Credit Contraint and Global Sourcing

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Abstract

I extend the Antras and Helpman (2004) model of the international organization of production to incorporate the role of credit constraint in the presence of financial frictions. A continuum of final-good producers with heterogeneous productivities decide to integrate or outsource the intermediate inputs and in which countries to source the inputs. In the model, under outsourcing, the intermediate supplier has to finance the fixed organization costs, whereas under vertical integration, the burden lies on the final good producer. Firms in some sectors need to finance a greater share of their costs externally. In addition, sectors differ in their endowment of tangible assets that can serve as collateral. Final-good producers in some sectors find it easier to operate because they need to raise less outside finance and have more tangible assets. Credit constraints vary across countries because contracts between firms and investors are more likely to be enforced at higher levels of financial development. This model generates equilibria in which firms with different productivity levels choose different ownership structure and suppliers location. I study the effect of improvements in financial contractibility on the relative prevalence of organizational forms. An improvement in financial contractibility in one country decreases the market share of vertically integrated firms in that country, this effect is more pronounced in the financially vulnerable sector, i.e. the sectors that are more dependent on outside finance and have less tangible assets. Second, the more financial developed a country is, the greater is the variety of products final good producers choose to outsource the intermediate inputs to that country. This effect is more pronounced in the financial vulnerable sector. I provide empirical results to support the theoretical predictions.

1. Introduction

The traditional theories of international trade in a complete-contracting framework cannot answer questions like which activities should firms locate in home country and which should they offshore, and if they decide to offshore, should they engage in foreign direct investment (FDI) and import intermediates within their boundaries or should they outsource the production of intermediates to independent foreign suppliers? Furthermore, traditional theories of international trade assume firms are homogeneous within industries while the data exhibit substantial within-industry heterogeneity in the size distribtion of firms and their participation in exporting (Bernard and Jensen (1999), Bernard and Jensen (2003), Melitz (2003)).

Antras and Helpman (2004) developed a two-country Ricardian model of international trade to address these questions. Their theoretical model combines the within-sectoral heterogeneity of Melitz (2003) with structure of firms in Antras (2003). Final-good producers in the North develop differentiated products. Then they decide whether to integrate the production of intermediates or to outsource them. In either case, they have to decide in which country to source these inputs, the high-cost North or the low-cost South, and incur a fixed organizational cost. Final-good producers and intermediate inputs suppliers cannot sign ex ante enforceable contracts specifiying the purchase of specialized intermediate inputs for a certain price. As in Grossmand and Hart (1986), incomplete contracting creates inefficiencies even when the production of intermediate inputs is carried out by the integrated suppliers. The only difference between integration and outsourcing is that final-good producers under integration can seize a fraction of intermediate inputs produced. Antras and Helpman showed that final-good producers that operate in the same sector but differ by productivity sort into different forms of organizational structure by productivity.

In this paper, I extend the Antras and Helpman (2004) model to incorporate the role of credit contraints. In particular, I develop a multi-sector model with credit-constrained heterogeneous firms financing their fixed organizational costs, countries at different levels of financial development, and

sectors of varying financial dependence. As in Antras and Helpman (2004), only the North knows how to produce the final goods. The production of the final good requires two inputs, headquarter services, and intermediate inputs. Headquarter services can only produced in the North. A fixed organizational cost is incurred when a final good producer chooses to supplier of intermediate inputs in the North or the South and whether to insource or outsource the inputs. By insourcing, the final good producer is responsible for financing the costs associated with production. By outsourcing, the intermediate supplier is responsible for financing the costs associated with production. The firm that is responsible for financing the costs faces the credit contraint of the country it is located in. This model delivers rich empirical predictions for the type and location of organizatial forms which find strong support in the data.

In the model, final good producer chooses ownership strucutre, and location of its supplier in the presence of credit constraint. As shown in Rajan and Zingales (1998), due to technological reasons, firms in some sectors need to finance a greater share of their costs externally. In addition, sectors differ in their endowment of tangible assets that can serve as collateral (Braun (2003)). Final-good producers in some sectors find it easier to operate because they need to raise less outside finance and have more tangible assets. Credit constraints vary across countries because contracts between firms and investors are more likely to be enforced at higher levels of financial development. If the financial contract is enforced, the financing firm makes a payment to the investor; otherwise the financing firm defaults and the investor claims the collateral.Financing firms then find it easier to raise external finance in countries with high levels of financial contractibility.

In the absence of credit constraints, all final-good producers above a certain cut-off level can operate and sort to different type and location of organizational forms according to their productivity level. With credit constraints, heterogeneity in productivity reinforce the selection of only the most productive firms to operate and affect the choice of organizational forms depending on their productivity. This is because more productive firms raise higher revenues, then they can offer

investors with higher return when the financial contract is enforced, and hence are more likely to raise the outside capital required for operating.

In a two-country world, wages are higher in the North, but North has better contracting institutions in two ways. First, a larger fraction of activities are contractable in the North; and second, financial contract is more likely to be enforced in the North. Final good producers always locate in the North. I make the contractibility of these investments to be a function of the location of the supplier only when the final good producer chooses to outsource.

Embedding credit constraints in this heterogeneous firms model delivers rich empirical predictions. I first derive the result that improvements in financial contractibility in the South reduces the share of vertical integration in the South. This effect is more prominent in the sectors that need more external finance and have less tangible assets, or financially vulnerable sectors. The more financially developed the South is, the greater is the variety of products final good producers choose to outsource to the South.

I find strong support for the model's predictions in my sample of intrafirm U.S. imports from 119 exporting countries and 103 4 -digit SIC sectors in 1996-2004. I study how the interaction of country level financial development and industry level external dependence on finance and asset tangibility predict the choice of organizational forms. I use the amount of credit extended to private sector as a share of GDP as my main measure of financial development, and show consistent results with indices of accounting standards, risk appropriation, contract repudiation, and stock capitalization. IV estimation confirms the results using a country's origin to instrument for private credit to GDP ratio. Sectoral financial vulnerability is measured by two variables. A sector is more financially vulnerable if it needs more external finance and has less tangible assets. External finance dependence reflects the share of investment not financed from internal cash flows. Asset tangibility is constructed as the share of plant, property and equipment in total assets. Both measures are taken for the median U.S. firm in a given sector in 1996-2004 from Compustat data.

The rest of the paper is organized as follows. Section 2 provides a first glance at the data. Section 3 develops my mode of firm in the presence of credit constraint. Section 4 shows how firms with different productivity sort into different organizational forms and what role credit constraint plays on the firms' choice of organizational forms. Section 5 provides the empirical specification to test. Section 6 discusses the data. Section 7 provides the regression results. Section 8 concludes.

2. First glance at the data

This section presents some basic summary statitics and highlights some simple correlations in the data which serve as motivation for the theoretical model and more empirical analysis. I take the share of intrafirm U.S. imports to be an indicator for prevalence of vertical integration. The higher the share of intrafirm U.S. imports, more trade takes place among the affiliated units of multinational firms, thus more prevalent is vertical integration.

Appendix Table 1 demonstrates substantial variation in the organizational behavior of 119 exporting countries in 103 manufacturing sectors. Sectors are defined in the 4-digit SIC industry classification. Conditional on positive trade volume, 35% of the exporter-sector cells show no intra-firm trade. The average capital labor ratio for the exporter-sector cells that show no intra-firm trade is not significantly different from those that show positive intra-firm trade, whereas the trade weighted capital labor ratio is higher for the exporter-sector cells that show no intra-firm trade. Capital labor ratio for each sector is defined as log of the U.S. capital stock in million of dollars over the number of production workers in thousands. On average, U.S. imports from 32 countries in a given industry with affliated units of multinational firms, with a standard deviation of 14. Within an sector, an average exporter sells 28 affiliated-trade product groups to U.S., with a standard deviation of 32.

Sector-level measures of external dependence on finance and asset tangibility are constructed based on data for all publicly traded U.S. based companies from Compustat's annual industrial

files. A firm's external dependence on finance is defined as capital expenditures minus cash flow from operations divided by capital expenditures. A sector's level's measure of external dependence on finance is the median firm's external depence on finance in a sector, as proposed by Rajan and Zingales (1998). Asset tangibility is similarly defined as the share of net property, plant and equipment in total book-value assets for the median firm in a given sector. Both measures are constructed as averages for the 1996-2004 period. For comparison reasons, after aggregating these measures to 3-digit SIC industry classficiation, they appear very similar to those constructed by Braun (2003).

The mean and standard deviation of external dependence on finance across all 103 manufacturing sectors are 24% and 11%, and 7% and 11% for asset tangibility. The sectors in greatest need for outside capital tend to be intensive in up-front investments, such as professional and scientific equipment and electrical machinery. Apparel and beverages are the sectors that require the least amount of outside capital. Sectors with highest level of asset tangibility are petroleum refineries, paper and products, iron and steel, and industrial chemicals. Assets are lacking in toys, electric machinery, and professional equipments.

Using U.S. as the reference country is convenient due to the limited data for many other countries. It's also reasonable to assume the U.S. measures reflect firms true demand for external finance and tangible assets because U.S. has the most sophisticated and advanced financial systems. Using U.S. measure also eliminates the potential bias for an industry's external dependence on finance to endogenously respond to a country's financial development. Industries do not have to have the same measure of external dependence on finance across countries; however, the ranking of industries external dependence on finance must be stable across countries.

The variation in the data across countries and sectors are not random. Sectors in greatest need for outside capital tend to have more affiliated trade with the U.S; and the opposite is true for sectors with greatest asset. As Figure 1 shows, sectors that are more dependent on external finance are

associated with a greater share of U.S. intra-firm trade. Figure 2 illustrates the opposite relationship for asset tangbility and share of U.S. intra-firm trade. This relationship persists for all years.

The organizational behavior of the 119 exporting countries are related to their financial development. Figure 3 shows the average financial vulnerability of the share of intra-firm trade over time. For each country c and year t, I calculate the average external finance dependence and asset tangbility of share of intra-firm trade as $\sum_i (FinDep_i * R_{ict}/T_{ict})$ and $\sum_i (Tang_i * R_{ict}/T_{ict})$ respectively, where R_{ict}/T_{ict} is the share of intra-firm trade in sector i in country c in year t. I plot both measures for the 20 countries with the largest changes in the credit extended to private sector as a share of GDP over the 9 year period. Vertical lines indicate the year the big change in the private credit to GDP ratio.

As the graphs illustrate, the average external dependence on finance of the share of intra-firm trade tends to decrease with better financial development, as indicated by higher private credit to GDP ratio, whereas the average asset tangbility tends to increase. The 20 graphs are ordered by the intensity of the change in private credit to GDP ratio as indicated in the graph headings.

A world where firm boundaries don't play a role in the pattern of international trade, one would not expect the behavior of the volume of intrafirm trade to correlate significantly with any of the classical determinants of international trade. To better understand why firms choose to vertically integrate over outsourcing, I build on models developed by Antras (2003) and Antras and Helpman (2004) to incorporate the role of credit constraint in determining the firm's choice of organizational forms.

3. The model

Consider a world with two countries, the North and the South, and J sectors. The only factor of production is labor. Consumers prefer more varieties to less and consume all differentiated products in each sector. The utility function of a representative consumer is given by:

$$U = x_0 + \frac{1}{\mu}\sum_{j=1}^{J} X_j^{\mu}, \qquad 0 < \mu < 1, \qquad (1)$$

$$X_j = \left[\int x_j(i)^{\alpha} di\right]^{1/\alpha}, \qquad 0 < \alpha < 1, \qquad (2)$$

where x_0 is the consumption of a homogeneous good, and X_j is the CES aggregate consumption index in sector j. The constant elasticity of substitution in a sector is given by $\varepsilon = 1/(1-\alpha) > 1$. The parameter μ indicate the share of each sector in total expenditure. assume $\alpha > \mu$, so that varieties within a sector are more substitutable for each other than they are across sector. With this utility function, the inverse demand for variety i in sector j is:

$$p_j(i) = X_j^{\mu-\alpha} x_j(i)^{\alpha-1}. \qquad (3)$$

This inverse demand function yields the revenue function:

$$R_j(i) = X_j^{\mu-\alpha} x_j(i)^{\alpha}. \qquad (4)$$

Producers of differentiated products face a perfectly elastic supply of labor in each country. I assume that the wage rate is fixed in the North and the South and $w^N > w^S$. The assumption of higher wage in the North can be justified by assuming that labor supply is large enough in each country so that both countries produce x_0 and $w^l, l = N, S$, is determined by the productivity of x_0 in that country.

As in Antras and Helpman (2004), only the North knows how to produce final-good variety. The production of the final good requires two inputs, headquarter services $h_j(i)$, and intermediate inputs, $m_j(i)$ using a Cobb-Douglas production function,

$$x_j(i) = \theta \left[\frac{h_j(i)}{\eta_j}\right]^{\eta_j} \left[\frac{m_j(i)}{1-\eta_j}\right]^{1-\eta_j}, \qquad 0 < \eta_j < 1, \qquad (5)$$

where θ is the productivity level of final good producer H of variety i in sector j drawn from a known distribution $G(\theta)$ after H paid a fixed cost of entry $w^N f_E$. η_j is sector specific, with higher η_j indicating the sector is more intensive in headquarter services. Headquarter services can

be produced only in the North, whereas intermediate inputs can be produced in both the North and the South. H chooses a supplier of intermediate inputs M in the North or in the South and whether to insource or outsource the intermediate inputs. Let $w^N f_k^l$ denote the joint management costs of final and intermediate goods production (fixed organizational costs), where k is an index of ownership structure and l is an index of where M is located and the manufacturing of intermediate goods takes place. Ownership structure takes one of two forms, vertical integration V or outsourcing O, $k \in \{V, O\}$. The supplier M is located either the North N or the South S, $l \in \{N, S\}$.

The fixed organizational costs are assumed to be ranked in the following order:

$$f_V^S > f_O^S > f_V^N > f_O^N. \qquad (6)$$

The costs of vertical integration are higher than outsourcing given the location of M and costs in the South are higher than costs in the North regardless of ownership structure.

3.1 Credit Constrained Final Good Producers

Producing a final good is associated with a fixed organizational cost $w^N f_k^l$ when final good producer H chooses a supplier M in the North or the South and to vertically integrate or outsource. I model credit constraint as in Manova(2006). Final good producers or intermediate suppliers face credit constraints in the financing of production costs depending on the ownership structure chosen by the final good producers. I begin by assuming all firms can finance their variable costs internally, but they need to raise outside capital for a fraction d_j, $0 < d_j < 1$,to finance the fixed organizational costs. Final good producer H or the intermediate supplier has to borrow $d_j w^N f_k^l$ to produce. This way of modelling financial constraint is similar to firms experiencing liquidity constraints because of up-front costs which they can cover after revenues are realized but not internally in advance. The relative importance of up-front costs varies across sectors due to technological reasons innate in each industry, as argued by Rajan and Zingales (1998). This variation is captured by parameter d_j and

corresponds to the measure of external dependence on finance in each industry I use in the empirical analysis.

To obtain outside finance, firms use tangible assets as collateral. A fraction t_j, $0 < t_j < 1$, of the sunk costs final good producers pay to enter the market counts as collateral, such as plant, property and equipment. A final good producer needs to pledge $t_j w^N f_E$ as collateral to obtain outside finance. t_j corresponds to the measure of asset tangibility in my empirical analysis and is also innate to each industry, as in Braun (2003).

The North and the South varies in their level of financial contractibility. Investors can be expected to be repaid with λ^l, $0 < \lambda^l < 1$, with $\lambda^N > \lambda^S$. λ^l is exogenous in the model and corresponds to the strength of country l's financial institution in my empirical analysis. Final good producer who is located in the North defaults with probability $(1 - \lambda^N)$, and intermediate supplier who is located in the North or South defaults with probability $(1 - \lambda^l)$, and the investors claim $t_j w^N f_E$.

The timeline of raising outside capital for organizational fixed costs is as follows. The financing firm makes a take it or leave it offer to a potential investor. This contract specifies the amount H needs to borrow, the repayment F in the case the contract is enforced, and the collateral in case of default. Revenues are then realized and investors receive payments.

3.2 Incomplete Contract in Intermediate Inputs

As in Antras (2003), final good producers and intermediate input suppliers cannot sign ex ante enforceable contracts specifying the purchase of specialized intermediate inputs for a certain price nor a contract contingent on the amount of labor hired or the volume of sales after the final good is sold. This can be justified as in Hart and Moore (1999) and Segal (1999) where the precise nature of the intermediate input is revealed ex post only and is not verifiable by a third party. Therefore, surplus is split between final good producer and intermediate supplier in a generalized

Nash bargaining game. Final good producer obtains a fraction $\beta \in (0,1)$ of the ex post gains from the relationship.

Ex post bargaining takes place both under vertical integration and outsourcing. Under outsourcing, the outside option of both parties is assumed to be zero because the inputs are tailored specifically to the other party in the transaction and assumed to have no outside value. Under vertical integration, failure to reach an agreement on the distribution of surplus leaves M with no income; however, H can appropriate a fraction δ^l, $0 < \delta^l < 1$, of the intermediate inputs produced because H cannot use the intermediate inputs without M as effectively as it can with M. $\delta^l \neq 1$ because if H were able to appropriate all intermediate inputs, H would always have an incentive to seize all inputs, and this would lead M to choose $m_j(i) = 0$ which leaves $x_j(i) = 0$. I assume $\delta^N \geqslant \delta^S$, because a contractual breach is more costly to H when M is in the South. This also reflects more corruption and worse legal protection in the South.

There is infinitely elastic supply of M in each country. H chooses the location of M and the kind of ownership to maximize ex ante profits. To ensure the relationship is at minimum costs to H, M has to pay a fee for participation in the relationship. In equilibrium, M's profits from the relationship are equal to its outside option, which is assumed to be 0 here.

3.3 Equilibrium

Index j for sector is dropped for simplicity since we look at a particular sector. If H and M agree in the bargaining, the potential revenue from the sale of the final good is:

$$R(i) = X^{\mu-\alpha}\theta^{\alpha}\left[\frac{h(i)}{\eta}\right]^{\alpha\eta}\left[\frac{m(i)}{1-\eta}\right]^{\alpha(1-\eta)}. \qquad (7)$$

If they fail to agree, the outside option for M is always zero. The outside option for H varies with ownership structure and the location of M.

When H outsources the intermediate inputs, its outside option is zero regardless of M's location. Thus, H gets $\beta R(i)$, M gets $(1-\beta)R(i)$.

If H vertically integrates, when parties fail to reach agreement, H can sell $\delta^l x(i)$ of output when M is in country l, which yields revenue $(\delta^l)^\alpha R(i)$. In the bargaining, H receives its outside option and a fraction β of ex post gains from the relationship, that is $\left[(\delta^l)^\alpha + \beta(1-(\delta^l)^\alpha)\right] R(i)$. M receives $(1-\beta)\left(1-(\delta^l)^\alpha\right)R(i)$.

Let $\beta_k^l R(i)$ denotes the payoff of H under ownership structure k and the location of M in country l, then:

$$\beta_V^N = (\delta^N)^\alpha + \beta(1-(\delta^N)^\alpha) \geqslant \beta_V^S = (\delta^S)^\alpha + \beta(1-(\delta^S)^\alpha) > \beta_O^N = \beta_O^S = \beta. \tag{8}$$

As in Grossman and Hart (1986), integration gives H the right to ex post use the inputs produced by M, which in turn enhances H's position ($\beta_V^l > \beta_O^l$).

Since final good producers and intermediate input suppliers cannot sign ex ante enforceable contracts, the parties choose their quantities noncooperatively. In absence of credit constraint H provides an amount of headerquarter services that maximizes $\beta_k^l R(i) - w^N h(i)$ subject to (7).M provides the intermediate input that maximizes $(1-\beta_k^l)R(i) - w^l m(i)$ subject to (7). Combining the two first-order conditions■the total operating profit is

$$\pi_k^l(\theta, X, \eta) = X^{(\mu-a)/(1-\alpha)}\theta^{a/(1-\alpha)}\psi_k^l(\eta) - w^N f_k^l$$

$$\text{where } \psi_k^l(\eta) = \frac{1-\alpha\left[\beta_k^l\eta + (1-\beta_k^l)(1-\eta)\right]}{\left\{(1/\alpha)\left(w^N/\beta_k^l\right)^\eta\left[w^l/\left(1-\beta_k^l\right)\right]^{1-\eta}\right\}^{\alpha/(1-\alpha)}}.$$

Under credit constraint, two additional conditions must be satisfied. If H chooses vertical integration, no matter where the supplier is located, H faces the financial friction in the North and chooses an amount of headquarter services that maximizes:

$$\max_{h,F(a)} \quad \beta_V^l R(i) - w^N h(i) - (1-d)w^N f_V^l - \lambda^N F(i) - (1-\lambda^N)tw^N f_E + T \qquad (9)$$

$$\text{subject to} \quad (1)\ R(i) = X^{\mu-\alpha}\theta^\alpha \left[\frac{h(i)}{\eta}\right]^{\alpha\eta} \left[\frac{m(i)}{1-\eta}\right]^{\alpha(1-\eta)}$$
$$(2)\ A(i) \equiv \beta_V^l R(i) - w^N h(i) - (1-d)w^N f_V^l + T \geqslant F(i)$$
$$(3)\ B(i) \equiv -dw^N f_V^l + \lambda^N F(i) + (1-\lambda^N)tw^N f_E \geqslant 0.$$

The expression above reflects the fact that H maximizes its profits by financing all its variable costs and a fraction $(1-d)$ of its fixed costs internally, pays the investor $F(i)$ when the financial contract is enforced (with probability λ^l), and replaces the collateral claimed by the investor in case of default (with probability $1-\lambda^l$). T is the transfer payment M has to pay to H. H chooses T so that the profit going to the intermediate supplier is 0, because once a relationship is formed between H and M, the participation fee T has no further effects on the outcomes:

$$T = (1-\beta_V^l)R(i) - w^l m(i). \qquad (10)$$

When financial contract is enforced, H can offer at most $A(i)$, its net revenue, to the investor. In addition, investors only lend to H if they expect to at least break even. $B(i)$ represents the net return to the investor. With competitive credit markets, investors break even and make zero expected profits. H adjusts $F(i)$ to bring investors' net rereturn to 0, so $B(i) = 0$ in equilibrium. The profit for H is

$$\pi_{HV}^l = \beta_V^l R(i) - w^N h(i) - (1-d)w^N f_V^l + T - \frac{dw^N f_V^l - (1-\lambda^N)tw^N f_E}{\lambda^N}$$

Substituting (10) for T,

$$\max_m \pi_{HV}^l = R(i) - w^N h(i) - w^l m(i) - (1-d+\frac{d}{\lambda^N})w^N f_V^l + \frac{(1-\lambda^N)}{\lambda^N} tw^N f_E \qquad (11)$$

$$\text{subject to} \quad R(i) = X^{\mu-\alpha}\theta^\alpha \left[\frac{h(i)}{\eta}\right]^{\alpha\eta} \left[\frac{m(i)}{1-\eta}\right]^{\alpha(1-\eta)}.$$

Thus the maximization problem has been reduced to (11). Hence H and M optimally chooses the same quantities and prices as in absence of credit constraint. The profit for H from this relationship is

$$\pi^l_{HV} = X^{(\mu-a)/(1-\alpha)}\theta^{a/(1-\alpha)}\psi^l_V(\eta) - (1-d+\frac{d}{\lambda^N})w^N f^l_V + \frac{(1-\lambda^N)}{\lambda^N}tw^N f_E.$$

If H chooses to outsource the intermediate inptus, M raises outside capital to finance fixed cost. M chooses an amount of intermediate inputs to maximize the following objective function facing the financial friction in the country it is located in:

$$\max_m (1-\beta^l_O)R(i) - w^l m(i) - (1-d+\frac{d}{\lambda^l})w^N f^l_k + \frac{(1-\lambda^l)}{\lambda^l}tw^N f_E - T$$

subject to (7).

H has incentive to choose T as much as possible, so

$$T = (1-\beta^l_O)R(i) - w^l m(i) - (1-d+\frac{d}{\lambda^l})w^N f^l_k + \frac{(1-\lambda^l)}{\lambda^l}tw^N f_E.$$

H chooses an amount of headquarter services to maximize

$$\max_h \pi^l_{HO} = R(i) - w^N h(i) - w^l m(i) - (1-d+\frac{d}{\lambda^l})w^N f^l_k + \frac{(1-\lambda^l)}{\lambda^l}tw^N f_E \text{ s.t. } (7).$$

Again H and M optimally chooses the same quantities and prices as in absence of credit constraint. The profit for H is

$$\pi^l_{HO} = X^{(\mu-a)/(1-\alpha)}\theta^{a/(1-\alpha)}\psi^l_O(\eta) - (1-d+\frac{d}{\lambda^l})w^N f^l_O + \frac{(1-\lambda^l)}{\lambda^l}tw^N f_E.$$

In absence of credit constraints, the total operating profit function defines a productivity cutoff $(\theta^*)^{a/(1-\alpha)}$ above which H finds it profitable to operate, given by $X^{(\mu-a)/(1-\alpha)}(\theta^*)^{a/(1-\alpha)}\psi^l_k(\eta) = w^N f^l_k$.Since profits are increasing in productivity θ, low productivity firms do not operate.

When final good producers face credit contraints, more productive firms can offer investors greater returns in case of repayment (i.e. when financial contract is enforced). Therefore, there are final good producers who could operate in absence of credit constraints but are not productive enough to obtain sufficient outside finance.

As a result, in the presence of credit constraint, a new and higher productivity cut-off for firms operating under vertical intergration is $\left(\theta^*_{V,c}\right)^{a/(1-\alpha)}$. This productivity cutoff is given by the condition $A(\theta^*_{V,c}, B(\theta^*_{V,c}) = 0; i) = F(\theta^*_{V,c}; i)$ for variety i. That is:

$$X^{(\mu-a)/(1-\alpha)} \left(\theta^*_{V,c}\right)^{a/(1-\alpha)} \psi^l_k(\eta) = (1 - d + \frac{d}{\lambda^N}) w^N f^l_V + \frac{(1-\lambda^N)}{\lambda^N} t w^N f_E. \qquad (12)$$

The productivity cut-off for firms operating under outsourcing is

$X^{(\mu-a)/(1-\alpha)} \left(\theta^*_{O,c}\right)^{a/(1-\alpha)} \psi^l_k(\eta) = (1 - d + \frac{d}{\lambda^l}) w^N f^l_O + \frac{(1-\lambda^l)}{\lambda^l} t w^N f_E.$

Regardless of organizational ownership, there is a higher productivity cut-off under credit constraint. Note that without financial frictions ($\lambda^l = 1$), the model reduces to original Antras and Helpman (2004) formulation. Hence, credit constraints only have an impact when financial contracts are not perfectly enforced. $F(i)$ is decreasing in financial development. The way to think of this is intermediate suppliers in the South that have to raise outside capital usually have to face a higher interest rate on loans (e.g. not good enough credit history, financial institution not fully developed to be able to provide the loans, etc). This then reduces the transfer payment they can make to the headquarter, and thus headquarters that choose to outsource in the South in essence need to pay a higher repayment on loans.

Final good producers regardless of ownership cannot operate with productivity lower than $\min(\theta^*_{V,c}, \theta^*_{O,c})$ when they face credit constraints. $\min(\theta^*_{V,c}, \theta^*_{O,c}) > (\theta^*)^{a/(1-\alpha)}$ whenever $df^l_k > t f_E$, which means credit constraints bind when firms need to borrow more than thay can offer in collateral (Manova, 2005, Greenaway et al., 2005, Becker and Greenberg, 2004, and Beck, 2002, 2003). I assume this condition holds for the rest of the analysis. In addition, $\theta^*_{V,c} < \theta^*_{O,c}$ since $f^l_V < f^l_O$.

Figure 4 illustrates the productivity cut-offs between credit constrained and unconstrained final good producers.

By observing its productivity level θ, a final good producer H chooses the ownership structure and the location of M that maximizes π^l_{Hk}, or exits the industry and forfeits the fixed cost of entry $w^N f_E$. $\pi^l_{Hk}(\theta, X, \eta)$ is decreasing in w^l_k and f^l_k. Looking at variable costs, producing intermediate inputs in the South is preferred to producing intermediates in the North regardless of ownership structure because $w^S < w^N$. Looking at fixed costs, $f^S_V > f^S_O > f^N_V > f^N_O$, ranking of profits is the reverse order of the fixed costs.

As shown in Antras and Helpman (2004), if final good producer H could freely choose β, $\dfrac{\partial \beta^l_k}{\partial \eta} > 0$. This means the more intensive a sector is in headquarter services, the higher β^l_k H would prefer. Following Grossman and Hart (1986), β cannot be chosen freely, so the choice of β^l_k is constrained to the set $\{\beta^N_V, \beta^S_V, \beta^N_O, \beta^S_O\}$.

In equilibrium, free entry must be satisfied.

4. Organizational Forms

4.1 Component Intensive Sector

First consider a sector with low headquarter intensity η. In this case H prefers outsourcing to integration in every country l, because outsourcing has lower fixed costs and H prefers β^l_k to be as low as possible, or $\beta^l_k = \beta^l_O = \beta$. H trades off between lower variable cost in the South against the lower organizational costs in the North. If wage differential is small relative to the fixed cost differential, $w^N/w^S < (f^S_O/f^N_O)^{(1-\alpha)/\alpha(1-\eta)}$, Top panel in Figure 5 depicts the choice of location of M depending on productivity level θ without credit constraint. The cutoffs θ^* and θ^*_S are given by:

$$\theta^* = X^{(\alpha-\kappa)/\alpha} \left[\frac{w^N f^N_O}{\psi^N_O(\eta)} \right]^{(1-\alpha)/\alpha},$$

$$\theta_S^* = X^{(\alpha-\kappa)/\alpha}\left[\frac{w^N(f_O^N - f_O^N)}{\psi_O^S(\eta) - \psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha}.$$

This figure illustrates that for firms cannot operate with productivity lower than θ^* and can only outsource in the South if their productivity level is above θ_S^*.

Bottom panel in Figure 5 depicts the choice of location of M depending on productivity level with credit constraint. The cutoffs are given by:

$$\theta_c^* = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^N)w^N f_O^N - \frac{1-\lambda^N}{\lambda^N}tw^N f_E}{\psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha}$$

$$\theta_{O,c}^S = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^S)w^N f_O^S - \frac{1-\lambda^S}{\lambda^S}tw^N f_E - \left[(1-d+d/\lambda^N)w^N f_O^N - \frac{1-\lambda^N}{\lambda^N}tw^N f_E\right]}{\psi_O^S(\eta) - \psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha}$$

H with productivity lower θ_c^* cannot operate. H outsources in the North when its productivity is between θ_c^* and $\theta_{O,c}^S$, and outsources in the South when its productivity is above $\theta_{O,c}^S$. Looking at the comparative statistics,

$$\frac{\partial\theta_c^*}{\partial\lambda^N} \propto (\frac{tf_E - df_O^N}{\lambda^{N2}})w^N/\psi_O^N < 0, \frac{\partial\theta_c^*}{\partial\lambda^S} = 0$$

$$\frac{\partial\theta_{O,c}^S}{\partial\lambda^N} \propto -\frac{\partial\theta_c^*}{\partial\lambda^N} > 0,$$

$$\frac{\partial\theta_{O,c}^S}{\partial\lambda^S} \propto (\frac{tf_E - df_O^S}{\lambda^{S2}})w^N/(\psi_O^S(\eta) - \psi_O^N(\eta)) < 0. \qquad (13)$$

The expression in (13) indicates that an increase in the financial development in the South only will leads to a lowering of the cut-off productivity for outsourcing firms in the South as depicted in figure 6. This implies that the most productive firms initially outsourcing in the North now switch to outsourcing in the South to take the advantage of better financial institutions in the South. The firms that are able to switch to outsourcing in the South enjoy a higher profit as a result. The profits of the firms that were initially outsourcing in the South are also increased. This is because with

less financial frictions, the repayment required when the financial contract is enforced is effectively reduced. More firms outsource in the South as a result of an increase in the financial development in the South. This effect is bigger for financially vulnerable sectors (i.e. sectors that need more outside capital or have less tangible assets) because:

$$\frac{\partial \theta_c^*}{\partial d \partial \lambda^N} \propto -\frac{1}{\lambda^{N2}} w^N f_O^N / \psi_O^N < 0, \ \frac{\partial \theta_c^*}{\partial d \partial \lambda^S} = 0$$

$$\frac{\partial \theta_{O,c}^S}{\partial d \partial \lambda^N} > 0, \frac{\partial \theta_{O,c}^S}{\partial d \partial \lambda^S} \propto -\frac{1}{\lambda^{S2}} w^N f_O^S / \psi_O^S < 0,$$

and opposite for tangible assets:

$$\frac{\partial \theta_c^*}{\partial t \partial \lambda^N} \propto \frac{1}{\lambda^{N2}} w^N f_O^N / \psi_O^N > 0, \ \frac{\partial \theta_c^*}{\partial d \partial \lambda^S} = 0$$

$$\frac{\partial \theta_{O,c}^S}{\partial t \partial \lambda^N} < 0, \frac{\partial \theta_{O,c}^S}{\partial t \partial \lambda^S} \propto \frac{1}{\lambda^{S2}} w^N f_O^S / \psi_O^S > 0,$$

An increase in the financial development in the North will lead to a lower cut-off productivity for outsourcing firms in the North and a higher cut-off productivity for outsourcing firms in the South. This implies that the firms that were initially unable to operate due to credit constraint can now operate in the North. The newly entered firms make positive profits and the firm with the new cut-off productivity make zero profits. The firms that were operating in the North before the increase in North financial development now enjoy higher profits. Firms that were marginally operating in the South now choose to operate in the North due to better financial contractibility in the North. By choosing to outsource in the North, the intermediate suppliers pay less repayment and as a result the final good producer enjoys higher profit. Overall, we'd would expect a higher proportion of firms outsourcing in the North. This effect is stronger in financially vulnerable sectors.

It is clear from figure 5 that the intersection of the two profit lines takes place at a negative profit level when the fixed organizational costs of outsourcing in the South is close to the fixed organizational costs of outsourcing in the North, i.e. $w^N/w^S > (f_O^S/f_O^N)^{(1-\alpha)/\alpha(1-\eta)}$. In this case,

θ^* is the point of intersection of the profit line π_O^S with the horizontal axis, and the credit constrained cut-off is:

$$\theta_c^* = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^S)w^N f_O^S - \frac{1-\lambda^S}{\lambda^S}tw^N f_E}{\psi_O^S(\eta)}\right]^{(1-\alpha)/\alpha}$$

where all firms with produtivities above θ_c^* operate and outsource in the South. Firms with lower than θ_c^* can not operate. In this case, all firms that operate choose to outsource in the South.

Proposition 1. In component intensive sectors, firms do not integrate. An increasement in financial development in the South leads to more outsourcing in the South and an increase in financial development in the North leads to less outsourcing in the South. This effect is stronger in the financially vulnerable sector.

4.2 Headquarter Intensive Sector

Next, I consider a sector with high headquarter intensity η, such that profits are increasing in β_k^l. In a headquarter intensive sector, the marginal product of headquarter services is high, making underinvestment in headquarter services more costly and integration more attractive. Because $\psi_V^l > \psi_O^l$, π_V^l is steeper than π_O^l. The slope of π_O^S can be steeper than the slope of π_V^N when the variable costs in the South are very low, or flatter than the slope of π_V^N because integration gives higher the final good producer a larger fraction of the revenue. Figure 7 reflects the benchmark case when slope of π_O^S is steeper than the slope of π_V^N. In this case, all four forms of organization are possible. The cutoffs without credit contraint are given by:

$$\theta^* = X^{(\alpha-\kappa)/\alpha}\left[\frac{w^N f_O^N}{\psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha},$$

$$\theta_V^N = X^{(\alpha-\kappa)/\alpha}\left[\frac{w^N(f_V^N - f_O^N)}{\psi_V^N(\eta) - \psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha},$$

$$\theta_O^S = X^{(\alpha-\kappa)/\alpha}\left[\frac{w^N(f_O^S - f_V^N)}{\psi_O^S(\eta) - \psi_V^N(\eta)}\right]^{(1-\alpha)/\alpha},$$

With credit constraints, the new cutoffs are given by:

$$\theta_c^* = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^N)w^N f_O^N - \frac{1-\lambda^N}{\lambda^N}tw^N f_E}{\psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha}$$

$$\theta_{V,c}^N = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^N)w^N(f_V^N - f_O^N)}{\psi_V^N(\eta)-\psi_O^N(\eta)}\right]^{(1-\alpha)/\alpha}$$

$$\theta_{O,c}^S = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^S)w^N f_O^S - \frac{1-\lambda^S}{\lambda^S}tw^N f_E - \left[(1-d+d/\lambda^N)w^N f_V^N - \frac{1-\lambda^N}{\lambda^N}tw^N f_E\right]}{\psi_O^S(\eta)-\psi_V^N(\eta)}\right]^{(1-\alpha)/\alpha}$$

$$\theta_{V,c}^S = X^{(\alpha-\kappa)/\alpha}\left[\frac{(1-d+d/\lambda^N)w^N f_V^S - \frac{1-\lambda^N}{\lambda^N}tw^N f_E - \left[(1-d+d/\lambda^S)w^N f_O^S - \frac{1-\lambda^S}{\lambda^S}tw^N f_E\right]}{\psi_V^S(\eta)-\psi_O^S(\eta)}\right]^{(1-\alpha)/\alpha}$$

From the comparative statistics,

$$\frac{\partial\theta_c^*}{\partial\lambda^N} \propto (\frac{tf_E - df_O^N}{\lambda^{N2}})w^N/\psi_O^N < 0, \qquad \frac{\partial\theta_c^*}{\partial\lambda^S} = 0$$

$$\frac{\partial\theta_{V,c}^N}{\partial\lambda^N} \propto \frac{-df_V^N}{\lambda^{N2}}w^N(f_V^N - f_O^N)/(\psi_V^N(\eta)-\psi_O^N(\eta)) < 0, \qquad \frac{\partial\theta_{V,c}^N}{\partial\lambda^S} = 0$$

$$\frac{\partial\theta_{O,c}^S}{\partial\lambda^N} \propto -(\frac{tf_E - df_V^N}{\lambda^{N2}})w^N/(\psi_O^S(\eta)-\psi_V^N(\eta)) > 0,$$

$$\frac{\partial\theta_{O,c}^S}{\partial\lambda^S} \propto (\frac{tf_E - df_O^S}{\lambda^{S2}})w^N/(\psi_O^S(\eta)-\psi_V^N(\eta)) < 0$$

$$\frac{\partial\theta_{V,c}^S}{\partial\lambda^N} \propto (\frac{tf_E - df_V^S}{\lambda^{N2}})w^N/(\psi_V^S(\eta)-\psi_O^S(\eta)) < 0,$$

$$\frac{\partial\theta_{V,c}^S}{\partial\lambda^S} \propto -(\frac{tf_E - df_O^S}{\lambda^{S2}})w^N/(\psi_V^S(\eta)-\psi_O^S(\eta)) > 0 \qquad (14)$$

Expression (14) says for an increase in financial development in the South, the high end of the firms that were vertically integrating in the North can now choose to outsource in the South and realize higher profits and the low end of the firms that were vertically integrated in the South have to outsource in the South to realize higher profits. Overall, it is clear that the number of firms

conducting business in the South will increase and the profits of the firms operating in the South will increase. The share of firms vertically integrated in the South will decrease. This effect is stronger in the financially vulnerable sectors.

For an increase in financial development in the North, firms that were unable to operate before, below the cut-off θ_c^*, can now outsource in the North. The high end of outsourcing firms in the North will now choose to vertically integrate and realize higher profits. Existing firms in the North before the increase in the financial development of the North also enjoy higher profits as a result. Better financial development in the North will lead to fewer firms doing business in the South, and make the high end firms that were outsourcing in the South to vertically integrate in the South to utilize the financial improvement in the North. Overall, increase in financial development in the North will lead to higher share of vertically integrated firms in the South. This effect is stronger in the financially vulnerable sectors.

It is easy to see that either one of the first three organizational forms, outsourcing in North, vertical integration in North, and outsourcing in South, may not exist in equilibrium but the last one, vertical integration in South, always exists in the absence of an upper bound on support of $G(\theta)$. That is, there always exists high productivity firms that choose to in-source in the South. See figure 8 for illustration. Organizational forms that survive in equilbrium have firms sorted according to the pattern in figure 8 according to their productivities. Insourcing in the North would not be viable if its fixed organizational costs were too high.

Proposition 2. For headquarter intensive sectors, firms tend to choose outsourcing in more financially developed country. This effect is more pronounced in financially vulnerable sectors. In sectors with higher headquarter intensity, integration is favored relative to outsourcing.

For the second part of the proposition 2, integration is favored relative to outsourcing with higher headquarter intensity because $\frac{\partial}{\partial \eta} \frac{\psi_V^l(\eta)}{\psi_O^l(\eta)} > 0$ for l=N,S (see Antras 2003a).

Proposition 3. For headquarter intensive sectors, an increase in the financial development in the South will lead to higher firm revenues in the South because more firms will be conducting business in the South.

Together with proposition 1, regardless of headquarter intensity, an increase in financial development in the South will lead to higher firm revenues in the South. This is more pronouced in the financially vulnerable sectors.

5. Empirical Analysis

The model presented above actually predicts that the share of intrafirm imports should be 0 for industries with headquarter intensity η below a certain threshold. After grouping the share of intrafirm U.S. imports into sic 4 digit category, there is 35% of the sample that contains 0 share of intrafirm trade.

5.1 Component Intensive Sector

Under Proposition 1, all firms in industries below a certain cut-off headquarter intensity choose outsourcing. In the component intensive sectors, outsourcing in the South is equivalent to total imports from the South. The first hypothesis to test is that there is more imports from the South the more financially developed the South is, and this effect is stronger in the financially vulnerable sectors. I report estimates from regression of the form:

$$\ln(M_j^l) = \delta_1 + \delta_2 FinDev^l * ExtFin_j + \delta_3 FinDev^l * Tang_j + \delta_4 FinDev^l + \delta_7 W_j^l + \varepsilon_j^l, \quad (15)$$

where M_j^l is the total US. imports from country l and sector j, $j \in$component intensive sectors, or share of intra-firm trade is zero. I assume the terms in d, λ, and t can be expressed as the observed measures of country level financial development $FinDev$, sectoral indicators of external finance dependence $ExtFin$ and asset tangibility $Tang$. $FinDev^l * ExtFin_j$ is the interaction of financial development in country l and industry j's external dependence on finance, $FinDev^l * Tang_j$

is the interaction of financial development in country l and industry's asset tangibility, and W_j^l is a vector of controls. The theory predicts that $\delta_2 > 0$, $\delta_3 < 0$, $\delta_4 > 0$.

5.2 Headquarter Intensive Sector

Under Proposition 2, in headquarter-intensive sector, with higher headquarter intensity η, outsourcing in the North is favored relative to outsourcing in the South, and integration is favored relative to outsourcing regardless of location. The more financially developed the South is, the more prevalent outsourcing is in the South, i.e. the less vertical integration there is in the South. This effect is strengthened in sectors that require more external capital and have less tangible assets.

Since the dependent variable share of U.S. intrafirm imports is a variable between 0 and 1, the effect of any particular explanatory variable cannot be constant throughout the range of the explanatory variables. This problem can be overcome by augmenting a linear model with non-linear functions of the explanatory variable. This most common approach is to model the log-odds ratio of the dependent variable share of U.S. intrafirm imports as a linear function. This requires the dependent variable to be strictly between 0 and 1. Since in headquarter intensive sectors, integration from the South always exists in the absence of an upper bound on support of $G(\theta)$, the dependent variable is always bigger than 0. About 3% of the data is lost using this log-odds transformation approach from 100% of vertical integration in the South.

I report estimates from regression of the form:

$$\ln(S_j^l/(1-S_j^l)) = \beta_1 + \beta_2 \ln(K/L_j) + \beta_3 FinDev^l * ExtFin_j + \beta_4 FinDev^l * Tang_j + \beta_5 FinDev^l + \beta_6 W_j^l + \varepsilon_j^l, \qquad (16)$$

where S_j^l is the industry j's share of U.S. intrafirm imports from country l, K/L_j is the capital-labor ratio in industry j. I test the first hypothesis that $\beta_2 > 0, \beta_3 < 0$, $\beta_4 > 0$, and $\beta_5 < 0$.

Under Proposition 3, there is more imports from the South the more financially developed the South is, and this effect is stronger in the financially vulnerable sectors. I run the regression of the following form:

$$\ln(M_j^l) = \zeta_1 + \zeta_2 \ln(K/L_j) + \zeta_3 FinDev^l * ExtFin_j + \zeta_4 FinDev^l * Tang_j + \zeta_5 FinDev^l + \zeta_6 W_j^l + \varepsilon_j^l, \quad (17)$$

where M_j^l is the total imports from country l in sector j. The theory predicts that $\zeta_2 > 0$, $\zeta_3 > 0$, $\zeta_4 < 0$, and $\zeta_5 > 0$.The effect of financial development and its interaction with financial vulnerability on the total imports from the South should be stronger in the headquarter intensive sectors than in the component intensive sectors.

6. Data

In this section I use data on intrafirm and total U.S. imports from 119 countries and 103 sectors over the 1996-2004 period. I have also confirmed my results in a cross section for each year. I evaluate the impact of credit constraints on the choice of organizational form and location of supplier by regressing intrafirm trade variables on the interaction of country level measure of financial development and industry level measure of dependence on external finance and asset tangibility.

6.1 Intrafirm and total U.S. imports data

A sector in the data is defined as a 4-digit category in the SIC industry classification system. Intrafirm U.S. imports include imports shipped by overseas affiliates to their U.S. parents and imports shipped to U.S. affiliates by their foreign parent group. Intrafirm and total U.S. imports data come in 6-digit HS commodity form. The share of intrafirm U.S. imports in HS6 classification is converted into 4 digit SIC industry system using $Intra_{sic,j}^l = \frac{\sum_{hs6,i \in sic,j} Related_i^l}{\sum_{hs6,i \in sic,j} Total_i^l}$, where $Related_i^l$ is the U.S. reported import value from country l for good i that is from a related party, and $Total_i^l$ is the total U.S. import from country l for good i. $Intra_j^l$ is the share of U.S. intra-firm imports from country l in sector j.

To study for the product composition of the organizational forms, I conduct the analysis at two different levels of industry disaggregation. In the absence of detailed cross-country firm level data, I take the 6-digit HS commodity groups within a 4-digit SIC sector as a proxy for product variety.

Table 1 summarizes the share of intrafirm U.S. imports in my sample.

6.2 Financial development data

The first measure of fianancial development I use is the ratio of credit banks and other financial intermediaries to the private sector as a share of GDP, which I obtain from Beck et al. (2000). Domestic credit has been used extensively in the finance and growth literature (Rajan and Zingales, 1998; Braun 2003; Aghion et al. 2004). Stock market capitalization and stock traded are also used for robustness checks, which I obtain from the IMF.

In the panel of 119 countries that I'm limited to by data, private credit varies significantly across country and over time. Table 2, panel A summarizes the cross sectional variation in these measures.

In additional robustness checks, I use measures of the accounting standards, the risk of expropriation, and the repudiation of contracts from La Porta et al. (1998). Even though these indices are not direct measures of the probability that financial contracts will be enforced, they are good measures for the conracting environment in a country, which allies to financial contracting as well. These indices are available for a subset of countries and do not vary over time. Table 2, panel B summaries the cross sectional variation in these measures.

6.3 External dependence on finance data

Industry-level measures of external dependence on finance and asset tangibility are constructed based on data for all publicly traded U.S. based companies from Compustat's annual industrial files based on usSIC 1987 classification. It is then converted to the ISIC 4 digit industry classification system based on the concordance table provided by Jon Haveman. A firm's external dependence

on finance is defined as capital expenditures minus cash flow from operations divided by capital expenditures. An industry level's measure of external dependence on finance is the median firm's external depence on finance in an industry, as proposed by Rajan and Zingales (1998). Asset tangibility is similarly defined as the share of net property, plant and equipment in total book-value assets for the median firm in a given industry. Both measures are constructed as averages for the 1996-2004 period, and appear very stable over time compared to indices for 1986-1995, 1980-1989, or 1966-1975 period.

Using U.S. as the reference country is convenient due to the limited data for many other countries. It's also reasonable to assume the U.S. measures reflect firms true demand for external finance and tangible assets because U.S. has the most sophisticated and advanced financial systems. Using U.S. measure also eliminates the potential bias for an industry's external dependence on finance to endogenously respond to a country's financial development. Industries do not have to have the same measure of external dependence on finance across countries; however, the ranking of industries external dependence on finance must be stable across countries. If some of the external finance dependent industries use more internal financing in countries with worse credit conditions, then $FinDev^l * ExtFin_j$ would be underestimated. Similarly, if firms obtain more tangible asset to compensate for lower financial development, $FinDev^l * Tang_j$ would be underestimated as well.

Table 3 summarizes the measures of external dependence on finance and asset tangibility in my sample.

7. Regression Results

7.1 Component Intesive Sector

I test proposition 1 by estimating equation (15) for the effect of financial development and its interaction with financial vulnerability in the component intensive sectors using OLS specification.

Table 7 provides the regression results. The sample is limited to sector and country pairs that have no intrafirm trade. The dependent variable is log of the total U.S. imports from a country sector pair. According to Proposition 1, in the component intensive sectors, an increasement in financial development in the South leads to more outsourcing in the South and this effect is stronger in the financially vulnerable sector. Table 7 presents strong empirical support for proposition 1. There is more U.S. imports from a country that is more financially developed when the sector is more dependent on outside finance and has less tangible assets. The effect of the financial development is not significant by itself; however, the sign works in the right direction. The second part of the Proposition 1 regarding the financial development of the North cannot be tested due to lack of the within U.S. intrafirm trade data. Table 7 column 1 uses the ratio of the private credit to GDP as a measure of the financial development of a country. Subsequent columns use accounting standards, risk of expropriation, contract repudiation, and stock capitalization as different measures of the financial development as reported in La Porta(). Since these variables do not have a time dimension, the financial development variable is not included in the present of country dummies. Last column includes the IV estimation using country of origin to instrument for financial development. This set of the results confirm the results presented in Manova(2007) regarding exporting and credit constraint[1]. In the last column with IV estimation, both the interaction of financial development with external dependence on finance and asset tangbility are strongly significant, whereas in the previous columns only the interaction with asset tangibility is strongly significant.

7.2 Headquarter Intesive Sector

7.2.1 The Effect of Credit Constraints on the Choice of Organizational Forms

The second part of the Proposition 2 states that vertical integration is favored relative to out-

[1]Manova (2007) uses bilateral export data to test the effect of financial development and its interaction with financial vulnerability of a sector using Heckman's selection to correct for the selection into exporting. Here the OLS and IV did not correct for selection into exporting and the data is limited to exports to U.S. only.

sourcing the more headquarter intensive a sector is. Capital to labor ratio is used to measure the headquarter intensity of a sector. Earlier papers on the role of capital labor ratios on the choice of organizational forms also have documented that the share of intrafirm imports is significantly higher, the higher the capital intensity of the exporting industry j in country i (Antras 2003). Table 4 column 1 re-establishes this basic pattern between 118 countries and 103 sectors in the period 1996-2004. Since capital labor ratio, external dependence on finance, and asset tangibility do not have a time dimension, sector dummies are not included for all subsequent analysis. Industry dummies at 3 digit classification level are included.

Column 2 is the OLS regression results of equation (16) using the ratio of private credit to GDP for each country as a measure of financial development. The interaction of financial development and external finance dependence enters negatively into the equation and the interaction of financial development and asset tangibility enters positively into the equation as predicted by the theory. This implies that North chooses more outsourcing than integration in financially developed countries when the sectors are in need of more external finance and have less tangible assets. Column 3-7 are the same OLS regression results but using different measures of financial development for robustness checks. Those include the ratio of stock capitalization to GDP, ratio of stock traded to GDP, accounting standards, risk of expropriation, and contract repudiation. One might argue that degree of a country's financial development is an endogenous outcome of a country's history, origion of law, or some other endowment factors. Column 8 provides the IV estimation result using the colonial origin of a country's legal system as reported in La Porta et al to instrument for the private credit to GDP ratio. These results confirm the first part of Proposition 2: the North tends to choose more outsourcing instead of vertical integration when the South is more financially developed and the sector is more financially vulnerable.

Table 5 provides additional robustness checks by including additional measures of headquarter intensity and the interaction of headquarter intensity with financial development of a country to

isolate the effect of financial development and its interaction with the financial vulnerability of a sector. Those include the U.S. industry research and development at 3 digit NAICS from NS R&D in industry in 2004, the Rauch from Rauch (1999), and Lall Index from Lall (2000). By including additional measures of headquarter intensity and their interaction with a country's financial development measure, the results provided are in Table 4 are not changed.

7.2.2 The Effect of Credit Constraints on Total U.S. Imports

Column 1 in Table 6 re-establishes the positive relationship between the capital labor ratio and total U.S. imports as shown in Antras(2003). Under Proposition 3, there is more imports from the South the more financially developed the South is, and this effect is stronger in the financially vulnerable sectors. I test Proposition 3 by looking at the OLS regression results of equation (17). Column 2-8 in Table 6 provide the results using different measures of financial development. Those measures include private credit to GDP ratio, ratio of stock capitalization to GDP, ratio of stock traded to GDP, accounting standards, risk of expropriation, and contract repudiation. The last three measures are time invariant and therefore are not included by themselves in the regression due to multicollinearity with country dummies in the regression. All results confirm the statement in Proposition 3 that the North imports more from the South when the South becomes more financially developed, and especially so in the financially vulnerable sector.

8. Conclusion

In this paper I have extended the global sourcing model of Antras and Helpman (2004) to incorporate the role of credit constraint. In the model, a continuum of firms with heterogeneous productivities decide to whether to integrate or outsource the intermediate inputs and in which countries to source the inputs. By choosing an organizational structure, the firm (final good producer or intermediate supplier depending on the choice of organizational structure) faces a fixed cost, part of which cannot be financed internally and needs to raise outside capital to finance it. When

the financial contract is enforced, the firms needs to make a payment to the investor; when the financial contract is not enforced, the investors claim the collaterals of the firms. By competing for investors' capital, some firms that could operate without credit constraint are now forced to exit the market with credit constraint because they cannot make enough repayment to the investors when the financial contrct is enforced. The productivity cut-off level is raised for all forms of organization under credit constraint.

This model generates equilibria in which firms with different productivity levels choose different ownership structure and suppliers location. In the model, credit constraints affect firms in different countries and sectors differently. Final-good producers in some sectors find it easier to operate because they need to raise less outside finance and have more tangible assets. Credit constraints vary across countries because contracts between firms and investors are more likely to be enforced at higher levels of financial development.In particular, I study the effect of improvements in financial contractibility on relative prevalence of these organizational forms. I have shown that an improvement in financial contractibility in the South decreases the market share of vertically integrated final-good producers, this effect is more pronounced in the financially vulnerable sector, i.e. the interaction of financial development and external dependence on finance has a negative effect on the market share of vertically integrated firms, and the interaction of financial development and asset tangibility has a positive effect on the market share of vertically integrate firms.

Although this model is partial equilibrium, it can be extended in a general equilibrium framework. Such an analysis might shed light on the sources of international income differences and their relationship to the structure of financial frictions and the resulting trade and investment.

References

Abraham, Katharine G., and Susan K. Taylor. (1996). "Firms' Use of Outside Contractors: Theory and Evidence." J. Labor Econ. 14 (July): 394–424.

Antras, Pol. (2003). "Firms, Contracts, and Trade Structure." Q.J.E. 118 (November):1375–1418

Antras, Pol (2005), "Incomplete Contracts and the Product Cycle," American Economic Review, 95:4, pp. 1054-1073.

Antras, Pol, and Elhanan Helpman (2004), "Global Sourcing," Journal of Political Economy 112:3, pp. 552-580.

Beck, T. (2003). "Financial Dependence and International Trade." Review of International Economics 11, p.296-316.

Beck, T. (2002). "Financial Development and International Trade. Is There a Link?" Journal of International Economics 57, p.107-31.

Beck, T., DemirgKunt, A., Laeven L. and R. Levine (2005). "Finance, Firm Size, and Growth." NBER Working Paper 10983.

Beck, T., DemirgKunt, A. and R. Levine (2000). "A New Database on Financial Development and Structure." World Bank Economic Review, September 2000, p.597-605.

Beck, T., DemirgKunt, A. and V. Maksimovic (2005). "Financial and Legal Constraints to Firm Growth: Does Size Matter?" Journal of Finance 60(1), p.137-77.

Becker, B. and D. Greenberg (2005). "Financial Development and International Trade." University of Illinois at Urbana-Champaign mimeo.

Braun, M. (2003). "Financial Contractibility and Asset Hardness." University of CaliforniaLos Angeles mimeo.

Braun, M. and C. Raddatz (2004). "Trade Liberalization and the Politics of Financial Development." University of California - Los Angeles mimeo.

Feenstra, Robert C. (1998). "Integration of Trade and Disintegration of Production in the Global Economy." J. Econ. Perspectives 12 (Autumn): 31–50.

Feenstra, Robert C., and Gordon H. Hanson. (1996). "Globalization, Outsourcing, and Wage Inequality." A.E.R. Papers and Proc. 86 (May): 240–45.

Grossman, Gene M., and Elhanan Helpman. (2002). "Integration versus Outsourcing in Industry Equilibrium." Q.J.E. 117 (February): 85–120.

Grossman, Sanford J., and Oliver D. Hart. (1986). "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." J.P.E. 94 (August): 691–719.

Hart, Oliver D., and John Moore. (1999). "Foundations of Incomplete Contracts." Rev. Econ. Studies 66 (January; special issue): 115–38.

Helpman, Elhanan, and Paul R. Krugman. (1985). Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy. Cambridge, Mass.: MIT Press.

Helpman, Elhanan, Marc J. Melitz, and Stephen R. Yeaple. (2004). "Export versus FDI with Heterogeneous Firms." A.E.R. 94 (March): 300–316.

Hopenhayn, H. (1992). "Entry, Exit and Firm Dynamics in Long Run Equilibrium." Econometrica 60(5), p.1127-50.

Hummels, David, Jun Ishii, and Kei-Mu Yi. (2001). “The Nature and Growth of Vertical Specialization in World Trade.” J. Internat. Econ. 54 (June): 75–96.

Kaufmann, Daniel., Aart Kraay, and Massimo Mastruzzi (2007). "Governance Matters VI: Governance Indicators for 1996-2006". World Bank Policy Research June 2007.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and R. Vishny, (1998). "Law and Finance." Journal of Political Economy 106, p.1113-55.

Manova, K. (2005). "Credit Constraints in Trade: Financial Development and Export Composition." Harvard University mimeo.

Manova, K. (2006). "Credit Constraints, Heterogeneous Firms, and International Trade." Harvard University.

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

Nunn, N. (2007). "Relationship-Specity, Incomplete Contracts, and the Pattern of Trade." Quarterly Journal of Economics 122(2) (forthcoming).

Rajan, R. and L. Zingales (1998). "Financial Dependence and Growth." American Economic Review 88, p.559-86.

Puga, Diego, and Daniel Trefler. (2002). “Knowledge Creation and Control in Organizations.” Working Paper no. 9121 (August). Cambridge, Mass.: NBER.

United Nations Industrial Development Organization (2006). UNIDO Industrial Statistics Database at the 3-digit level of ISIC (Rev. 2). Vienna, Austria.

Figure 1 Share of Intrafirm Trade and Log Dependence on Finance in 2000

The graph plots the share of U.S. intra-firm trade from sector j against the log tangibility in sector j in the year 2000.

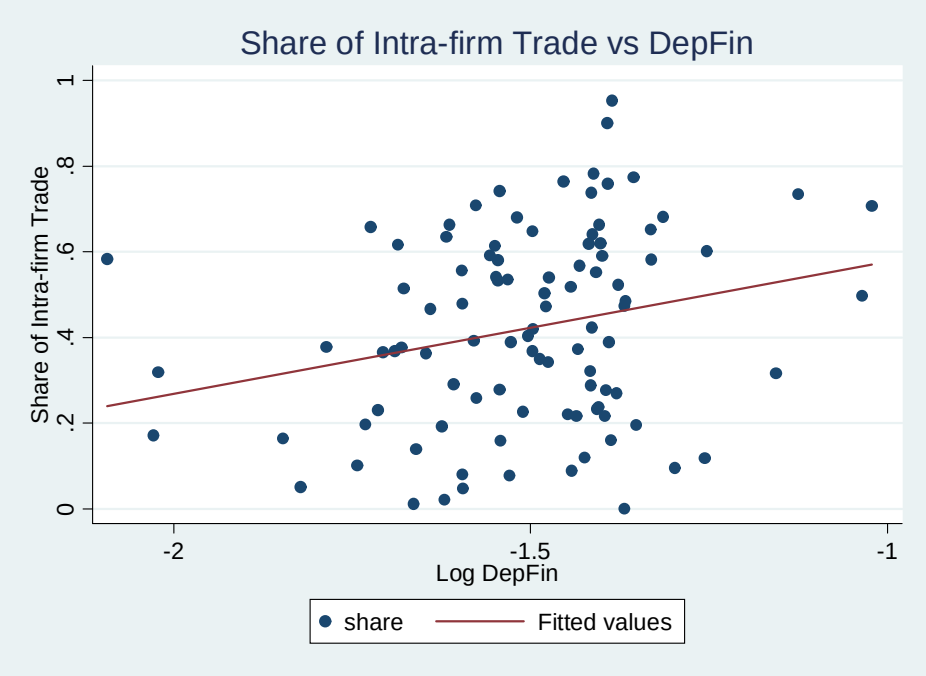


Figure 2 Share of Intra-firm Trade and Tangbility in 2000

The graph plots the share of U.S. intra-firm trade from sector j against the log tangibility of sector j in the year 2000.

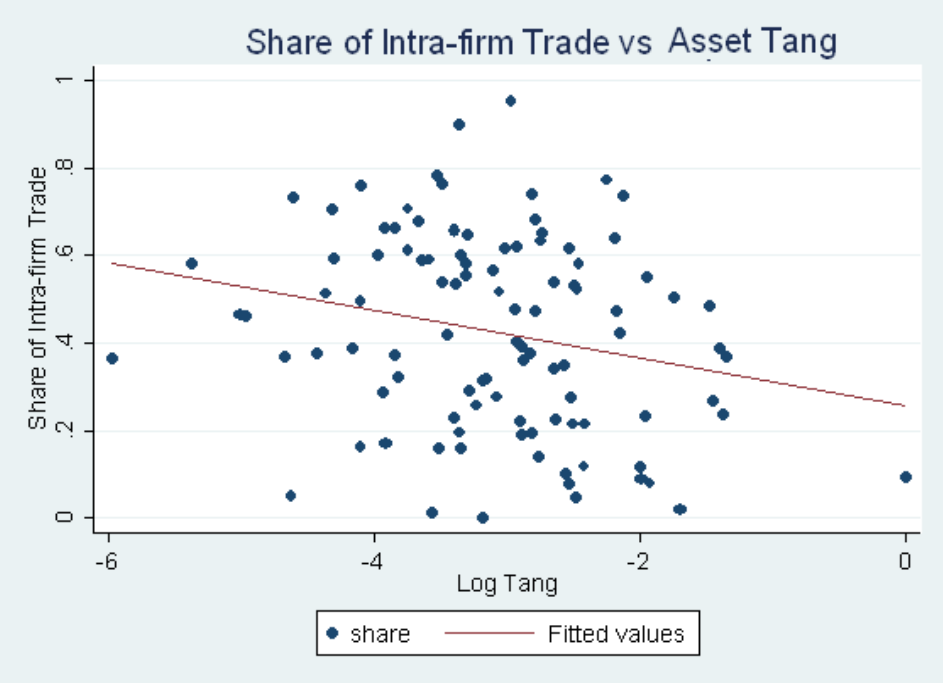
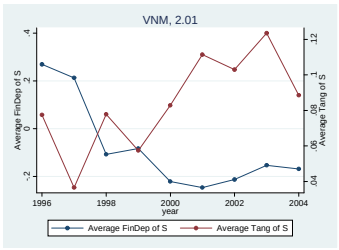
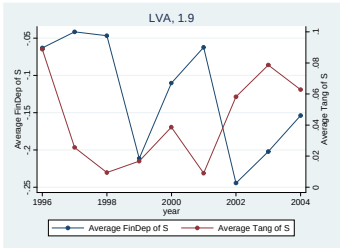
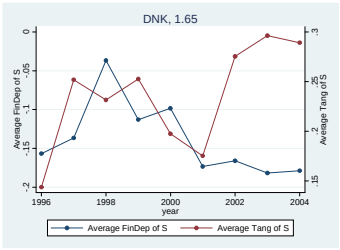

Share of Intra-firm Trade vs Asset Tang
Share of Intra-firm Trade
0
.2
.4
.6
.8
1
-6
-4
-2
0
Log Tang
share
Fitted values

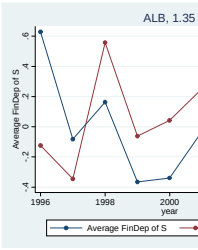
Figure 3 Average Financial Vulnerability of Intra-firm Trade

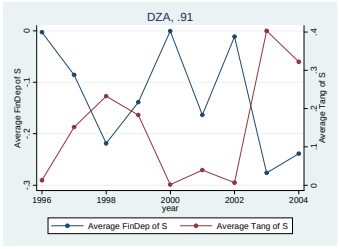
This figure shows the average financial vulnerability of share of intra-firm trade overtime for 20 countries that have improved their financial development by the measurement of private credit to GDP ratio by at least 20% of their 1996 level. For each year the average intensity of intra-firm trade with respect to external finance dependence (Avg Fin Dep of S) is calculated as $\sum_j FinDep_j * Intra^l_{j,t}$, where $Intra^l_{j,t}$ is the share of U.S. intrafirm imports in sector j from country l in time t. The average intensity of intra-firm trade with respect to asset tangibility (Avg Tang of S) is similarly constructed. Each country graph plots Avg Fin Dep of S (Avg Tang of S) on the left (right) vertical axis. Each graph's title indicates the difference between the log private credit in 1996 and 2004. The graphs are sorted by the degree of change in the financial development of a country.

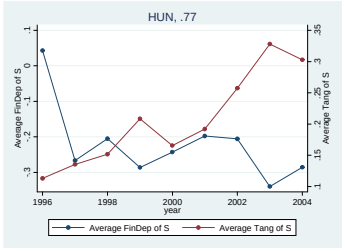

VNM, 2.01
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

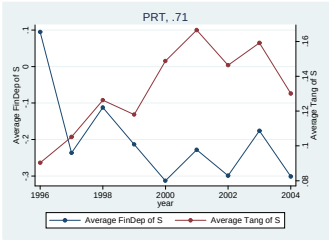

LVA, 1.9
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

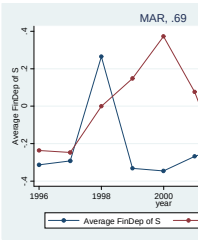

DNK, 1.65
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

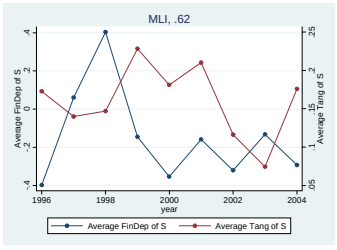

ALB, 1.35
Average FinDep of S
year
1996
1998
2000
Average FinDep of S

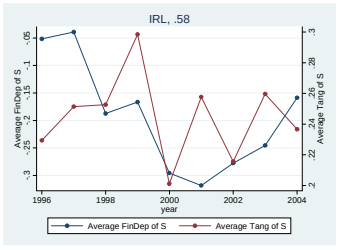

DZA, .91
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S


HUN, .77
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

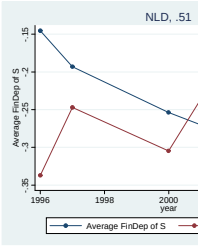

PRT, .71
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

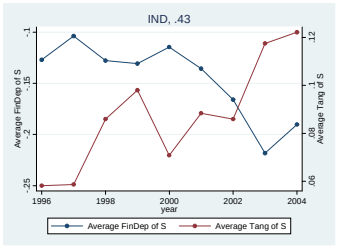

MAR, .69
Average FinDep of S
year
1996
1998
2000
Average FinDep of S

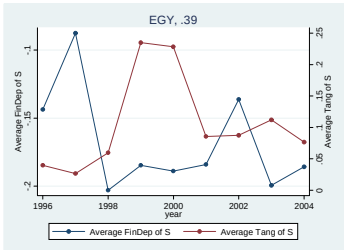

MLI, .62
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

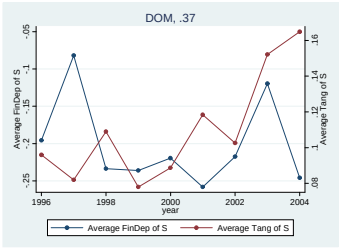

IRL, .58
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

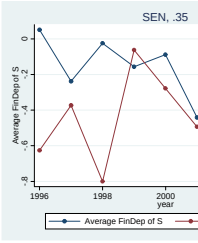

POL, .52
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

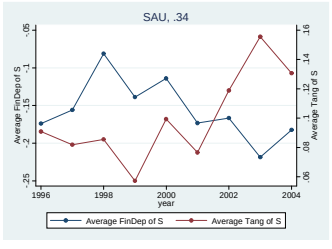

NLD, .51
Average FinDep of S
year
1996
1998
2000
Average FinDep of S

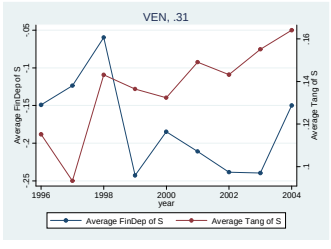

IND, .43
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

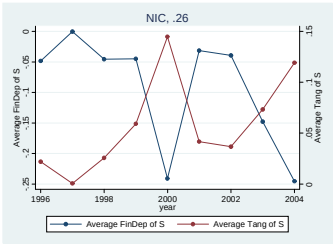

EGY, .39
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S


DOM, .37
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S


SEN, .35
Average FinDep of S
year
1996
1998
2000
Average FinDep of S


SAU, .34
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S


VEN, .31
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S


NIC, .26
Average FinDep of S
Average Tang of S
year
1996
1998
2000
2002
2004
Average FinDep of S
Average Tang of S

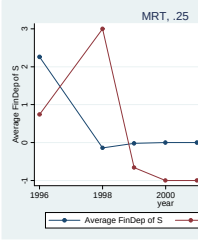

MRT, .25
Average FinDep of S
year
1996
1998
2000
Average FinDep of S

Figure 4 Productivity Cut-off and Credit Constrained Productivity Cut-off.

This graph plots profits as a function of productivity and shows the wedge between the productivity cut-offs for operating with and without credit constraints in the financing of fixed costs.

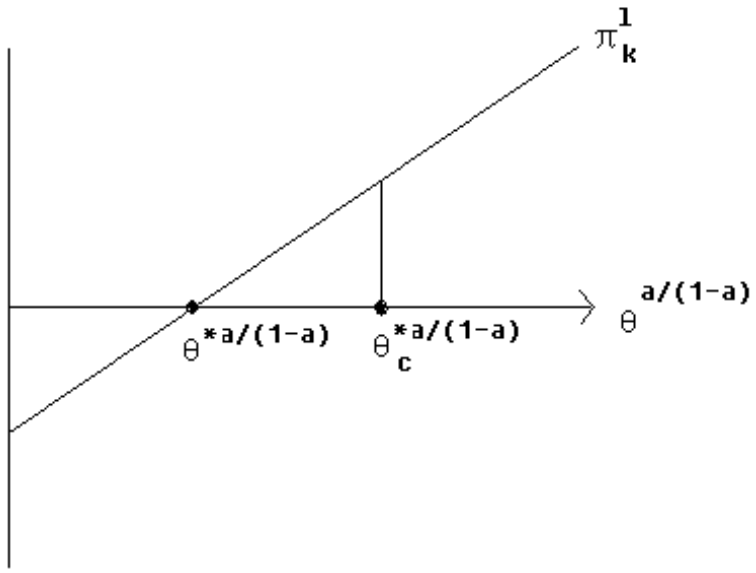


Figure 5 Productivity and Credit Constrained Productivity Cut-offs in Comopnent Intensive Sector

This graph plots profits as a function of productivity in the Component Intensive Sector and shows the wedge between the productivity cut-offs for outsourcing in the North and South with and without credit constraints in the financing of fixed costs.

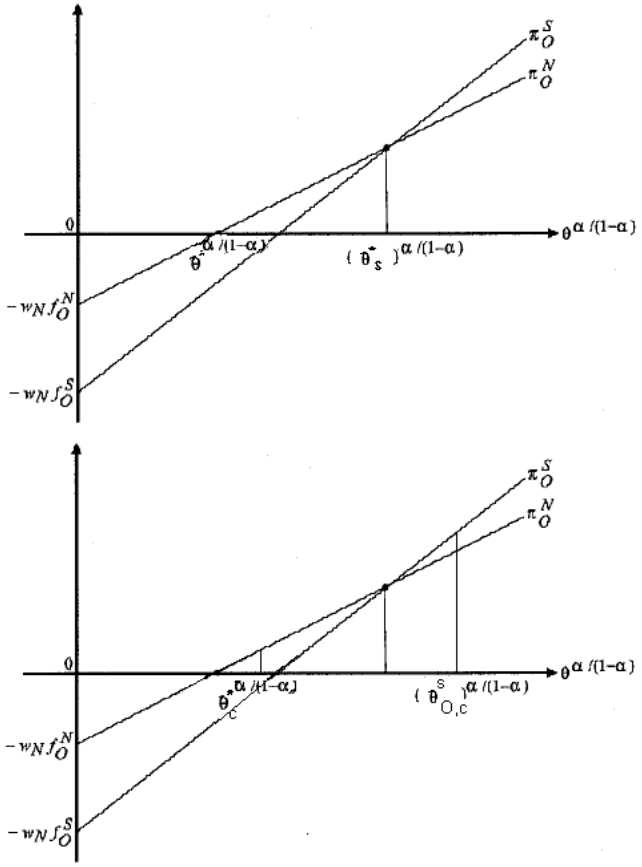


Figure 6 Increase in Financial Development in the South

This graph shows the change in the productivity cut-offs for outsourcing in the North and South with credit constraints in the financing of fixed costs when there is the South becomes more financially developed.

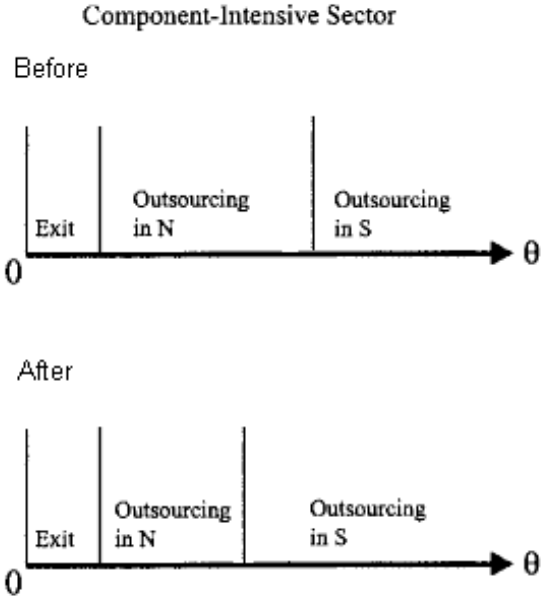


Figure 7

This graph plots profits as a function of productivity in the Headquarter Intensive Sector and shows the productivity cut-offs for outsourcing in the N, vertical integration in the N, outsourcing in the South, and vertical integration in the South without credit constraints in the financing of fixed costs.

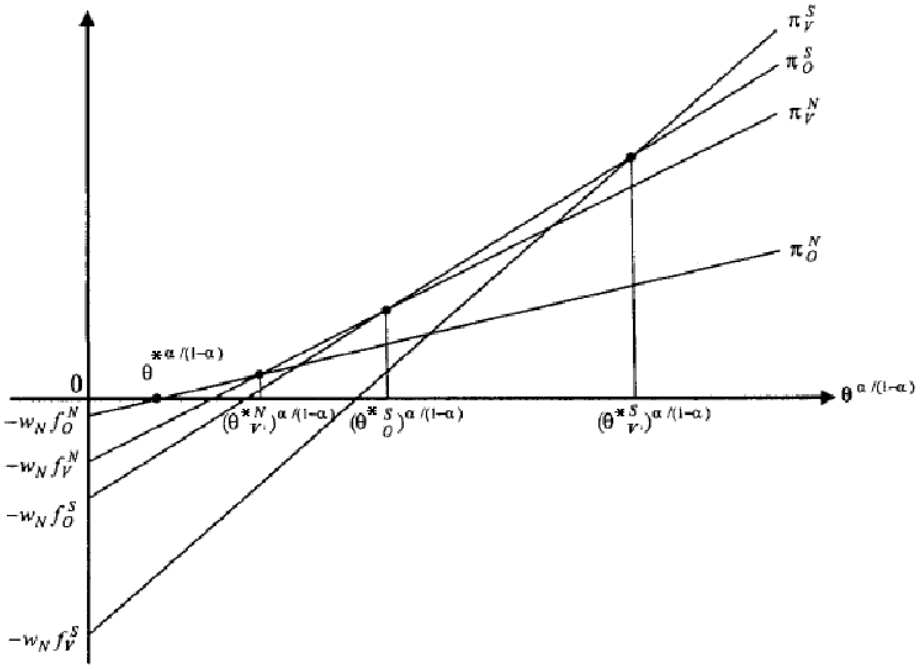


Figure 8

This graph shows that different subset of forms of firm organization may exist in the equilibrium, however vertical integration in the South will always exist due to lack of the upper bound on the productivity.

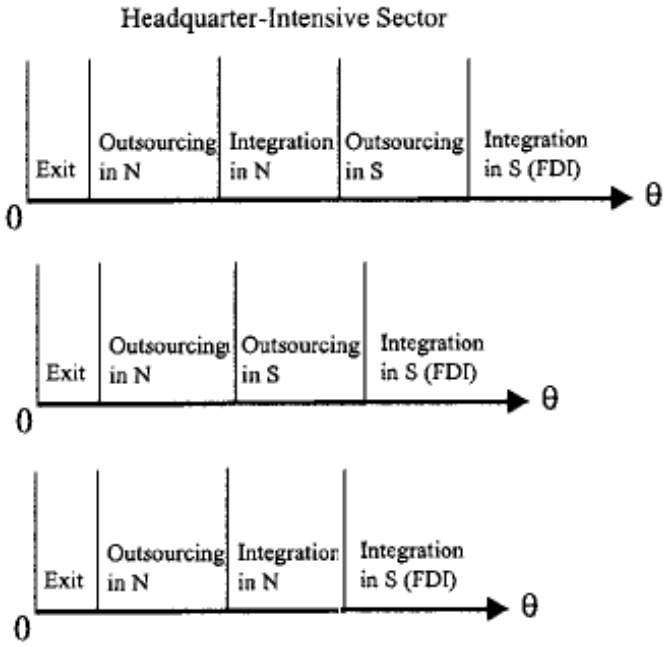


Table 1

This table summarizes the variation in the U.S. intrafirm imports from 119 countries and 103 sectors in the period 1996-2004.

	Trading Partners					
	# of Trading Partners	# of Obs. in SIC-3	Average Share of Intrafirm Trade (sic3 unweighted)	Std Dev	Min	Max
full sample	119	2184	0.204	0.284	0	1
>0 intrafirm trade	115	1524	0.292	0.3	0.00006	1

	Product Variety				
	# of Obs in HS6	Avg # of H: Commodity	Standard Dev	Min	Max
full sample	69061	31.621	58.433	0	493
>0 intrafirm trade	35639	16.318	39.514	0	429

	US Imports Volume (log)	
	# of Obs in HS6	
full sample	69061	26.723
>0 intrafirm trade	35639	26.131

Table 2

This table summarizes the variation in financial development in the data. This table reports the time-series mean and standard deviation of the ratio of private credit to GDP for each country in the sample 1994-2004.

Country	Average	St Dev	Country	Average	St Dev	Country	Average	St Dev
CHE	1.598	0.034	GUY	0.403	0.062	GTM	0.158	0.019
HKG	1.554	0.113	URY	0.400	0.130	LVA	0.157	0.069
NLD	1.257	0.260	SLV	0.385	0.047	BDI	0.153	0.040
GBR	1.249	0.127	HRV	0.384	0.088	SWZ	0.152	0.023
PRT	1.113	0.315	VUT	0.372	0.035	PNG	0.148	0.021
JPN	1.110	0.050	PHL	0.369	0.074	MLI	0.144	0.029
LUX	1.059	0.093	OMN	0.354	0.069	LSO	0.138	0.034
MLT	1.056	0.019	NAM	0.351	0.037	SUR	0.137	0.040
NZL	1.046	0.099	IDN	0.330	0.156	LTU	0.131	0.035
SGP	1.014	0.101	TON	0.324	0.062	HTI	0.131	0.014
CYP	0.991	0.153	SVN	0.316	0.068	NGA	0.127	0.025
AUT	0.984	0.049	FJI	0.315	0.042	MDA	0.126	0.039
THA	0.935	0.161	HND	0.299	0.061	MNG	0.125	0.064
MYS	0.921	0.103	TTO	0.294	0.023	BFA	0.122	0.009
IRL	0.901	0.227	QAT	0.294	0.000	KAZ	0.109	0.053
ESP	0.897	0.139	HUN	0.288	0.073	BWA	0.107	0.047
FRA	0.848	0.026	BRA	0.278	0.010	SLB	0.098	0.009
ISL	0.842	0.338	CPV	0.278	0.043	MDG	0.098	0.019
DNK	0.832	0.543	KEN	0.266	0.036	SYR	0.097	0.003
AUS	0.826	0.108	ECU	0.262	0.053	MOZ	0.095	0.052
PAN	0.797	0.134	MRT	0.256	0.039	GAB	0.094	0.016
ISR	0.783	0.122	LKA	0.255	0.055	BEN	0.091	0.020
BEL	0.758	0.018	IND	0.254	0.033	BTN	0.088	0.020
LCA	0.751	0.102	SAU	0.246	0.027	GHA	0.088	0.026
GRD	0.692	0.089	VNM	0.242	0.139	RWA	0.087	0.011
ITA	0.686	0.113	MDV	0.234	0.046	CMR	0.080	0.011
JOR	0.675	0.035	NPL	0.234	0.038	ARM	0.070	0.013
NOR	0.656	0.079	POL	0.233	0.044	ROM	0.066	0.026
CAN	0.648	0.040	EST	0.231	0.065	ZMB	0.064	0.008
ZAF	0.643	0.008	PAK	0.229	0.014	GNB	0.063	0.016
VCT	0.631	0.008	BGD	0.228	0.034	GEO	0.061	0.018
SWE	0.601	0.292	PER	0.220	0.049	DZA	0.061	0.023
FIN	0.582	0.067	DOM	0.217	0.045	KHM	0.059	0.007
DMA	0.578	0.034	BGR	0.216	0.119	ALB	0.054	0.020
CHL	0.548	0.053	NIC	0.213	0.036	NER	0.051	0.017
TUN	0.531	0.045	PRY	0.209	0.025	TZA	0.051	0.019
MUS	0.505	0.059	JAM	0.201	0.049	MWI	0.050	0.013
KOR	0.485	0.011	CRI	0.200	0.069	UGA	0.048	0.005
GRC	0.478	0.149	ETH	0.192	0.059	CAF	0.048	0.006
CZE	0.466	0.139	MEX	0.192	0.054	TCD	0.036	0.003
BOL	0.465	0.051	ZWE	0.191	0.018	GNQ	0.035	0.000
KWT	0.463	0.126	ARG	0.190	0.047	SDN	0.025	0.008
MAR	0.449	0.110	COL	0.187	0.021	SLE	0.024	0.004
BHR	0.448	0.032	SEN	0.167	0.021	AGO	0.011	0.000
BRB	0.438	0.051	SYC	0.163	0.061			
BLZ	0.423	0.051	TUR	0.161	0.022			
			TGO	0.159	0.019			

Table 3

Panel A reports the summary statistics for other financial measures, risk of expropriation, risk of contract repudiation, accounting standard, and English Origin. Panel B reports the summary statistics for Industry's external dependence on finance and asset tangibility.

Panel A

Variable	Obs	Mean	Std. Dev.	Min	Max
Expropriation	10404	8.104728	1.553326	5.22	9.98
Contract Rep.	10404	7.601682	1.771186	4.36	9.98
acc. stand.	8590	62.26973	12.2532	31	83
English Orig.	10404	.3721646	.4834052	0	1

Panel B

Variable	Obs	Mean	Std. Dev.	Min	Max
extfin	22349	.2732102	.3273468	-.4512	1.1401
tang	22349	.2843681	.1315753	.0745	.6708

Table 4 Financial Development and Organizational Forms

This table examines the effect of credit constraints on the choice of organizational forms. The dependent variable is log [R^l_{jt}/(1-R^l_{jt})], where R^l_{jt} is the share of intrafirm U.S. imports in a 4-digit ISIC sector j from country l in year t. There are 103 4-digit sectors, 27 3-digit industries, and the data spans from year 1996 to 2005. Financial development is measured by private credit. External finance dependence Ext fin dep and asset tangibility Tang are defined in the text. Log of capital to labor ratio is K/L in the table. T-statistics in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10% level.

Dependent Variable	Log R/(1-R)																			
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)					
			PC/GDP		Stock Cap		Stock Traded		Accounting Stand.		Contract Repud		Expropriation		IV Estimat					
Fin Dev * Ext Fin Dep			-0.20	***	-0.06		-0.09	***	-0.97	*	-0.17	***	-0.18	***	-0					
			[0.07]		0.06		0.04		0.59		0.04		0.05		0					
Fin Dev * Tang			0.05		0.10	***	0.03		1.32	***	0.13	***	0.15	***	2					
			[0.05]		0.04		0.02		0.38		0.03		0.03		0					
Fin Dev			0.40	***	0.02		0.15	***							-0					
			[0.15]		0.12		0.07								0					
K/L	0.14	***	0.17	***	0.18	***	0.18	***	0.18	***	0.19	***	0.19	***	0					
	[0.02]		[0.02]		0.02		0.02		0.02		0.02		0.02		0					
Ext Fin Dep			0.68	***	0.84	***	0.77	***	1.46	***	2.28	***	2.40	***	1					
			[0.10]		0.06		0.07		0.39		0.36		0.43		0					
Tang			-0.71	***	-0.68	***	-0.71	***	-1.58	***	-1.84	***	-2.05	***	-2					
			[0.07]		0.05		0.05		0.25		0.24		0.29		0					
Country Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes					
Year Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes					
Number of Observations	28195		28195		26971		26843		20488		22172		22172		22					
Adjusted R-squared	0.096		0.1169		0.119		0.1199		0.1112		0.1165		0.1164		0.1					

Table 5 Financial Development and Organizational Forms: Robustness Checks

This table examines the robustness of the effect of credit constraints on the choice of organizational forms. The dependent variable is log $[R^l_{jt}/(1\text{-}R^l_{jt})]$, where R_{jt} is the share of intrafirm U.S. imports in a 4-digit ISIC sector j from country l in year t. There are 103 4-digit sectors, 27 3-digit industries, and the data spans from year 1996 to 2005. Financial development is measured by private credit. External finance dependence Ext fin dep and asset tangibility Tang are defined in the text. Log of capital to labor ratio is K/L in the table. R & D is log R&D from U.S.; Lall index is equal to one for high- and medium-tech products, zero for low-tech products (Lall, 2000); and Rauch Index is equal to one if it's traded on integrated market or referenced priced (Rauch, 1999), see detail discussion in text. T-statistics in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10% level.

Dependent Variable	Log Total U.S. Imports															
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Private Credit		Stock Cap		Private Credit		Stock Cap		Private Credit		Stock Cap		Private Credit		Stock Cap	
Fin Dev * Ext Fin Dep	-0.18	***	-0.07	***	-0.11		-0.06	***	-0.21	***	0.05	***	-0.12	*	-0.01	
	0.08		0.03		0.08		0.03		0.08		0.02		0.07		0.06	
Fin Dev * Tang	0.05		0.12	***	0.11	**	0.15	***	0.07		0.10	**	0.11	**	0.15	
	0.05		0.04		0.05		0.04		0.05		0.04		0.05		0.05	
Fin Dev * R & D	0.00		0.00										0.00		0.01	
	0.00		0.00										0.00		0.00	
Fin Dev * Lall Index					-0.01		0.00						-0.03		-0.03	
					0.04		0.03						0.04		0.03	
Fin Dev * Rauch Index									0.03		0.08		0.07		0.13	
									0.06		0.05		0.06		0.05	
Fin Dev	0.36	**	-0.04		0.21		-0.09		0.41644	***	0.02		0.20		-0.15	
	0.15		0.13		0.15		0.12		0.15134		0.12		0.15		0.13	
R & D	0.06	***	0.06	***									0.00		0.00	
	0.01		0.00										0.01		0.00	
Lall Index					0.92	***	0.92	***					0.86	***	0.86	
					0.05		0.04						0.06		0.04	
Rauch Index									-0.78	***	-0.74	***	-0.40	***	-0.38	
									0.09		0.06		0.09		0.06	
K/L	0.16	***	0.17	***	0.05	***	0.06	***	0.29	***	0.28	***	0.13	***	0.13	
	0.02		0.02		0.02		0.02		0.02		0.02		0.02		0.02	
Ext Fin Dep	0.65	***	0.78	***	0.48	***	0.56	***	0.60	***	0.78	***	0.45	***	0.57	
	0.10		0.05		0.10		0.05		0.10		0.05		0.10		0.06	
Tang	-0.46	***	-0.41	***	-0.06		-0.06		-0.44	***	-0.43	***	0.04		0.03	
	0.08		0.05		0.08		0.06		0.08		0.06		0.09		0.06	
Country Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Number of Observations	28183		26964		28183		26964		28183		26964		28183		2696	
Adjusted R-squared	0.1256		0.1277		0.1494		0.1543		0.1258		0.1276		0.1524		0.154	

Table 6 Financial Development and Total U.S. Imports in Headquarter Intensive Sector

This table examines the effect of credit constraints on the total U.S. imports. The dependent variable is log M_{jt}^{l}, where M_{jt}^{l} is the total U.S. imports in a 4-digit ISIC sector j from country l in year t. There are 103 4-digit sectors, 27 3-digit industries, and the data spans from year 1996 to 2005. Financial development is measured by private credit. External finance dependence Ext fin dep and asset tangibility Tang are defined in the text. Log of capital to labor ratio is K/L in the table. T-statistics in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10% level.

Dependent Variable	Log Total U.S. Imports															
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
			PC/GDP		Stock Cap		Stock Traded		Accounting Stand.		Contract Repud		Expropriation		IV Estimatio	
Fin Dev * Ext Fin Dep			0.31	***	0.14	***	0.12	***	3.52	***	0.32	***	0.30	***	0.7	
			0.08		0.07		0.04		0.67		0.05		0.05376		0.1	
Fin Dev * Tang			-1.42	***	-0.82	***	-0.56	***	-7.26	***	-0.62	***	-0.61	***	-1.1	
			0.05		0.05		0.02		0.44		0.03		0.04		0.0	
Fin Dev			-0.02		0.06		-0.02									
			0.16		0.14		0.08									
K/L	0.34	***	0.28	***	0.28	***	0.29	***	0.31	***	0.31	***	0.31	***	0.3	
	[0.02]		0.02		0.02		0.02		0.02		0.02		0.02		0.0	
Ext Fin Dep			0.85	***	0.58	***	0.62	***	-1.81	***	-2.19	***	-2.19	***	1.0	
			0.11		0.07		0.08		0.44		0.40		0.48		0.1	
Tang			-1.62	***	-0.43	***	-0.71	***	4.75	***	5.16	***	5.37	***	-1.6	
			0.08		0.06		0.06		0.29		0.28		0.33		0.1	
Country Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Number of Observations	29612		29612		27942		27812		20949		22788		22788		2278	
Adjusted R-squared	0.3857		0.4035		0.3625		0.3684		0.3044		0.3229		0.3202		0.328	

Table 7 Component Intensive Sector Financial Development and Financial Vulnerability

This table examines the effect of credit constraints on the total U.S. imports. The dependent variable is log M_{jt}^{l}, where M_{jt}^{l} is the total U.S. imports in a 4-digit ISIC sector j from country l in year t. There are 103 4-digit sectors, 27 3-digit industries, and the data spans from year 1996 to 2005. Financial development is measured by private credit. External finance dependence Ext fin dep and asset tangibility Tang are defined in the text. Log of capital to labor ratio is K/L in the table. T-statistics in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10% level.

Dependent Variable	Log U.S. Imports					
	(1)	(2)	(3)	(4)	(5)	(6)
	Private Credit/GDP	Accounting Standards	Risk of Expropriation	Contract Repudiation	Stock Capitalization	IV Estimati
Fin Dev * Ext Fin Dep	0.06	-0.17	0.07	0.02	0.03	1.35
	[0.06]	[0.71]	[0.056]	[0.05]	[0.02]	[0.45]
Fin Dev * Tang	-0.27 ***	-1.82 ***	-0.20 ***	-0.16 ***	-0.11 ***	-1.26
	[0.04]	[0.51]	[0.04]	[0.03]	[0.04]	[0.34]
Fin Dev	0.12					1.13
	[0.13]					[2.30]
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Product Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	16099	6630	8163	8163	12849	81
Adjusted R-squared	0.2786	0.2571	0.2591	0.2588	0.2665	0.25