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**Vertical Integration and
Investor Protection in
Developing Countries**

By **Rocco Macchiavello**, Oxford
(Nuffield College) and CEPR

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Address for correspondence:

Rocco Macchiavello
Oxford (Nuffield College)
New Road
Oxford OX1 1NF
UK
E-mail: rocco.macchiavello@nuffield.ox.ac.uk

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Rocco Macchiavello*

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Abstract

The industrial organization of developing countries is characterized by the pervasive use of subcontracting arrangements among small, financially constrained firms. This paper asks whether vertical integration relaxes those financial constraints. It shows that vertical integration trades off the benefits of joint liability against the costs of rendering the supply chain more opaque to external investors. In contrast to the commonly held view that pervasive input and capital market imperfections are conducive to vertical integration, the model predicts that the motives for vertical integration are not necessarily higher in developing countries. In particular, vertical integration is more likely to arise at intermediate levels of investor protection and better contract enforcement with suppliers reduces vertical integration only if financial markets are sufficiently developed. Evidence supporting both predictions is discussed.

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1 Introduction

The industrial organization of developing countries is characterized by the pervasive use of subcontracting arrangements among small firms. Evidence of these subcontracting arrangements in the developing world (see, e.g., the footwear industry in Taiwan (Levy (1990)), Mexico (Woodruff (2002)) and Brazil (Schmitz (1995)) contrasts with the intuition that, in response to input market failures and poor contract enforcement, firms should tend to be larger and more vertically integrated in those countries (see, e.g., Khanna and Palepu (1997, 2000)).¹ A second well-known characteristic of the industrial organization of developing countries is that underdeveloped financial markets are a serious constraint to investment for small and medium-sized firms (see, e.g., Banerjee and Duflo (2004) for a survey of the literature).² This paper argues that the relationship between (capital and input) market development and vertical integration is a complex one. In contrast to commonly held views, the motives for vertical integration are not necessarily higher in developing countries. In particular, the relationship between investor protection and vertical integration is, instead, likely to take an inverted U-shape.

To explore the connection between financial constraints and vertical integration, a first necessary step is to ask whether vertical integration makes it easier or harder to raise external finance. Section 2 starts by introducing an incomplete contract model in which a seller can produce a good that can be used by a buyer or sold on a spot market. Which of those two trading configurations yields a higher surplus depends on market conditions, which are unknown at the time of initial contracting. Neither the seller nor the buyer has cash, and both need to borrow from an external investor. Since owners can steal part of the profits of their firms, rents need to be provided in order to insure repayment of the loan. This implies that entrepreneurs can only pledge a fraction of the profits of their project to external investors and therefore face borrowing constraints. In environments in which it is hard to borrow, the choice between vertical integration and non-integration is then

¹Acemoglu et al. (2006) show that this anecdotal observation is not explained by differences in industrial composition: developing countries have relatively larger shares of firms in industries that are relatively *more* vertically integrated in richer countries. Rajan and Zingales (1995), Macchiavello (2006) and Kim and Shin (2007) also provide evidence that systematic differences in the degree of vertical integration across countries correlate with the degree of financial development.

²The paper provides a framework to think about small and medium-sized enterprises, for which borrowing constraints are likely to be important. In focussing on borrowing constraints we do not deny that other characteristics of the business environment in developing countries have potentially large effects on the incentives of firms to vertically integrate (e.g., low skills in the labour force, labour regulation, other reasons pushing firms into the informal sector).

taken to maximize the pledgeable income (i.e., the expected returns that can be promised to the investor) of the two projects.

Section 3 highlights the main mechanisms through which the choice between vertical integration and non-integration affects pledgeable income. The main message is that, from a financial point of view, vertical integration trades off the benefits of joint liability against the costs of rendering the supply chain more opaque for the external investor. The positive “*joint liability*” effect associated with vertical integration comes from the fact that, given final product market conditions, the profits of two vertically related firms depend, through bargaining, on input market conditions and are therefore negatively correlated. When the price of the input is high, so are the profits of the upstream firm. When, instead, the price of the intermediate input is low, it is the downstream firm that benefits. Negatively correlated returns make joint liability relatively more attractive. Vertical integration, however, comes with a negative “*demonitoring*” effect. Under vertical integration the financier of the firm can seek repayment from a single entrepreneur but not from an employee, whilst under non-integration she can seek repayments from both the downstream and upstream owners. In other words, under non-integration the investor can claim repayments from two parties rather than one, as well as over earnings which represent a compensation for effort.

The trade-off implies that vertical integration is preferred when pledgeable income is higher. For instance, a high cash flows at the end of the chain implies that the optimal financial structure chooses a relatively low level of debt, which guarantees repayment regardless of input market conditions. Under those circumstances, vertical integration achieves higher pledgeable income since it insulates the profits of the firm from input market conditions. When the value of production at the end of the chain is low, instead, the optimal contract sets a high debt, which is repaid only when input market conditions are favorable to the downstream firm. While the pledgeable income of an integrated firm is equal to that of a non-integrated downstream firm, non-integration allows the investor to receive the pledgeable income of the upstream firm as well and is therefore preferred.

Section 4 presents two extensions to the baseline model and derives testable predictions linking the institutional environment to the vertical integration decision. The two extensions combine the baseline model implication that vertical integration is preferred when pledgeable incomes are higher with well known mechanisms associated with imperfect contracting and borrowing constraints.

The first extension introduces a distinction between the degree of “investor protection” (i.e., the

extent to which entrepreneurs can steal profits from external investors) and “contract enforcement”, i.e., the extent to which buyers can avoid paying suppliers for the input provided. In particular, we assume that, in stealing the profits of her firm, the buyer can also default on a fraction of the (trade) credit extended by the supplier. As a consequence of this imperfection, to ensure loan repayment the financial contract must leave higher rents to the entrepreneur.

Imperfections in the enforcement of contracts between the seller and the buyer have an ambiguous effect on vertical integration. On the one hand, since input transactions among independent firms occur at higher prices, the rents necessary to ensure repayment are higher under non-integration than under vertical integration. This effect captures the common argument that vertical integration is preferred in the presence of contractual imperfections with input suppliers. On the other hand, by increasing the rents necessary to ensure loan repayment, imperfect contract enforcement with the input supplier reduces the income that can be pledged by the two firms. According to the logic of the baseline model, this favors non-integration.

The interplay of those two effects implies that the relationship between vertical integration and the institutional environment is complex. In particular, contract enforcement and investor protection are complementary determinants of vertical integration, in the sense that non-integration is more prevalent when both are either relatively high or relatively low. The overall quality of the institutional environment, in terms of both investor protection and contract enforcement, therefore, has a non-monotonic effect on the incentives for vertical integration.

The second extension to the baseline model introduces product market competition at the end of the value chain. The interplay between product market competition and the positive relationship between vertical integration and pledgeable income gives an additional mechanism through which the relationship between investor protection and vertical integration is non-monotonic. At very low levels of investor protection, it is not possible to finance both the downstream and upstream units. The industry is then characterized by small, vertically disintegrated firms that outsource their components in the market. As investor protection increases, two effects kick in. On the one hand, as access to finance gets easier, it becomes possible to expand the firm and finance the investments required to set up the upstream unit as well. This effect pushes towards vertical integration. On the other hand, better investor protection fosters entry of firms in the industry, increases competition, and eventually leads to lower equilibrium cash flows at the end of the chain.

This effect, as emphasized above, pushes towards non-integration. The first effect is stronger at relatively low levels of investor protection; while the second effect is stronger at higher levels of investor protection.

Section 5 confronts the theoretical predictions with empirical evidence based the historical experience of the textile industry in the nineteenth century as well as contemporary cross-country studies. Section 6 discusses the implications of relaxing many of the assumptions alongside with other possible extensions to the model.

Related Literature

This paper contributes to the literature on the relationship between financial development and the industrial organization of developing countries. Banerjee (2004) and Banerjee and Munshi (2004) present insightful evidence on the relationship between financial constraints and vertical integration in industries based within communities in India. The model in this paper provides an analytical treatment of the issues treated in those papers. Mookherjee (1999) also provides a discussion of the costs and benefits of vertical integration in less developed countries, but he focuses on the role of uncertainty in input supply. More recently, Kranton and Swamy (2006) have studied the microeconomics of exporting in a model that also features multiple hold-up problems between various actors along the supply chain (exporters, agents and producers). They discuss why vertical integration might not be feasible in institutionally poor environments, which complements the insights of this paper. Moreover, they provide an analysis of putting-out systems, a hybrid organizational form closely related to some of the discussion in this paper. Finally, this paper is related to the theoretical literature on microfinance and joint liability contracts across firms in developing countries (see, e.g., Ghatak and Guinnane (1999) and Ghatak and Kali (2001)). An important difference, however, is that in our context the joint liability of the two productive units is linked to an input transaction.

This work is also closely related to the literature on the theory of the firm. While we do not intend to downplay the importance of non-contractible investments in determining the vertical integration decision (a view formalized in the property right approach (see, e.g., Hart (1995)), this paper emphasizes how vertical integration affects the ex-post (governance) relationship between the external investor and the entrepreneurs, and is therefore closer in spirit to the transaction costs approach to firm boundaries (e.g., Williamson (1971)). Property rights theories of the firm

with financially constrained entrepreneurs (see, e.g., Legros and Newman (2004)) predict that the allocation of control rights is twisted in favour of the entrepreneur with more ex-ante bargaining power or wealth. The ex-ante distribution of wealth and bargaining power, however, might be context specific and difficult to observe, making those theories hard to test. The approach in this paper emphasizes the financial properties of the organizational form and allows for predictions that do not depend on those details. Finally, In defining a firm as a nexus of contracts characterized by a centralized allocation of control rights and joint liability, the paper borrows from the legal literature (e.g., Cheung (1983), Hausmann and Kraakman (2001)), as well as from the work of business historians (e.g., Lamoreaux (1998)).³

2 The Model

Set up

Consider two managers, a buyer and a seller, respectively in charge of two different projects: a downstream (d) plant and an upstream (u) plant. The two managers have no cash and borrow from an investor to finance the investments required to start their respective plants. The upstream unit produces a good that can be used by the downstream unit or sold to an external market. The two managers are aware of the possibility that certain features of the input may make it best suited to be traded on the spot market, but they cannot foresee the nature of these features, and hence cannot write an ex-ante contract which is contingent on the nature of ex-post trade.

The production process generates final cash flows V . The input can be purchased (respectively sold) on the spot market at price p (respectively p'). There is ex-ante uncertainty over the prevailing input market conditions. To simplify, assume that with probability π the input can be purchased at price $p = \bar{p} < V$, otherwise $p = \underline{p} < \bar{p}$. For simplicity, let us assume that $p' = \gamma p$ with $\gamma < 1$. The upstream manager can always produce an appropriate input at cost c , where $\underline{p} < c < \bar{p}$. A fraction μ of the costs is monetary and corresponds to a financial outlay (for example, it could correspond to the purchase of tools). The remaining fraction $1 - \mu$, however, is an effort cost that cannot be transferred and is borne by the upstream manager, for example the opportunity cost of working

³The trade-off associated with vertical integration is reminiscent of the informal discussions in Williamson (1971) and Holmstrom (1999). This paper is also related to the literature on trade credit (see, e.g., Burkart and Ellingsen (2004)) and internal capital markets (see Stein (2003) for an excellent survey). The link between vertical integration and investor protection distinguishes this paper from those literatures.

to produce the intermediate input. Since $\underline{p} < c < \bar{p} < V$, when $p = \underline{p}$, the upstream manager is not cost-effective, and the input should be procured on the market. When $p = \bar{p}$, however, the upstream manager is cost-effective and it is strictly more profitable for the input to be produced by the upstream manager and to be sold to the downstream manager. The parameters π and γ therefore capture the specificity of the relationship.

As is commonly assumed in the incomplete contracts literature, the realization of the state of nature is observable but not verifiable: it is observed by the two managers but not by third parties such as investors and courts.⁴

Ownership

Ownership determines residual control rights over the use of the input. We focus on two different configurations. Under *non-integration* the two units are separately owned and managed firms. In the absence of an enforceable contract, two independent firms trade with each other if and only if the two owners agree on a suitable price P for the input. Under *vertical integration* the owner of the firm, i.e., the downstream manager, bargains with her employee, i.e., the upstream manager, over wage w , but can impose by *fiat* whether the two divisions of the integrated firms should trade with each other or trade on the spot market. Both P and w are negotiated through an ex-post efficient bargaining process in which the downstream manager has the right to make a take-it-or-leave-it offer to the upstream manager.⁵

Control over financial streams is transferred with ownership. Only a fraction φ of the monetary profits are verifiable, and therefore an owner can always guarantee a fraction $(1 - \varphi)$ of the monetary profits of the firm for himself.⁶ The parameter φ is a proxy for the degree of external investor protection in the economy.⁷

In contrast to repayment to an investor lending capital, the model assumes that owners cannot

⁴Prices cannot be verified by courts because the exact features of the required input cannot be described. The court observes many input prices on the market, but does not know which input is appropriate.

⁵General divisions of surplus between the two managers could be considered without affecting the main results.

⁶This assumption is stronger than necessary. What is important for the analysis is that repayments to investors cannot be made fully contingent on the realization of profits. Assuming a linear stealing technology avoids a bias in favour of (respectively, against) vertical integration purely originating from increasing (respectively, decreasing) returns in such technology.

⁷We assume that control over financial streams cannot be (fully) separated from ownership because (part of) the returns cannot be verified. Ownership entails the right to sign contracts with third parties that could be used to generate private benefits for the owner. The assumption that employees cannot steal is made to focus our attention on the agency conflict between the firm(s) and the investor.

avoid repayments to employees and suppliers. Section 4.1 relaxes the assumption and considers a more general case in which the owner can avoid payments to employees and input suppliers as well.

In the remainder of the text, the downstream manager will also be called buyer under non-integration and owner under vertical integration. Similarly, the upstream manager will also be called seller under non-integration and worker (or employee) under vertical integration.

Initial Contract and Timing of Events

Neither manager has cash, and both needs to borrow in order to finance the start up costs of the two projects. These costs are denoted by k_d and k_u for the downstream and upstream units, respectively. If either of the two managers fails to get capital to finance her project, she can start a smaller project that requires no initial capital disbursement (she could, for instance, become self-employed in the informal sector). We normalize the payoff of starting such a business with no capital to be equal to zero. Since we are interested in determining i) which organizational form raises more external funds, and ii) which projects can be financed by external investors, the analysis assumes that there is a unique risk-neutral investor who has all the ex-ante bargaining power. Contracts are thus signed to maximize the pledgeable income of the two projects, subject to the participation constraints of the two managers.⁸

Only simple debt-like contracts are feasible. The investor holds a debt-like claim B over the profits of a firm. When the firm is integrated there is a unique B . When the two firms are not integrated, the investor holds claims B_d and B_u on the profits of the downstream and upstream firms, respectively. The monitoring costs associated with equity-like contracts are assumed to be prohibitively high.

To summarize, the timing of events is as follows (see Figure 1). At date 0 contracts are signed. First, either an integrated firm or two non-integrated firms are created (allocation of control rights). Then, the financial contract(s) between the owner(s) of the firm(s) and the investor are signed. At date 1/2, the state of nature is realized and observed by the managers. Given the ownership configuration, the two managers bargain at date 1 over the input transaction. At date 2 profits are realized. The owner(s) then decide(s) whether to hide profits or not. Finally, if profits have not been hidden, existing financial contracts are executed.

⁸Even in a competitive credit market, two cash constrained managers might try to maximize the amount they can raise from the external investor in order to transfer rents according to the initial distribution of bargaining power, as discussed in Section 6.

the monetary profits, keeping a fraction $1 - \varphi$ of them. This happens if $\Pi(\bar{p}) - B \geq (1 - \varphi) \Pi(\bar{p})$, i.e., if $B \leq \varphi(V - c)$.

Similarly, with probability $1 - \pi$ the market price for an appropriate input is $p = \underline{p} < c$. The input is procured on the spot market at price \underline{p} . The monetary profits (gross of debt repayments) of the firm are given by $\Pi(\underline{p}) = V - \underline{p}$, so that the owner of the firm repays debt B if and only if $B \leq \varphi(V - \underline{p})$.

The investor trades off a higher debt level B with a higher probability that the debt is repaid. The investor can set $B = \varphi(V - c)$ and be repaid regardless of the state of the world, or set $B = \varphi(V - \underline{p})$ and be repaid only with probability $1 - \pi$. When V is higher, the first option becomes relatively more profitable. The following proposition summarizes the previous discussion.

Proposition 1 *The pledgeable income of an integrated firm, denoted P_{int} , is given by*

$$P_{int} = \varphi \max\{(V - c), (1 - \pi)(V - \underline{p})\}. \quad (1)$$

The pledgeable income of an integrated firm is i) increasing in the degree of investors' protection φ , ii) decreasing in the (expected) cost of the input (c , π and \underline{p}), iii) increasing and convex in downstream cash flows V , and iv) independent of the composition of input costs μ .

Pledgeable Income under Non-Integration

Under non-integration the two units are two independent firms managed by two separate owners. The investor chooses debt levels B_d and B_u in order to maximize the joint pledgeable income of the two non-integrated firms.

With probability $1 - \pi$ the market price for an appropriate input is $p = \underline{p} < c$. The input should be procured on the spot market at price \underline{p} . The monetary profits (gross of debt repayments) of the downstream and upstream firm are respectively given by $\Pi_d(\underline{p}) = V - \underline{p}$ and $\Pi_u(\underline{p}) = 0$. The owner of the downstream firm repays debt B_d if and only if $B_d \leq \varphi(V - \underline{p})$, while the owner of the upstream firm never repays debt.

With probability π the market price for an appropriate input is $p = \bar{p} > c$. The two firms should trade together. The owners bargain over the price P for the input. Since the downstream manager has all the bargaining power, she proposes a price $P = \gamma\bar{p} \simeq \bar{p} > c$ for the input, and her

offer is accepted by the seller. The monetary profits (gross of debt repayments) of the downstream and upstream firms are respectively given by $\Pi_d(\bar{p}) = V - \bar{p}$ and $\Pi_u(\bar{p}) = \bar{p} - \mu c$. The buyer repays the debt if and only if $B_d \leq \varphi(V - \bar{p})$. Similarly, the seller repays the debt if and only if $B_u \leq \varphi(\bar{p} - \mu c)$.⁹

As for the case of integration, the investor trades off a higher debt level B_i in each firm $i \in \{d, u\}$ with a higher probability that the debt will be repaid. For the upstream firm, the optimal debt level is obviously given by $B_u = \varphi(\bar{p} - \mu c)$. This debt is repaid with probability π , and the pledgeable income of the upstream firm is given by $P_u = \pi\varphi(\bar{p} - \mu c)$. The pledgeable income of the downstream firm is given by $P_d = \varphi \max\{(V - \bar{p}), (1 - \pi)(V - \underline{p})\}$.

The following proposition summarizes the previous discussion.

Proposition 2 *The total pledgeable income of two non-integrated firms, denoted P_{ni} , is given by*

$$P_{ni} = \varphi[\max\{(V - \bar{p}), (1 - \pi)(V - \underline{p})\} + \pi(\bar{p} - \mu c)]. \quad (2)$$

The total pledgeable income of two independent firms P_{ni} is i) increasing in the degree of investors' protection φ , ii) increasing and convex in downstream cash flows V , and, iii) decreasing in the share of monetary costs borne by the owner μ . In contrast to the pledgeable income under integration P_{int} , P_{ni} depends on \bar{p} and μ . P_{ni} depends on \bar{p} because when the two firms trade together the price $p = \bar{p}$ prevailing in the input market pins down, through bargaining, the division of surplus between the two firms. It also depends on μ because of a fundamental accounting difference between vertical integration and non-integration. While the value added and the profits are equal along the chain under the two organizational forms, the monetary profits are not. This is because under integration the non-monetary costs $(1 - \mu)c$ are transformed into a monetary disbursement corresponding to a wage, while under non-integration they are not.

Under non-integration the division of surplus between the two firms does not depend on the debt levels B_d and B_u . In fact, the pledgeable income P_{ni} is simply given by the sum of the pledgeable incomes of the two firms, i.e., $P_{ni} = P_d + P_u$.¹⁰

⁹Note that the seller's monetary payoff is given by $(\bar{p} - \mu c) - B_u$ which is strictly larger than her effort cost $(1 - \mu)c$, under the assumption $(1 - \varphi)(\bar{p} - \mu c) > (1 - \mu)c$. If, instead, $(1 - \varphi)(\bar{p} - \mu c) < (1 - \mu)c$, the participation constraint of the upstream manager is binding and $B_u = \bar{p} - c$.

¹⁰Moreover, since the buyer has all the ex-post bargaining power and $\gamma \simeq 1$, P_d is independent of whether firm u

3.2 Comparison of the two structures

The next proposition compares the pledgeable income under the two organizational forms and provides necessary and sufficient conditions under which vertical integration delivers a higher pledgeable income than non-integration.

Proposition 3 *1. If the monetary profits $\pi(\bar{p} - \mu c)$ of an upstream firm are larger than the surplus $\bar{p} - c$ in the intermediate input market, then non-integration always has a higher pledgeable income, i.e., $P_{ni} > P_{int}$.*

2. If, instead, $\pi(\bar{p} - \mu c) \leq \bar{p} - c$, there exists a threshold \bar{V} such that $P_{int} \geq P_{ni}$ if the value of the final good V is higher than \bar{V} , i.e., $V \geq \bar{V}$. Moreover, $\frac{\partial \bar{V}}{\partial \mu} < 0$, $\frac{\partial \bar{V}}{\partial \pi} < 0$ and $\frac{\partial \bar{V}}{\partial \varphi} = 0$.

Depending on parameters, the pledgeable income might be higher either under vertical integration or under non-integration, as illustrated in Figure ???. Figure ??? plots the pledgeable incomes under vertical integration and non-integration as a function of product market cash flows V .

When V is sufficiently low, it is optimal to set a high debt level which is repaid only when input market conditions are favorable to the downstream firm, i.e., when $p = \underline{p}$. This implies that the debt capacity of an integrated firm is equal to the debt capacity of the downstream firm under non-integration, i.e., $P_d = P_{int} = \varphi(1 - \pi)(V - \underline{p})$. Under non-integration, however, the investor can also seek repayment from the upstream owner, $P_u = \varphi\pi(\bar{p} - \mu c)$. Non-integration then dominates since under vertical integration the investor cannot seek repayments from an employee, whilst under non-integration she can seek repayments from the upstream firm owner, thus laying claims on the earnings of this agent as well. I label this negative effect of vertical integration “*demonitoring*” effect.¹¹

At higher levels of V , however, it becomes optimal to set a level of debt which is repaid regardless of input market conditions. Relative to the profits in a non-integrated chain, the profits of the vertically integrated firm are relatively more insulated from input market conditions, and

has been financed or not (and vice versa). All financial externalities have been removed and the optimal financial contract can be obtained independently for each firm. The more general case is briefly discussed in Section 6.

¹¹This effect resonates with the discussion in Williamson (1971) about the increasing interest rates associated with vertical integration: “ (...) unable to monitor the performance of large, complex organizations in any but the crudest way (...) investors demand larger returns as finance requirements become progressively greater, ceteris paribus”. Garcia-Appendini (2006) finds evidence that banks extend loans based on information about trade-credit relationships between the firm and its suppliers. This information becomes unavailable if the firm is vertically integrated.

therefore vertical integration becomes more attractive. To see why this is the case, note that under non-integration the downstream firm pays the input from the upstream firm a price equal to \bar{p} , which implies an associated pledgeable income equal to $P_d = \varphi(V - \bar{p})$. Under vertical integration, instead, the firm pays for the intermediate input only a cost equal to c , with corresponding pledgeable income equal to $P_{int} = \varphi(V - c)$. The difference in the pledgeable incomes of a vertically integrated firm and a non-integrated downstream firm is therefore positive and at most equal to $\varphi(\bar{p} - c)$. I label this positive effect of vertical integration “*joint liability*” effect.

If $\varphi\pi(\bar{p} - \mu c) > \varphi(\bar{p} - c)$, therefore, vertical integration is always dominated by non-integration, since the negative demonitoning effect is always larger than the positive joint liability effect. This corresponds to the first case in Proposition 3. If, instead, $\varphi(\bar{p} - c) > \varphi\pi(\bar{p} - \mu c)$, vertical integration is preferred for sufficiently high V , an important result for the analysis in Section 4.2. This corresponds to the second case in Proposition 3 which is illustrated in Figure ??.¹²

Higher π makes both the demonitoning and the joint liability effects stronger, and its effects are therefore *a priori* ambiguous. On the one hand, a higher π increases the pledgeable income of the upstream firm, $\frac{\partial P_u}{\partial \pi} = \varphi(\bar{p} - \mu c)$, strengthening the demonitoning effect. On the other hand, it reduces the pledgeable income of a non-integrated downstream firm by more than the pledgeable income of a vertically integrated firm, $\frac{\partial P_d}{\partial \pi} = -\varphi(V - \underline{p}) \leq \frac{\partial P_{int}}{\partial \pi}$, thereby amplifying the joint liability effect. This second effect dominates if $V \geq V^* = (\bar{p} - \mu c + \underline{p})$ and, since $V^* < \bar{V}$, vertical integration *always* becomes more likely as π increases (i.e., $\frac{\partial \bar{V}}{\partial \pi} < 0$).¹³ The model therefore predicts that, in a cross-section of firms, two plants belonging to a vertically integrated firm should be more likely to trade with each other than are two plants belonging to two separated firms. Mullainathan and Scharfstein (2001) finds evidence supporting this prediction.¹⁴

Before studying two extensions to the baseline model, it is worth noting how vertical integration in the model maps into the measurement of vertical integration in the data. Following the seminal work of Adelman (1955), a commonly used index to measure vertical integration is given by the ratio of value added VA over sales revenues V , i.e., $VI = \frac{VA}{V}$, where value added is defined as the

¹²Proposition 3 also implies that vertical integration is preferred for higher μ (i.e., $\frac{\partial \bar{V}}{\partial \mu} < 0$). This result resonates with the view that independent ownership is better when human capital investments are important, while coordination of capital investment is better achieved through centralized ownership (see, e.g., Holmstrom and Tirole (1991)).

¹³Obviously, this result is only valid in Case 2 of Proposition 3.

¹⁴The linear stealing technology implies that the conditions in Proposition 3 do not depend on the degree of investor protection φ . Decreasing (respectively increasing) returns to scale in the stealing technology favor vertical integration (respectively non-integration).

difference between revenues and material input costs. The idea beyond the index is that, *ceteris paribus*, a vertically integrated firm has higher value added, since more stages of the production process are performed in-house. The definition of vertical integration in the model parallels the index.

Remark

Under constant value added along the chain across organizational forms (i.e. $VA_{int} = VA_{ni}$), $VI_{int} > VI_{ni}$

4 Extensions

The preceding considerations give some confidence that the trade-off captured by the baseline model has practical relevance. This section considers two extensions to the baseline model and derives testable predictions linking the degree of investor’s protection and vertical integration. Both extensions combine the baseline model implication that vertical integration is preferred when pledgeable incomes are higher with well known mechanisms associated with imperfect contracting and borrowing constraints. The first extension introduces contractual imperfections between the downstream buyer and the input supplier, a force that would normally give an advantage to vertical integration. The second extension introduces product market competition at the end of the chain and highlights the role of better investor protection in fostering entry of new firms in the industry.

4.1 Contractual Imperfections with Suppliers

In practice, the buyer and the seller rarely exchange cash for the input at the same time. Trade credit is extended by suppliers to buyers whenever inputs are paid for at a later date (see, e.g., Burkart and Ellingsen (2004) for an insightful model of trade credit). Conversely, putting-out systems emerge when buyers collect finished inputs after having supplied upstream producers with cash or material advances (see, e.g., Kranton and Swamy (2006) for a model of putting-out systems inspired by textile manufacturing during the colonial period in India).

Under both systems (trade credit and putting-out), the contractual relationship between the downstream manager and the upstream manager could be plagued by similar agency problems as

the one described in the model between the investor and the entrepreneurs. For instance, in the case of putting-out systems, the seller could use the cash or material advanced by the buyer to produce an input that would then be sold on the market. Under trade credit, the buyer could simply hide cash flows, avoiding repayment to investors as well as to suppliers (and/or employees).

This section discusses a simple extension of the model that allows the buyer to steal revenues avoiding repayment to the investor as well as to the supplier (or employee). In particular, we are interested in distinguishing between the degree of “investor protection” φ (i.e., the extent to which entrepreneurs can steal profits from external investors) and “contract enforcement” η , i.e., the extent to which buyers can avoid paying suppliers for the input provided.

The model is as in the previous section, the only difference being that entrepreneurs can, at some cost, avoid repaying input suppliers as well as external investors. After receiving the input at an agreed price P and producing final cash flows V , assume that the owner can hide revenues and keep $(1 - \varphi)(V - \eta P)$ for herself, with $\eta \leq 1$ parametrizing the degree through which it is possible to avoid repaying input suppliers. If $\eta \rightarrow 1$, an entrepreneur can only hide profits, as in the previous section. Conversely, if $\eta \rightarrow 0$, the entrepreneur can steal revenues, and completely avoid repaying suppliers.

The parameter η is related to the possibility of assuring repayment for the input and does not depend on the nature of the input transacted (e.g., labour or tools). The parameter η captures in a simple way the level of difficulties in avoiding repayment to suppliers of intermediate inputs, regardless of whether they are employees of the firm or arm’s length suppliers on the market. While η can be linked to the technology of production (for instance, if the input can easily be split into small components that are used at different dates, then $\eta \rightarrow 1$), our preferred interpretation links η to features of the institutional environment in which the firms operate.

A first interpretation links η to the degree of contractual enforcement. In countries with relatively more efficient courts, it might be harder to avoid payments and circumvent the contractual obligation of paying suppliers. A second interpretation is that η proxies for the quality of informal monitoring mechanism available to suppliers. For example, within communities, η should be expected to be higher. Avoiding repayment to suppliers and hiding profits might be at the same time more difficult and more costly (in terms of loss of reputation) within a closed community.

The only difference with respect to the baseline model is that the incentive compatibility con-

straint to induce debt repayment has to take into account the agency problem between the owner and her employee/supplier. In particular, given a generic debt level B and an input price p , the owner repays the investor and her employee/supplier if $V - p - B \geq (1 - \varphi)(V - \eta p)$, i.e. if

$$B \leq \varphi V - \delta p,$$

where $\delta = (1 - \eta(1 - \varphi)) \geq \varphi$. The key difference with respect to the baseline model is that the pledgeable income is now reduced by an amount $\Delta = (1 - \varphi)(1 - \eta)p$, which is increasing in the input price p .

The model can be solved following the same steps as in Section 3.2. When this is done, the pledgeable income of an integrated firm is given by

$$P_{int}(\eta) = \max\{\varphi V - \delta c, (1 - \pi)(\varphi V - \delta p)\}. \quad (3)$$

Similarly, the pledgeable incomes of the downstream and upstream firms are respectively given by $P_d = \max\{(\varphi V - \delta \bar{p}), (1 - \pi)(\varphi V - \delta p)\}$ and $P_u = \pi(\varphi \bar{p} - \delta \mu c)$. As before, the pledgeable income of a non-integrated structure is given by the sum of the pledgeable incomes of the two independent firms, i.e.,

$$P_{ni}(\eta) = \max\{(\varphi V - \delta \bar{p}), (1 - \pi)(\varphi V - \delta p)\} + \pi(\varphi \bar{p} - \delta \mu c). \quad (4)$$

Under both structures the pledgeable income is increasing in η since, through the incentive compatibility constraint, the debt level has to take into account the incentive costs associated with repaying the employee/supplier as well.

Proposition 4 *1. If the monetary profits of an upstream firm, $\pi(\bar{p} - \mu c)$, are larger than the surplus in the intermediate input market $\bar{p} - c$, then vertical integration has higher pledgeable income than non-integration, $P_{int} \geq P_{ni}$, only if the value of the final good produced by the chain V is high enough, i.e., $V \geq \tilde{V}$, and $\eta \geq \tilde{\eta}(V, \varphi)$. Moreover, $\frac{\partial \tilde{\eta}(\varphi, \eta)}{\partial V} \leq 0$ and $\frac{\partial \tilde{\eta}(\varphi, \eta)}{\partial \varphi} \leq 0$.*

2. If, instead, $\pi(\bar{p} - \mu c) < \bar{p} - c$, then $P_{int} \geq P_{ni}$ only if V is high enough, i.e., $V \geq \bar{V}$, and $\eta \in [\underline{\eta}(\varphi), \bar{\eta}(\varphi)]$ with $0 \leq \underline{\eta}(\varphi) < \bar{\eta}(\varphi) < 1$. Moreover, $\frac{\partial \underline{\eta}(\varphi, \eta)}{\partial \varphi} \leq 0$ and $\frac{\partial \bar{\eta}(\varphi, \eta)}{\partial \varphi} \leq 0$.

While the essence of the trade-offs described in Section 3.2 is preserved, there are a number of

important differences, since the comparison between the pledgeable incomes of the two structures depends on the degree of investor protection φ and on contractual enforcement η .

Imperfections in the enforcement of contracts between the seller and the buyer have an ambiguous effect on vertical integration. On the one hand, since input transactions among independent firms occur at higher prices, $\bar{p} > c$, the rents necessary to give repayment incentives are higher under non-integration than under vertical integration. This effect captures the common argument that vertical integration is preferred in the presence of contractual imperfections. On the other hand, by increasing the rents necessary to assure debt repayment, contractual imperfections reduce pledgeable incomes and, as discussed in Section 3.2, favor non-integration.

When pledgeable incomes are low, e.g., because of low φ , an increase in contractual enforcement η might raise the pledgeable income to the point at which the joint liability effect kicks-in and vertical integration becomes the preferred organizational form. At higher levels of pledgeable incomes, however, a further increase in η erodes the benefits of the joint liability, since $\frac{\partial \delta(\bar{p}-c)}{\partial \eta} < 0$. This effect might lead to non-integration being the preferred organizational form. The relationship between vertical integration and contractual enforcement η might then be non-monotonic, as in case 2 in Proposition 4.

How does the institutional environment shape the costs and benefits of vertical integration in terms of pledgeable income? Proposition 4 shows that the degree of investor protection φ and the degree of contractual imperfections in input markets η *interact* in a complex way. Figure ?? shows on the horizontal axis the quality η of contract enforcement between buyers and sellers, and on the vertical axis the degree φ of investor protection and illustrates case 2 in the Proposition.¹⁵

Figure ?? has two main implications. First, fixing φ , Figure ?? shows that higher contract enforcement in input markets leads to lower vertical integration only if financial markets are sufficiently developed (high φ). Otherwise, the increase in pledgeable income implied by higher η makes vertical integration relatively more profitable.

Second, since the parts of φ and η that are determined by formal institutions (i.e., legal system, courts, etc.) are positively correlated across countries (countries with courts enforcing contracts also protect the interests of external investors), the appropriate comparative statics should be performed along the diagonal, from bottom-left to top-right. Figure ??, then, casts doubts on the view that

¹⁵The first case in the proposition is qualitatively similar to the scenario illustrated in Figure ?? when φ is low enough.

vertical integration should be more prevalent in countries that do not have well-functioning courts which enforce contracts. Vertical integration dominates non-integration in terms of pledgeable income only at the intermediate level of institutional development.

4.2 Industry Equilibrium

This section introduces product market competition at the end of the value chain. To simplify exposition, we maintain the assumption that investors have all the ex-ante bargaining power. This is consistent with competition in the product market if, for example, there are many potential investors and each pair of entrepreneurs d and u can only raise funds from one investor (e.g., because of monitoring reasons).¹⁶

In order to study the industry equilibrium, we first need to characterize the optimal financing decision from the point of view of each investor, taking as given cash flows at the end of the chain, V . The existence of credit constraints implies that both units will not always be financed despite being profitable.¹⁷ In particular, each investor can choose one project ω in the set of available opportunities, denoted by $\omega \in \Omega \equiv \{d, u, ni, int\}$. She can choose one “large” project, $\omega = int$, in which case she finances the entire value chain under the umbrella of a single vertically integrated firm. Otherwise, she can finance two small projects organizing the value chain with two independent firms, i.e., $\omega = ni$. Finally, she can choose one of the two small projects, i.e., financing only one of the two units (either u or d), if this option delivers higher expected returns. The subscripts d and u will denote those two projects.¹⁸

The downstream and upstream units fixed costs are k_d and k_u respectively, while $\kappa = k_u + k_d$ are the fixed costs to finance the entire value chain, regardless of organizational form, i.e., $k_{int} = k_{ni} = \kappa$. The (net) present value PV_ω of a project $\omega \in \Omega$ is given by the difference between the expected returns from the project and the corresponding fixed costs. The expected returns are simply given by the pledgeable incomes derived in the previous section. Therefore, $PV_\omega = P_\omega - k_\omega$.

¹⁶For the sake of expositional simplicity, the analysis focuses on the baseline model in Section 2 and sets $\mu = 1$.

¹⁷There are credit constraints in the sense that there exist profitable investment opportunities that cannot be financed because of low investor protection. This follows from $\max\{P_{int}, P_{ni}\} < V - C$, where $C = \pi c + (1 - \pi)\underline{p}$ is the level of expected costs.

¹⁸Since, as noted in Section 3.1, the pledgeable income of two non-integrated firms P_{ni} is given by the sum of the pledgeable incomes of the two units, i.e., $P_{ni} = P_u + P_d$, the option ni available to the investor is simply the sum of the two projects d and u .

The investor chooses the option $\omega \in \Omega$ that delivers the highest returns.

Since the pledgeable income under non-integration is equal to the sum of the pledgeable incomes of the two independent firms, $P_{ni} = P_u + P_d$, the condition $P_{ni} > P_{int}$ implies that, if both units u and d deliver positive returns, i.e., $P_d > k_d$ and $P_u > k_u$, the investor finances a non-integrated value chain and vertical integration never arises. If either of the two projects has a negative return, the investor does not finance it. If, however, $P_{int} > P_{ni}$, vertical integration emerges in equilibrium only if it delivers higher returns than any combination of the two smaller projects d and u : $P_{int} > P_{ni}$ is necessary but not sufficient for vertical integration to emerge. The necessary and sufficient condition for vertical integration to be chosen by the investor is that

$$P_{int} - \kappa \geq \max\{P_u - k_u, 0\} + \max\{P_d - k_d, 0\} \geq P_{ni} - \kappa \quad (5)$$

For sufficiently high levels of investor protection φ , vertical integration is always chosen if $P_{int} > P_{ni}$, while for extremely low values of φ , no firm can be financed at all. At intermediate levels of investor protection, however, two alternative scenarios might arise, depending on whether a small firm can be financed or not.¹⁹ The following Lemma summarizes the preceding discussion and characterizes the investment decision as a function of investor protection φ .

Lemma 1 *a) If $P_{int} < P_{ni}$, vertical integration is never chosen. Moreover, there exist unique $\varphi' \geq \varphi''$, such that no firm is financed if $\varphi \leq \varphi''$ and non-integration is chosen if and only if $\varphi \geq \varphi'$.*

b) If $P_{int} \geq P_{ni}$, there exist thresholds φ^ and φ^{**} , with $\varphi^* \geq \varphi^{**}$, such that vertical integration is chosen if and only if $\varphi \geq \varphi^*$ and no firm is financed if $\varphi \leq \min\{\varphi^*, \varphi^{**}\}$.*

It is worth noting two implications of the Lemma. First, while the size of the two units, or plants, d and u is fixed, and given by k_d and k_u , the size of a firm is endogenous to the model: a

¹⁹Let φ_ω be implicitly defined by $P_\omega = k_\omega$. If $\varphi_{int} > \min\{\varphi_d, \varphi_u\}$, a small firm can be financed for intermediate levels of φ . When one of the two independent firms cannot be financed, it is possible that financing a small firm delivers higher returns to the investor than financing the entire chain. For example, if $P_u - k_u < 0$, it might be the case that financing the downstream firm alone delivers higher returns to the investor than financing a vertically integrated firm, i.e., $P_d - k_d > P_{int} - \kappa$. If, instead, $\varphi_{int} < \min\{\varphi_d, \varphi_u\}$, at intermediate levels of investor protection both independent firms are unprofitable, while a vertical integrated structure still yields positive returns. Under those circumstances, only a vertically integrated firm or no firm at all is financed.

vertically integrated firm has size $k_d + k_u$ while non-integrated firms have size either equal to k_d or k_u . The financial constraints implied by low investor protection, therefore, can take different forms depending on the type of industry. In industries in which $P_{ni} > P_{int}$, financial constraints affect the *creation* of firms. In industries in which $P_{int} > P_{ni}$, instead, financial constraints affect the *size* of firms. Second, if investors/entrepreneurs are heterogenous with respect to φ or initial wealth, *within industries* those with a higher φ are more likely to finance/run a vertically integrated firm.²⁰

Product Market Competition and Industry Equilibrium

Having determined the optimal investment from the point of view of each investor taking as given cash flows generated at the product market, we endogenize the number (mass) of value chains financed in the industry. Let us assume that the industry faces an aggregate demand schedule $P(Q)$ for the final good, where P is the price at which Q units of the good can be sold on the market, and $P'(Q) < 0$. Let $P(Q) < \bar{P}$ for all Q .

Since each firm produces only 1 unit of the final good, the supply in the industry is given by the number (mass) N of firms that are financed in equilibrium, i.e., $Q = N$ and $V = P(Q)$. Free entry requires that, in equilibrium, it is not possible to finance any additional firm without implying losses for the investor. This, in turn, implies that the pledgeable income of the marginal entrant must be exactly equal to the investments required to start a firm.²¹

Therefore, in an equilibrium in which the entire value chain is financed under organizational form $i \in \{ni, int\}$, it must be that

$$k_u + k_d = P_i(\varphi, V(N)). \quad (6)$$

Conditional on both units being financed, the free-entry condition (6) captures the common intuition that better investor protection leads to higher entry and lower equilibrium profits. Higher investor protection φ always increases N , the mass of firms entering the industry. In equilibrium, free entry implies that all investors earn zero profits. Since, under both organizational form

²⁰When $\varphi_{int} < \min\{\varphi_d, \varphi_u\}$ either large, vertically integrated firms are financed or no firm at all, since no investor can finance a firm with medium size k_u or k_d . The model then suggests a ‘missing middle’ in the distribution of firm sizes, a typical feature of the industrial organization of developing countries (see, e.g., Tybout (2000), Cull et al. (2005), Little et al. (1988), Snodgrass and Biggs (1996), Cabral and Mata (2003)).

²¹Since all entrepreneurs / projects are identical, in equilibrium the marginal firm entering the market has the same organizational form of all other firms in the industry.

$i \in \{int, ni\}$, the pledgeable income (and therefore investor's returns) are increasing in investor protection φ , the profits of each value chain must decrease when investor protection improves. This happens through an increase in entry, N , which, increasing competition in the final product market, lowers revenues V (since $V = P(N)$ and $P'(N) < 0$).

So far, we have focussed on the case in which the entire value chain is financed. The following proposition combines the insights of Proposition 3 ($P_{ni} > P_{int}$ if V is low), Lemma 1 and the free entry condition (6) to fully characterizes the industry equilibrium.

Proposition 5 *In the industry equilibrium with free-entry, the degree of investor protection φ has a non-monotonic effect on vertical integration. In particular, there exist thresholds φ^- , φ^+ and φ^0 such that vertical integration emerges in equilibrium for intermediate values of φ , i.e., $\varphi \in [\varphi^-, \varphi^+]$. Two non-integrated firms are financed in equilibrium if $\varphi > \varphi^+$, while a single non-integrated firm is financed at low φ , i.e., if $\varphi \in [\varphi^0, \varphi^-]$. Finally, no firm is financed if $\varphi < \varphi^0$.²²*

Combining the negative relationship between V and φ implied by the free entry condition (6) with the results in Proposition 3 and Lemma 1, the model captures the dual role of investor protection on vertical integration. When φ is sufficiently low it might not be profitable to finance an upstream firm ($k_u < \varphi\pi(\bar{p} - c)$), and the choice is between financing a small downstream firm or a large vertically integrated firm. The former solution emerges when φ is very low, while vertical integration emerges when φ is higher. When investor protection further increases, more firms enter the industry, and profits are lower. Eventually, non-integration becomes the organizational form that assures the highest returns to investors. Proposition 5, therefore, implies a *non-monotonic* effect of investor protection φ on vertical integration: low investor protection mostly hinders firm expansion, i.e., higher φ would allow small non-integrated downstream unit to vertically integrate. When φ is sufficiently high, however, better financial markets allow more firms to enter the industry implying that the value chain eventually disintegrates into two non-integrated firms.²³

²²One of the two intervals $\bar{I} \equiv [\varphi^-, \varphi^+]$ and $\underline{I} \equiv [\varphi^0, \varphi^-]$ might be empty. They cannot both be empty.

²³A further prediction is that higher capital intensity, i.e., greater $\kappa = k_u + k_d$, favours vertical integration. For a given level of φ , higher equilibrium revenues $V = P(N)$ are required to sustain higher capital investment κ . As seen above, when revenues are higher vertical integration delivers higher pledgeable income than non-integration, and therefore becomes the equilibrium organizational form.

5 Evidence

This section discusses evidence on the relationship between vertical integration and financial markets development. Section 4 combined the key insight from Proposition 3 with well known mechanisms associated with imperfect contracting and borrowing constraints. Before discussing the evidence, it is worth summarizing the main testable predictions of the model:

Summary of Testable Predictions:

i) better contract enforcement with input suppliers (resp., investor protection) reduces vertical integration if investor protection (resp., contract enforcement) is sufficiently high;

ii) better investor protection has an inverted-U relationship with vertical integration.²⁴

The part of the first prediction on the relationship between vertical integration and better contract enforcement with input suppliers is consistent with anecdotal evidence on subcontracting within networks of small firms in community-based industrial districts (see, e.g., Humphry (1995)). Brusco (1982), for the case of Italy, describes the organization of production in the industrial districts in Emilia-Romagna, a region well known for its high levels of social capital (high η). The organization of production is characterized by extensive subcontracting and very low levels of vertical integration. In contrast, Banerjee (2004) and Banerjee and Munshi (2004) discuss examples of community-based industries in India with relatively high degrees of vertical integration. For instance, the Stitched Garment industry in Calcutta is organized in relatively small but fully vertically integrated firms that almost exclusively employ workers of the same community as that of the owner of the firm (often migrating from remote rural areas). Similarly, in the Knitted Garment industry in Tirupur, the firms belonging to the local dominant community, and which presumably have access to higher η than firms owned by outsiders, are more vertically integrated than firms owned by outsiders, which tend to be relatively disintegrated. If firms in Italy have better access to capital (higher φ) than firms in India, these facts are consistent with our model. In the case of Italy, then, the model shows that tight community ties allow for a decentralized organization of production. In the case of India, however, the tight community ties lead to production being carried within vertically integrated firms.

²⁴This second prediction is implied by both extensions, although through a different economic mechanisms.

More generally, the first prediction is consistent with empirical evidence on differences in the degree of vertical integration across countries. For instance, Rajan and Zingales (1995) note that corporate balance sheets in countries with developed financial systems have relatively larger items reflecting interactions among firms (i.e., less vertical integration, top-right corner in Figure ??). Similarly, Acemoglu et al. (2006) do not find that differences in formal contract enforcement institutions across countries linearly correlate with the degree of vertical integration. However, they do find that financial development and contracting costs interact: vertical integration is significantly greater in countries with higher contracting costs and greater financial development (bottom-left to top-left in Figure ??).

I am not aware of evidence directly supporting the second prediction of the model. However, there is ample support for the two mechanisms that form the basis for the prediction: i) poor investor protection (low φ) leads to more concentrated industries in which firms enjoy higher rents (higher V), and ii) higher rents imply higher vertical integration. First, there is ample evidence suggesting that poor financial development limits the entry of firms and is associated with concentration. For instance, in the context of the nineteenth-century textile industry, Haber (1991) convincingly shows how poor access to credit has been a major determinant of the degree of concentration. He provides a comparative analysis of the cotton textile industry in the United States, Brazil and Mexico. He finds that Mexico and Brazil, with far less developed and more segmented capital markets, exhibited very high levels of concentration in the industry, with large firms dominating the industry. At the turn of the century, Brazil passed reforms which improved the working of the financial system. This led to a rapid growth of the textile industry in Brazil, and a reduction in the level of concentration.²⁵ The relationship between financial development and industry concentration is not specific to the nineteenth-century textile industry. In a recent paper, Mitton (2008) uses a new dataset of 1.3 million firms from over 100 countries and shows that concentration is higher in countries with lower investor protection and other regulatory barriers that restrict entry and competition.²⁶

Having established that low financial development leads to higher concentration and increases

²⁵The cotton textile industry is an ideal setting to analyze the effects of financial development on market concentration since, according to Haber (1991), in the early textile cotton industry “the usual mechanisms by which firms obtain market control were lacking” and “no significant barriers to entry existed” in the industry (other than credit constraints).

²⁶Similarly, Beck et al. (2005) find, in a different firm-level survey database covering 54 countries, that financial underdevelopment constrains the growth of smaller firms.

rents by sheltering firms from competition, we need to show that firms in less competitive environments are more vertically integrated. There is evidence supporting this prediction too, although the evidence relies on rents generated by trade protection rather than low financial development. Trade policies have been an important determinant of the degree of competition to which firms in the nineteenth-century textile industry were exposed. For instance, Temin (1988) notes that powerful interest groups in New England ensured very effective trade protection to the textile industry. Similarly, Brown (1992) reports that the German textile industry also enjoyed a very high level of protection in the late nineteenth century. In both Germany and New England firms were substantially larger and more vertically integrated than in England, where firms were instead exposed to a more competitive trade regime.

Similar evidence can be found in the automobile industry in the United States at the beginning of the twentieth century. Helper and Hochfelder (1996) report that credit was a substantial problem in the organization and expansion in the early years of the industry (when V was, presumably, still low). While the degree of vertical integration varied from firm to firm, virtually all automobile companies began as assemblers rather than as manufacturers, implying low degrees of vertical integration. While the industry witnessed a trend towards vertical integration in the 1920s, during the boom of the car market (higher V), Langlois and Robertson (1989) show that the Depression reverted the trend, with the share of intermediate inputs purchased from external suppliers going up. In the absence of significant technological innovations, the reduction in market size (lower V) and the more difficult access to credit (lower φ) were the major determinants of the organizational shift away from vertical integration.²⁷

6 Discussion

Efficiency

In order to focus on the effects of vertical integration on the capacity to raise external finance, we

²⁷Porter and Livesay (1971) and Banerjee and Munshi (2004) provide evidence that, *within industries*, entrepreneurs with better access to external finance run more vertically integrated firms. Porter and Livesay (1971) show that, in the early phase of industrialization of the cotton textile industry in New England, wealthy merchants owned firms that were backward vertically integrated into production stages. Rich entrepreneurs who were connected to local banking elites owned vertically integrated firms with larger plants, while “outsiders” operated smaller vertically disintegrated firms. Banerjee and Munshi (2004) in the garment industry in Tirupur describe an environment which is similar to Porter and Livesay (1971). This evidence is consistent with the remarks after Lemma 1

have made two key assumptions: i) production efficiency is the same under the two organizational forms, and ii) the investor has all the bargaining power. We now discuss those two assumptions in greater detail.

The assumption that production efficiency is the same under both organizational forms implies that the only efficiency implications that can be derived from the model concern whether firms get started or not.²⁸ The model does not deliver predictions about whether there is “too much” or “too little” vertical integration. It is possible to consider a case in which one of the two organizational forms is more efficient than the other without affecting the trade-off described in the model. In general, if the organizational choice is chosen to maximize pledgeable income, there is no guarantee that it will be the efficient one.

Competitive Credit Markets

The second assumption is that the investor has all the bargaining power, and the organizational form is chosen to maximize her returns. What happens, instead, if the credit market is competitive? Keeping the assumption that it is profitable to finance the entire value chain, we start by noting that, at the ex-ante contracting stage, the two managers bargain over the organizational form to be chosen. The outside options of the downstream and upstream managers in the ex-ante bargaining depend on whether their firms can be financed or not.

The main insights of the model are robust to the case in which the credit market is competitive. This is because two cash constrained managers tend to chose the organizational form that maximizes the amount of money they are able to raise from external investors and transfer the borrowed money according to the ex-ante distribution of bargaining power, enabling them to reduce inefficiencies in bargaining. As in the baseline model, $P_{int} > P_{ni}$ is a necessary but not sufficient condition for vertical integration to arise.²⁹ Similarly, vertical integration is never financed if it has a lower pledgeable income than non-integration, i.e., $P_{int} < P_{ni}$. Note, however, that the condition $P_{ni} >$

²⁸For instance, if $\varphi_{int} < \min\{\varphi_d, \varphi_u\}$, for intermediate levels of investor protection φ , vertical integration facilitates the financing of two projects that could not be financed as two separate firms.

²⁹To see why, assume that vertical integration is feasible, i.e., $P_{int} > k_d + k_u$. If both $P_d > k_d$ and $P_u > k_u$ the total surplus available to the two entrepreneurs is the same under the two organizational forms and therefore vertical integration cannot strictly increase the pay-off of a manager without violating the participation constraint of the other manager. In this case, however, the borrowing constraint is not binding. If, instead, $P_d > k_d$ and $P_u < k_u$, then vertical integration emerge, since the outside option of the u manager is equal to zero and can be easily compensated. Finally, if $P_d < k_d$ and $P_u > k_u$, vertical integration only emerges if it allows to borrow enough to compensate the upstream manager for giving up her firm, i.e., if $P_{int} - \pi(\bar{p} - c) > k_d$.

$k_d + k_u$ is necessary but not sufficient for the entire value chain to be financed. If one of the firms cannot be financed independently, i.e., either $P_d < k_d$ or $P_u < k_u$, the owner of the firm that can be financed will not agree to a contract that finances the other firm as well, and inefficiencies arise.

Wealth can also be added to the model. A wealthier entrepreneur is more likely to be able to finance her own firm, and will therefore have a better outside option. Whether this leads to more or less vertical integration, however, depends on which manager has the wealth.³⁰

Contractual Externalities

By focussing on the case in which $\gamma \simeq 1$, the model has removed ex-ante contractual externalities. When $\gamma < 1$, the two projects become linked by a *common destiny* and potential externalities arise. To see why this is the case, note that, when the upstream project has not been financed, the net present value of the downstream project is given by

$$PV_d^0 = V - \pi\bar{p} - (1 - \pi)\underline{p} - k_d.$$

Similarly, when the downstream firm is not financed, the net present value of the upstream firm is given by

$$PV_u^0 = \pi(\gamma\bar{p} - c) - k_u.$$

The net present value of the entire chain is given by

$$PV_c = V - \pi c - (1 - \pi)\underline{p} - k > PV_d^0 + PV_u^0.$$

In other words, when $\gamma < 1$, the whole chain is worth more than the sum of its parts. Decentralized investors typically will not replicate the contracts signed by a sole investor, as the investor financing the upstream unit might not take into account the positive effect on the net present value of the downstream unit, and vice versa. It can be shown that these externalities might lead to under-investment or to more vertical integration in the presence of inequality in borrowing capacity among entrepreneurs.

³⁰Property rights theories of the firm with financially constrained entrepreneurs (see, e.g., Legros and Newman (2004)) also predict that the allocation of control rights is twisted in favour of the party with more bargaining power or wealth. The ex-ante distribution of wealth and bargaining power, however, is likely to be context specific in practice and difficult to observe in the data making those theories hard to test empirically.

Further Remarks

The model abstracts from other factors that are likely to affect the integration decision of small and medium-sized firms in developing countries. An often quoted constraint on firms in developing countries is uncertainty in input supply (see e.g. Mookerjee (1999)). Since less developed countries are likely to be characterized by more uncertain and volatile input markets, vertical integration could be relatively more prevalent in those countries. If better financial markets increase entry (and reduce uncertainty) in input markets, a further negative effect of financial development on vertical integration should be observed in the data.³¹

Since the main benefits of vertical integration come from joint liability, a previous version of the paper studied joint liability contracts among independent firms.³² Restricting attention to collusion-proof contracts, in which the investor cannot hold claims on the profits of the firm which depend on the identity of the contractual parties involved in the input transaction, the model shows that joint liability does not change the condition under which vertical integration delivers higher pledgeable income. In other words, the benefits of joint liability are better achieved under vertical integration: joint liability and centralized allocation of control rights are complementary tools in the hands of the external investor to maximize pledgeable income.³³

7 Conclusions

This paper explores the connections between investor protection and vertical integration. It has derived the costs and benefits of vertical integration from the point of view of an external investor: vertical integration trades off the benefits of joint liability against the costs of rendering the supply chain more opaque to external investors. In contrast to standard arguments that link higher degrees of vertical integration to more pervasive input and capital market imperfections, the trade-off implies that the relationship between vertical integration and the quality of the institutional environment is a complex one, and that more vertical integration should not be expected in devel-

³¹Macchiavello (2006) finds evidence consistent with this effect in a cross-country-industry setting.

³²Joint liability contracts between independent firms can take the form of loan or mutual debt guarantees (as opposed to collateral) and have been documented in several contexts (see, e.g., Cull et al. (2005) for historical examples, or Park and Shen (2003) for contemporary China).

³³This result is in line with the work of business historians and legal scholars who define the firm as a nexus of contracts characterized by centralized allocation of control rights and joint liability (see, e.g., Cheung (1983), Hausmann and Kraakman (2001), and Lamoreaux (1998)).

oping countries. In particular, the model predicts that vertical integration is more likely to arise for intermediate levels of investor protection and that better contract enforcement reduces vertical integration only if financial markets are sufficiently developed. We have discussed various sources of evidence which is in line with both predictions.

This paper has taken the view that the institutional environment, as opposed to technological considerations, is a major determinant of organizational forms. Future theoretical work should explore the interaction between financial and other institutional constraints on industrial structure, supply chain performance, technology adoption, and organizational forms. Eventually, this line of research will not only improve our understanding of firms and markets but will also lead to better design of policies aimed at fostering industrial upgrading and development.

8 Appendix

Proof of Proposition 3:

Note first that P_{ni} and P_{int} are strictly increasing, convex and piecewise linear in V , and that their slopes with respect to V are either equal to φ or to $\varphi(1 - \pi)$. This implies that the two curves will cross once at most. When V is sufficiently large, we have $P_{int} > P_{ni}$ if and only if $(\bar{p} - c) \geq \pi(\bar{p} - \mu c)$ (denote this as condition N). When, however, V is sufficiently low, we have $P_{int} < P_{ni}$. The two curves cross exactly once if $(\bar{p} - c) \geq \pi(\bar{p} - \mu c)$ and never cross otherwise. If $(\bar{p} - c) \geq \pi(\bar{p} - \mu c)$, then $(V - c) > (V - \bar{p}) + \pi\bar{p}$ and since $(1 - \pi)(V - \underline{p}) + \pi(\bar{p} - c) > (1 - \pi)(V - \underline{p})$, the two curves must cross when $P_{int} = \varphi(V - c)$ and $P_{ni} = \varphi((1 - \pi)(V - \underline{p}) + \pi(\bar{p} - \mu c))$. Let $\tilde{V} = \bar{p} + \frac{(1 - \mu\pi)c - (1 - \pi)\underline{p}}{\pi}$ be the unique solution to this equation. To conclude the proof of the Proposition, note that straightforward differentiation implies $\frac{\partial \tilde{V}}{\partial \pi} < 0$, $\frac{\partial \tilde{V}}{\partial \mu} < 0$. ■

Proof of Remark:

Consider first the case $p = \bar{p}$. To see that the value added is constant under the two organizational forms note that under integration $VA_{int}(\bar{p}) = V - \mu c$ while under non-integration $VA_{ni}(\bar{p}) = VA_d(\bar{p}) + VA_u(\bar{p})$ and since $VA_d(\bar{p}) = (V - \bar{p})$ and $VA_u(\bar{p}) = (\bar{p} - \mu c)$ we have $VA_{ni}(\bar{p}) = V - \mu c$. The indexes are therefore $VI_{int}(\bar{p}) = (1 - \frac{\mu c}{V}) > VI_{ni} = \frac{(1 - \frac{\bar{p}}{V}) + (1 - \frac{\mu c}{\bar{p}})}{2}$.

Consider now the case $p = \underline{p}$. We have $VA_{int}(\underline{p}) = VA_{ni}(\underline{p}) = V - \underline{p}$. As $VA_u(\underline{p}) = 0$. It follows that $VI_{int}(\underline{p}) = VI_{ni}(\underline{p})$. Finally, the fact that any convex combination of the two cases implies $VA_{int} = VA_{ni}$ and $VI_{int} > VI_{ni}$ concludes the proof. ■

Proof of Proposition 4:

The proof of the Proposition mimics the proof of Proposition 3. Note first that P_{ni} and P_{int} are strictly increasing, convex and piecewise linear in V , and that their slopes with respect to V are either equal to φ or to $\varphi(1 - \pi)$. This implies that the two curves will cross once at most. When V is sufficiently large, we have $P_{int} > P_{ni}$ if and only if $(\bar{p} - c) > \pi(\frac{\varphi}{\delta}\bar{p} - \mu c)$. When, however, V is sufficiently low, we have $P_{int} < P_{ni}$. The two curves cross exactly once if $(\bar{p} - c) > \pi(\frac{\varphi}{\delta}\bar{p} - \mu c)$ and never cross otherwise. If the two curves cross, they do so when $P_{int} = \varphi V - \delta c$ and $P_{ni} = (1 - \pi)(\varphi V - \delta \underline{p}) + \pi(\varphi \bar{p} - \delta \mu c)$. Rearranging terms gives that $P_{int} \geq P_{ni}$ if and only if

$$\Omega(\eta, \varphi) = \min\{\Gamma(V, \varphi, \eta), \Lambda(\varphi, \eta)\} \geq c(1 - \mu\pi)$$

where we have $\Gamma(V, \varphi, \eta) = \frac{\pi\varphi}{1-\eta(1-\varphi)}(V - \bar{p}) + (1 - \pi)\underline{p}$ and $\Lambda(\varphi, \eta) = \left(1 - \frac{\pi\varphi}{1-\eta(1-\varphi)}\right)\bar{p}$. It is straightforward to show that $\frac{\partial\Gamma}{\partial z} > 0$ and $\frac{\partial\Lambda}{\partial z} < 0$ for $z = \varphi, \eta$. This implies that if $\Gamma(V, \varphi, \eta)$ and $\Lambda(\varphi, \eta)$ cross at some η , then $\Omega(\eta, \varphi)$ is non-monotonic.

Note that $\Lambda(\varphi, 1) = (1 - \pi)\bar{p}$, and therefore, if $\pi(\bar{p} - \mu c) > \bar{p} - c$, then $\Lambda(\varphi, \eta) \geq c(1 - \mu\pi)$ for all φ and η . When this is the case, we have $P_{int} > P_{ni}$ if and only if $\Gamma(V, \varphi, \eta) > c(1 - \mu\pi)$. Since Γ is increasing in V and $\Gamma(V, \varphi, 1) = \pi(V - \bar{p}) + (1 - \pi)\underline{p}$ does not depend on φ , there is a unique V above which $P_{int} > P_{ni}$ if η is high enough. Applying the implicit function theorem gives $\frac{\partial\tilde{\eta}(\varphi, \eta)}{\partial V} \leq 0$ and $\frac{\partial\tilde{\eta}(\varphi, \eta)}{\partial\varphi} \leq 0$.

If, instead, $\pi(\bar{p} - \mu c) < \bar{p} - c$, then $\Lambda(\varphi, \eta) < c(1 - \mu\pi)$ for η high enough. This implies that $P_{int} > P_{ni}$ only for values of V^e defined by $\Gamma(V^e, \varphi, \eta) = \Lambda(\varphi, \eta)$ such that $\Gamma(V^e, \varphi, \eta) \geq c(1 - \mu\pi)$. Solving the two equations in succession, we obtain that the minimum V is given by $\bar{V} = \bar{p}\frac{\bar{p} - (1 - \pi)\underline{p}}{\bar{p} - (1 - \pi\mu)c}$.

Moreover, since $\Lambda(\varphi, 1) < c(1 - \mu\pi)$, the condition can only be satisfied for $\eta < \bar{\eta}(\varphi) < 1$. At the same time, we need $\Gamma(V, \varphi, \eta) > c(1 - \mu\pi)$, i.e. $0 \leq \underline{\eta}(\varphi) < \eta$. Again, applying the implicit function theorem gives the comparative statics result and concludes the proof of the proposition. ■

Proof of Lemma 1:

Consider first the case $P_{int} \geq P_{ni}$. Since P_{int} and P_{ni} are both strictly increasing functions of φ , there exists a unique φ^* such that $P_{int}(\varphi^*) - k = 0$ and integration is not chosen if $\varphi < \varphi^*$. Obviously $P_{ni}(\varphi^*) - k \leq 0$, and therefore the two firms are never financed in a non-integrated way. Define φ_d^* and φ_u^* as the thresholds of φ at which $P_d(\varphi_d^*) - k_d = 0$ and $P_u(\varphi_u^*) - k_u = 0$ respectively. Since $P_{ni} = P_d + P_u \leq P_{int}$ it follows that $\max\{\varphi_d^*, \varphi_u^*\} \geq \varphi^*$, with equality holding if and only if $P_{ni} = P_{int}$ and $\varphi_d^* = \varphi_u^*$. Defining $\varphi^{**} = \min\{\varphi_d^*, \varphi_u^*\}$, and noting that $\varphi^{**} \leq \varphi^*$ depending on parameters, concludes the proof of the first part of the proposition.

The proof of the second part of the proposition is very similar. Obviously, there exists a unique $\varphi' = \max\{\varphi_d^*, \varphi_u^*\}$ such that if $\varphi \geq \varphi'$ two firms are financed, and non-integration is chosen. Similarly, defining $\varphi'' = \min\{\varphi_d^*, \varphi_u^*, \varphi^*\}$, if $\varphi \leq \varphi''$ no firm is financed. For $\varphi \in (\varphi', \varphi'')$ one firm is financed (either the downstream firm, the upstream firm or a vertically integrated firm). However, since $P_{ni} = P_d + P_u > P_{int}$ simple algebra shows that $\min\{\varphi_d^*, \varphi_u^*, \varphi^*\} \neq \varphi^*$, and therefore vertical integration never arises in equilibrium. This concludes the proof. ■

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