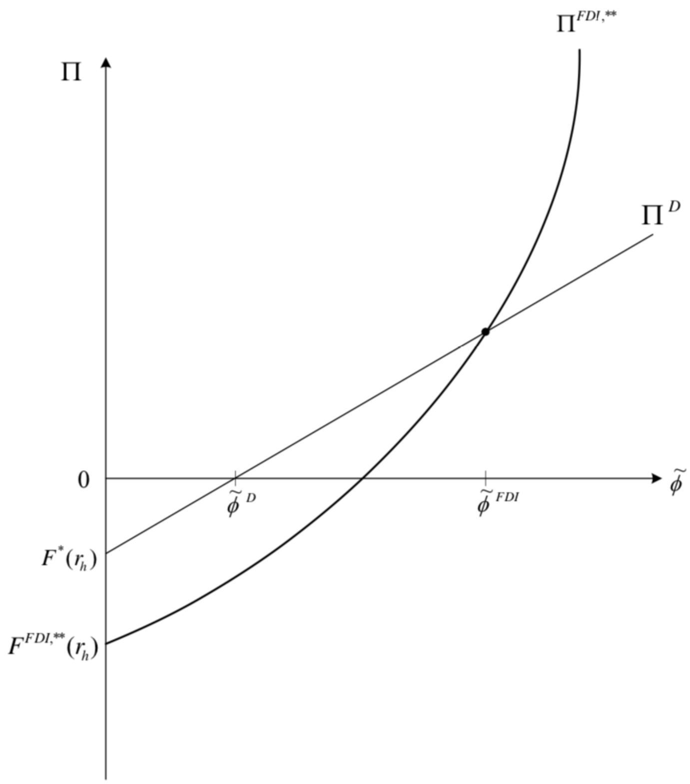


Figure 11: Country Composition in Greenfield FDI Data

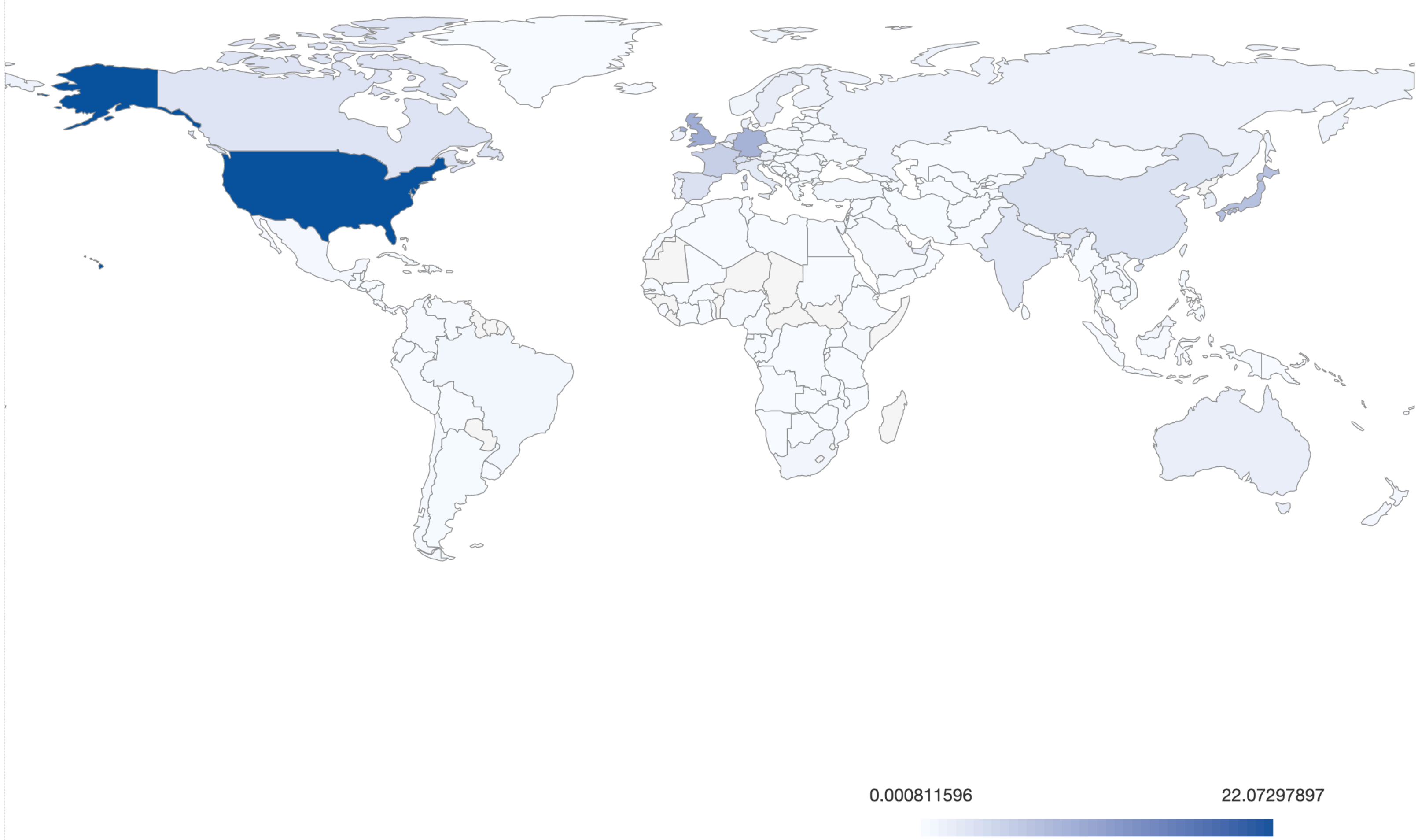


Figure 12: Country Composition in Merged Data

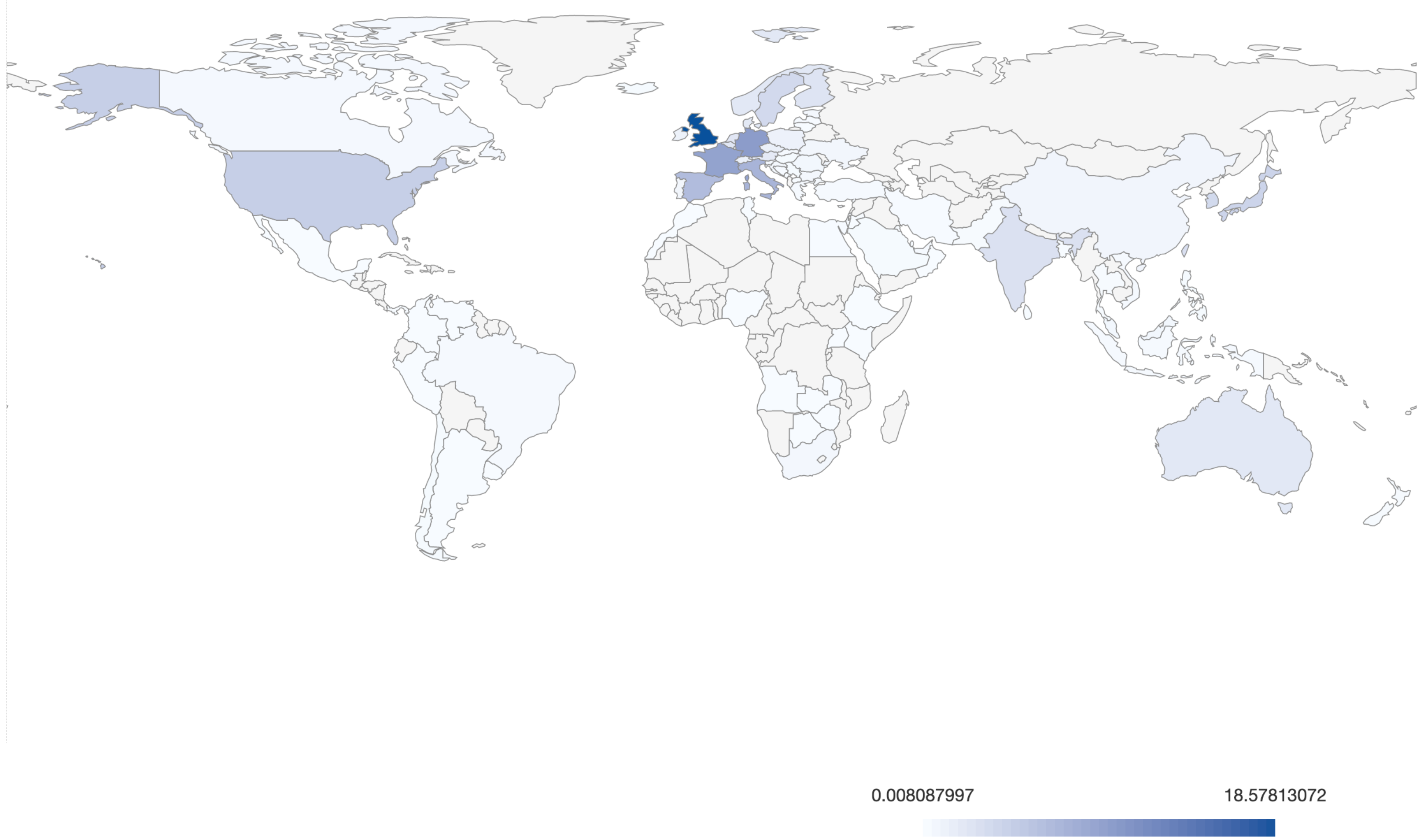


Figure 13: Sectoral Comparison before and After Merge

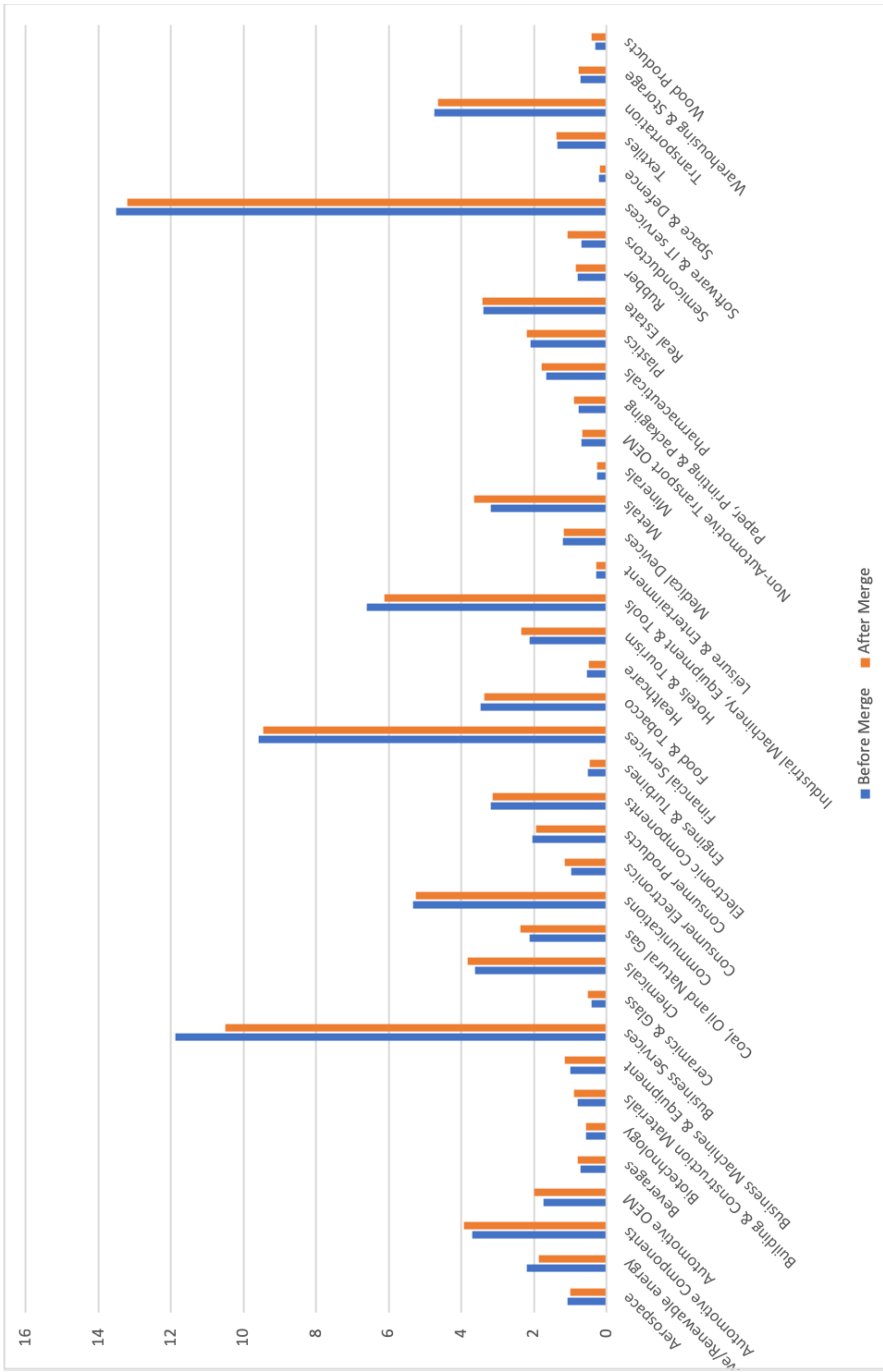


Figure 14: Initial Quality and Optimal Effort Choice

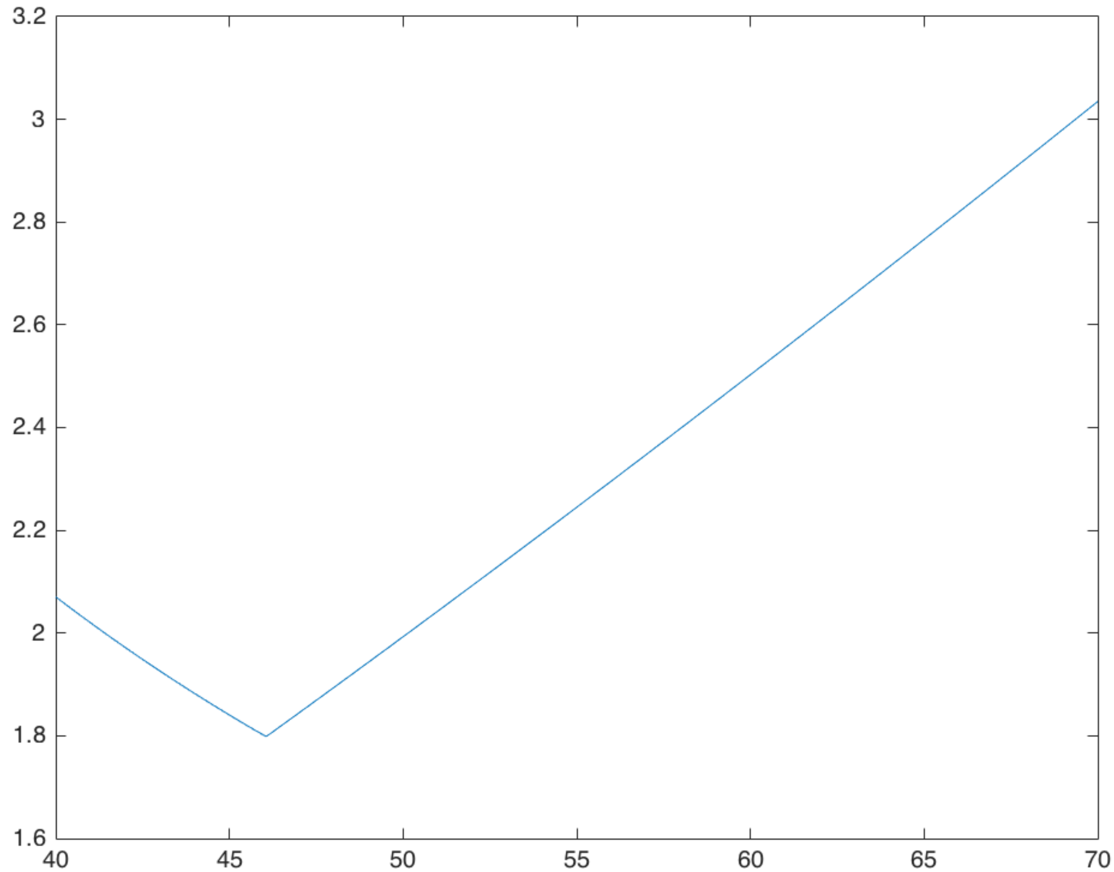


Figure 1 plots effort against firm initial quality levels. The vertical axis is effort level and the horizontal axis is the firm initial productivity. The above figure is plotted by setting the parameters as: $\alpha = 0.5$, $f_e = 3$, $f_{ji} = 5$, $f_{jj} = 0$, $\sigma = 4$, $\theta = 1.8$, $\tau_{jis} = 2$, $\gamma = 1$, $c_{js} = 1$, $\eta = 1$, $d_{jst} = 0.5$, $\lambda_j = 0.85$, and $t_{jst} = 0.5$

Figure 15: Initial Quality and Optimal Effort Choice: Small Difference

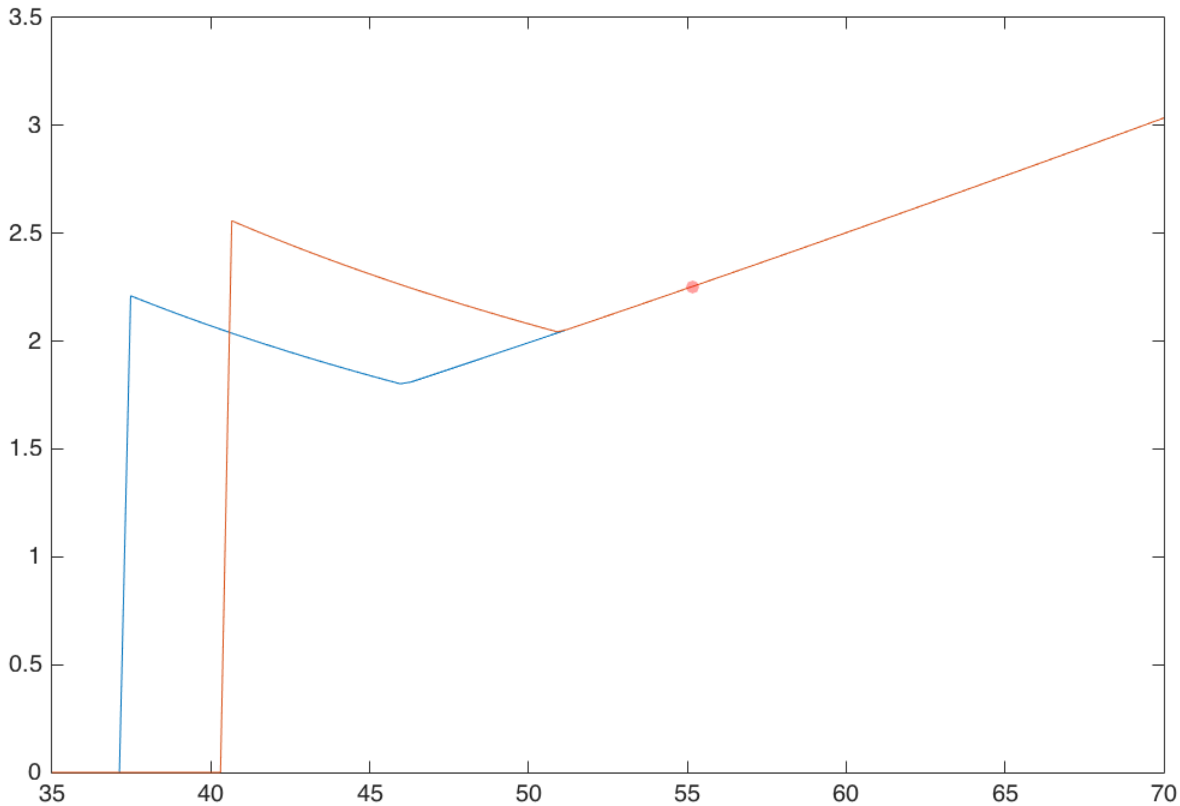


Figure 2 plots effort against firm initial quality levels. The vertical axis is effort level and the horizontal axis is the firm initial productivity. The above figure is plotted by setting the parameters the same as the last figure except that $\lambda_j = 0.85$, and 0.4

Figure 16: Initial Quality and Optimal Effort Choice: Large Difference

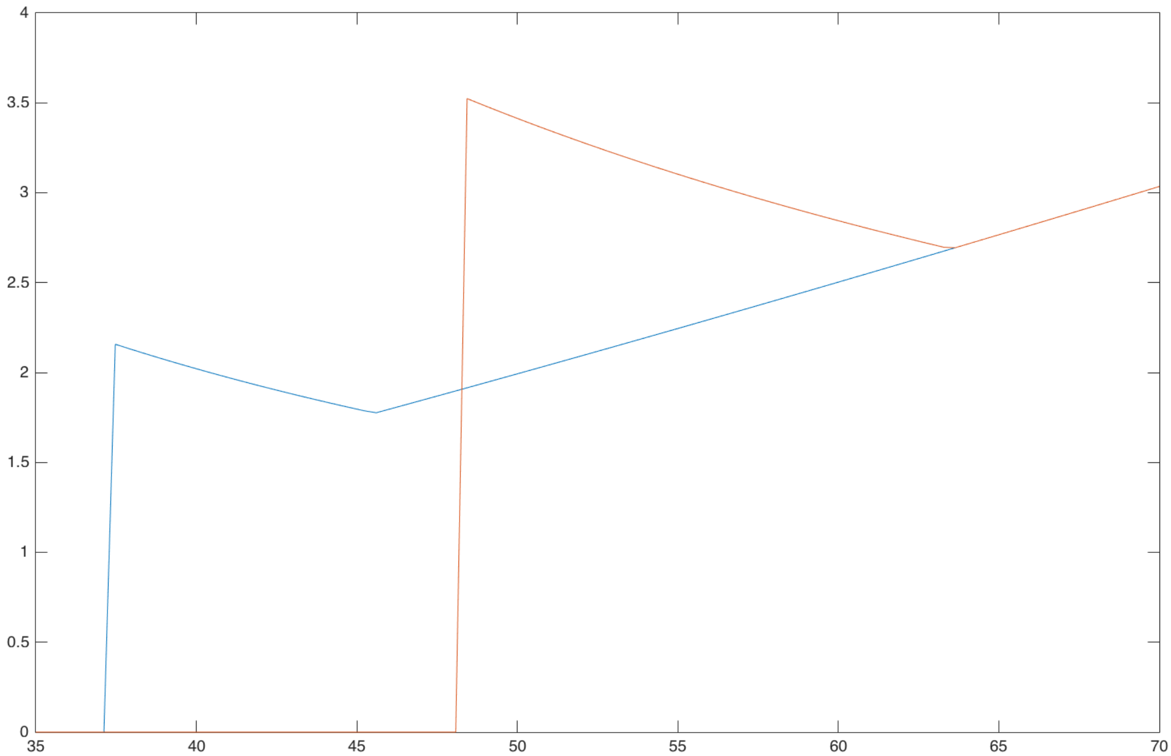


Figure 3 plots effort against firm initial quality levels. The vertical axis is effort level and the horizontal axis is the firm initial productivity. The above figure is plotted by setting the parameters the same as the last figure, with the exception $\lambda_j = 0.95$ and 0.15