

The Impact of Worker Bargaining Power on the Organization of Global Firms*

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Abstract

We study the effect of worker bargaining power on global firms' boundaries. Our theory posits that outsourcing weakens the workers' bargaining position by limiting the revenues subject to worker extraction. Furthermore, when capital is relationship-specific, outsourcing reduces the firm's exposure to ex-post worker opportunism. Hence, worker bargaining power provides incentives for vertical fragmentation, and the more so in capital-intensive industries characterized by specific investments. Our empirical analysis relates global sourcing strategies to observable measures of worker bargaining power. We provide firm-level evidence consistent with the theoretical predictions. A simple extension of the model predicts that integrated firms pay higher wages than non-integrated ones, a result consistent with a broad body of empirical evidence on the multinational wage premium.

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1 Introduction

The globalization process is characterized by increasing international specialization of production and the organization of firms' activities on a global scale. Around one-third of total trade takes place within multinational firms' boundaries, with developed countries posting an even larger proportion.¹ Furthermore, trade in intermediate inputs has risen steadily in recent decades (Hummels et al., 2001) to become a key feature of the current international trade structure.

The study of global production networks has naturally attracted a great deal of attention, with a flourishing body of literature studying why some international transactions are conducted in the form of multinational production and others through outsourcing relationships. This body of work, summarized in Antràs and Rossi-Hansberg (2010), has substantially improved our understanding of the firm, product, and country characteristics that shape global firms' organizational decisions. Yet, the role of labor market frictions has hitherto been overlooked. This is especially surprising given the recent interest by trade economists in the links between imperfect labor markets and international trade (e.g. Helpman et al., 2011). This paper attempts to fill this gap. We study the role of worker bargaining power as a determinant of the organizational strategies of global firms. Our theoretical analysis predicts that increases in worker bargaining power favor the outsourcing strategy over vertical integration. In addition, this effect depends on the capital intensity of the industry, but only for industries where capital has little outside value - industries intensive in "relationship-specific" investments. We provide firm-level evidence consistent with these claims.

Our simple model considers a firm operating a two-stage production process. In an upstream stage, an intermediate component is manufactured by workers, who bargain collectively on wages and employment. In a downstream stage, the intermediate input is transformed into a consumption good by means of the firms' capital stock. The organizational decision is whether to keep the production of the component within the firm's boundaries or to outsource it to an independent supplier. A key difference emphasized in the model is that, when operating an integrated facility, the final good producer bargains with the union over the sharing of total profits. Conversely, when production of the component is outsourced, the supplier and the workers bargain over the profits of the subcontractor. Through this *rent-sharing* mechanism, outsourcing weakens the workers' bargaining position.

The labor economics literature has long recognized the role of opportunistic union behavior in deterring firm investment (Grout, 1984; Baldwin, 1983). The prospect of expropriation by a trade union reduces incentives to invest in capital that is sunk to any extent. This *efficiency effect* reduces profits. Our contribution is to show how it impacts on optimal firm boundaries. In the model, outsourcing to an independent supplier reduces exposure to ex-post worker opportunism. Key to this result is the fact that, in the bargain with the workers, the outside option of the supplier is greater than that of the final good producer when he runs an integrated plant. This is because the final good producer bears the cost of investment, regardless of the prevailing organizational structure. A novel implication of the model is that, in the face of empowered workers, outsourcing boosts relationship-specific investments. Hence, worker bargaining power is more conducive to outsourcing in capital intensive industries. These effects are only to operate when there is scope for hold-up; that is, when capital is specific to a particular producer. Our results are robust to alternative contractual environments and sequences of moves.

¹For example, about 67% of French imports and 75% of French exports in 1999 concerned manufacturing groups that owned at least 50% of a foreign affiliate. Similar patterns are observed for the US. Nearly half of US trade is intra-firm.

We next use our model to study the relationship between wages and organizational forms. A key result is that there is a region where *increasing* worker power leads to suboptimal organizational choices and a *decrease* in wages. Our approach adds an “organizational channel” to the seminal contribution by Grout (1984) who shows that, in the absence of binding contracts between a firm and a union, increases in union power can reduce wages via the negative effect on investments. We use the model to discuss how rent-sharing is a plausible explanation for the vast empirical evidence in support of a multinational firm wage premium (surveyed in Barba-Navaretti and Venables, 2004, among others). Using the heterogeneous firm model developed by Antràs and Helpman (2004), we find that more productive firms self-select into multinational production and, due to rent-sharing, pay wages above those that the productivity differentials alone predict.

Our theory provides a framework to study how global firms’ sourcing strategies relate to observable industry and country characteristics. Our detailed data enables us to control for unobservable firm and imported product characteristics. In the empirical section of the paper, we test the following two predictions. First, the share of intra-firm imports at firm-product-country level is decreasing in the bargaining power of workers in the country of origin. Second, in industries characterized by ex-ante investments with little outside value, this effect is differentiated by the capital intensity of the importer’s industry.

We use data on imports by multinational firms in France, detailed by firm, product, and country of origin. An important feature of these data is that they provide the proportion of intra-firm trade for each observation. We use a new dataset presented in Botero et al. (2004) to measure the balance of power between firms and workers in exporting countries. We use an index that captures the power of workers by means of the extent to which industrial action is allowed by law. Our results show that the bargaining power of workers in exporting countries has a negative effect on the share of intra-firm trade by French multinationals. The effect is sizeable. The average share of intra-firm imports in the sample is 28%. Take the two countries with the highest (Italy) and lowest (Denmark) index value.² If Italy’s labor market institutions were equal to Denmark’s, the average intra-firm exports to France would increase by 7.6%. This figure rises to 12.8% when we run the regression on OECD countries alone. For robustness, we also present within-country evidence based on the variation in unionization rates across US industries. Next, we differentiate the industries where the importer’s investments have relatively large outside value based on the Rauch (1999) classification of commodities. We find that the negative correlation between intra-firm imports and worker bargaining power increases with capital-intensity for those industries only.

The idea that vertical integration raises the multinational’s exposure to workers is at odds with the widespread view that globalization weakens worker bargaining power. Yet there is empirical evidence to support the view put forward in this paper. Consider the two following anecdotal examples provided by Budd et al. (2005). In the 1980s, the US labor union United Auto Workers made compromises to help save the then US-owned Chrysler car company. Later on, when Chrysler had been taken over by the German company Daimler-Chrysler, the same union refused to help the struggling US affiliate on the basis that the German parent firm was making profits. Another example of a cross-border wage dispute concerns Anglo-Dutch steel-maker Corus. In 2002, the UK union blocked an attempt to impose a pay freeze in the UK while increasing Dutch workers’ wages on the basis that, “We all work for the same company, and we should all get the same deal”. Janssen (2009) mentions the case of General Motors EWC in the 1990s. The workers’ delegation rejected the closure of the UK plant, forcing through a redistribution of the cut

²See Hummels et al. (2011) for a discussion of the flexibility of the Danish labor market.

in car production among the company’s European plants.

Budd et al. (2005) also present the first firm-level econometric analysis of international rent-sharing. Drawing on panel data for European multinationals, they find that (instrumented) parent firms’ profits affect wages paid by foreign affiliates, controlling for affiliate profits. These findings expand on the Budd and Slaughter (2004) results based on data on union-firm wage contracts in Canadian manufacturing from 1980 to 2000. Their study finds that higher US profits raised the wages of US subsidiaries while lowering those of domestic-owned firms. More recently, Martins and Yang (2010) extend these results to panel data for MNE-affiliate pairs in 47 countries. Interestingly, they find the effect to be increasing in differences in per capita GDP across the locations where multinationals and their affiliates are established. This result is consistent with vertical multinationals sharing profits with their upstream affiliates.³

The above studies support the idea that multinationals share profits internationally. But how do wages paid by affiliates compare to those paid by foreign subcontractors? Faced with a lack of analysis to date, we turn to studies of domestic outsourcing. In 1998, a deregulation process in the German postal industry led the Deutsche Post (Germany federal post office) to outsource some activities.⁴ Significant differences between the Deutsche Post’s wages and those paid by its subcontractors persisted in 2007, unlikely to be explained by compositional effects.⁵ A judicial expert assessment found no evidence of wage dumping, arguing that the wage differential was explained by profit-sharing. Doellgast and Greer (2007) discuss how the increase in outsourcing and spin-offs that followed deregulation in the German telecommunications industry contributed to reducing wages at subcontractors covered by firm-level agreements. Similar patterns were observed in the auto parts industry. Rent-sharing seems to explain wage differences between firms and their subcontractors. This mechanism is facilitated by the predominance of firm- and plant-level bargaining.⁶ Doellgast and Greer argue that, even in a country with a strong collective bargaining tradition, “Coordinated bargaining across the production chain becomes next to impossible” (p. 26).

The reasoning put forward in this paper encompasses different strands of the literature, to which we contribute. By unearthing the role of worker bargaining power in shaping firms’ boundaries, we add to the literature on the determinants of intra-firm trade. Previous work has focused on the role of contractual frictions between firms and their foreign suppliers (Antràs, 2003; Antràs and Helpman, 2004 and 2008; Antràs and Chor, 2011). In keeping with Grossman and Hart (1986), these studies predict that, when contracts are incomplete, efficiency is maximized through the allocation of ownership rights to the party that contributes relatively more to value creation. Hence, firms in headquarter-intensive industries should engage in vertical integration. A number of empirical studies have provided support for this claim (Antràs 2003; Yeaple, 2009; Nunn and Treffer, 2008 and 2011; Bernard et al., 2010). Our results complement these works in two respects. First, we show that intra-firm trade correlates positively with capital intensity (a common proxy for headquarter intensity). However, this is only statistically true in the case of industries governed by relationship-specific investments. Interestingly, similar conclusions are reached by Nunn and

³Both papers introduce parent profits (instrumented with lagged values) in a regression where the dependent variable is affiliate wages. Martins and Yang (2010) interact parent profits with per capita GDP differences and find a positive sign. They also introduce an interaction with the total number of affiliates for each parent, and find a negative sign. These findings are consistent with a bargaining process driving the results.

⁴<http://www.eurofound.europa.eu/eiro/2007/06/articles/de0706039i.htm>

⁵The Deutsche Post paid average hourly wages of 11.4 euros. Subcontractors paid on average 8 euros, a figure in line with the average wage in comparable jobs. As the study argues, this differential is unlikely to be driven by compositional effects given the low-skilled nature of postal services. In 2007, the Deutsche Post controlled around 50% of the market.

⁶Firm-level is the most common bargaining level in many countries, including the US, UK, France and most Eastern European countries. In other countries where sector-level agreements are mandatory (euro zone countries, Denmark, Japan and Norway), firm-level is the second stage of bargaining (Du Caju et al., 2008.)

Trefler (2008 and 2011) and Antràs and Chor (2011), who use US data and an alternative definition of specificity. Second, our evidence suggests that labor market imperfections introduce a second source of contractual incompleteness. Without the possibility of integrating their workers, firms tend to rely on external suppliers to alleviate this alternative hold-up problem.

Our paper also contributes to a growing body of literature linking labor market frictions to international investment patterns. One pervasive idea in the literature is that domestic unions cause firms to engage in FDI (Zhao, 1995 and 2001; Eckel and Egger, 2009; Gaston, 2002; Lommerud et al., 2003) and in international outsourcing (Skaksen, 2004, Lommerud et al., 2009). These studies assume that shifting production across borders enhances firms' bargaining positions (predictions that are hard to reconcile with the well-documented multinational-firm wage premium). Our model highlights a new channel via which the nature of international linkages conditions how firms share profits with workers in host countries, delivering new predictions consistent with previous evidence. We present the first analysis of the relationship between union power in host economies and sourcing strategies.⁷ Our paper can be seen as contributing to a recent body of literature that analyzes the link between trade and labor market frictions (see Helpman et al., 2011, and appended references).

Lastly, our paper can be seen as complementary to the literature on firm behavior in closed economies with imperfect labor markets. Examples include Bronars and Deere (1991), who highlight the strategic use of debt, and the above-mentioned studies by Baldwin (1983) and Grout (1984) on investment behavior. A paper similar in spirit to ours is Lyons and Sekkat (1991). In their model, the presence of opportunistic trade unions provides an incentive to subcontract. Unlike ours, their analysis is purely theoretical. Their findings on the effect of specific investments rely on numerical results, while we derive analytical conditions linking capital intensity and organizational choice. Holmes and Thornton Snider (2011), in a very different set-up to ours, find that the presence of a monopoly union can lead to production processes where labor intensive tasks are separated from capital intensive tasks. Key to their result is the fact that labor demand elasticity is increasing in labor intensity. Unlike us, they do not look at the role of investment. The mechanisms highlighted in our model are very different and independent of the elasticity of substitution. Hence we see their work as complementary to ours. To the best of our knowledge, ours is the first attempt to empirically identify how bargaining institutions determine the organization of firms using detailed firm-level data. Notice that the international nature of our data allows for proper identification strategies not found in closed economy studies. Our analysis draws on the observed variation in organizational arrangements for the same firm across countries that differ extensively in their labor market regulations. Hence, we consider that our results provide information on the potential impact of labor market institutions on corporate structures in closed economies.⁸

The rest of the paper is organized as follows. Section II develops the theoretical model and presents the theoretical robustness and extensions. Section III presents the empirical analysis. Section IV concludes.

⁷Allowing for higher bargaining power for multinational corporations would temper the effects we point up in our theory. Yet our empirical results suggest that this channel is not strong enough to reverse the negative effects of labor power on vertical integration. A related group of studies analyzes the interactions between firms and labor in foreign locations, focusing on firms' decisions to serve a foreign location through horizontal FDI (e.g. Mukherjee, 2008; Haaland and Wooton, 2007).

⁸Following renewed interest in the determinants of firms' organizations across countries, a recent series of papers uses cross-country data to study the institutional determinants of the organization of firms in closed economies (Acemoglu et al., 2010; Bloom et al, 2009; Marin and Verdier, 2008). None of them has studied the role of bargaining institutions.

2 A simple model

2.1 Setup

Technology and demand

An entrepreneur owns the technology to produce a final good with downward-sloping demand curve $y = Ap^{-1/(1-\alpha)}$, where y is quantity, p is the price and A is a demand shifter. The parameter $\alpha \in (0, 1)$ governs the elasticity of demand. This demand schedule generates a revenue function $R = A^{1-\alpha}y^\alpha$. It can be derived from consumer preferences that feature constant elasticity of substitution between differentiated varieties of a generic consumption good (see Dixit and Stiglitz, 1977). Under this interpretation, α is an inverse index of the degree of differentiation across varieties.

Production requires the combination of two inputs: an investment in capital, k , and a manufactured component, m . Technology is represented by the following Cobb-Douglas production function:

$$y(k, m) = \left(\frac{k}{\beta}\right)^\beta \left(\frac{m}{1-\beta}\right)^{(1-\beta)} \quad (1)$$

For simplicity we assume that one unit of labor is necessary to produce one unit of the intermediate good, according to the linear production function $m = l$.⁹

Organization of production

The entrepreneur can interact with two other types of agents: a supplier of manufactured components and a pool of workers of size L . Each worker is endowed with one unit of labor. Two organizational arrangements are available:

1. *Vertical Integration*. The entrepreneur undertakes investments in capital, hires labor to insource the production of the intermediate input and produces and markets the good.
2. *Vertical Fragmentation (Outsourcing)*. The entrepreneur undertakes capital investments and outsources the production of the component by subcontracting with the independent supplier. The subcontractor hires labor, produces the intermediate and trades it to the entrepreneur, which then produces and markets the good.

In either case, the entrepreneur is responsible for the capital investment. At this stage we could use the broader term “headquarter services” to refer to the same input. However, we think of physical capital in view of the empirical analysis. For simplicity we are assuming away the existence of any agency problems within the integrated firm (this view of the firm is close to the transaction cost literature initiated by Coase (1937), and successively developed in Williamson (1985)).¹⁰ We also refrain from imposing an extra governance cost under integration, although it would not alter the nature of any of the subsequent results.

⁹In the appendix we present a version of the model where production of the component requires an investment in capital. We show that the main mechanisms remain unchanged. We therefore choose this formulation for simplicity of exposition and to highlight that the existence of an input-specific investment is not essential to our results. Notice that we choose to parameterize the revenue function because it allows obtaining closed-form solutions.

¹⁰Applications of this theory of the firm to context similar to ours include Ethier (1986), Grossman and Helpman (2002a,b and 2005), and McLaren (2000). A similar view is taken by an important strand of the industrial organization literature, which highlights that vertical integration reduces the “double marginalization problem” that arises when suppliers and buyers have monopoly power.

These features are relevant and have been widely studied elsewhere (e.g. Grossman and Helpman 2002a). Abstracting from them allows us to capture the role of the labor market succinctly.

Labor markets

A trade union encompasses the entire pool of workers (L). L is assumed to be large enough so that input choices are not constrained by labor shortages. Irrespective of the prevailing organizational form, production of the intermediate component requires an agreement with the trade union.¹¹

Right before starting to produce the intermediate component, and depending on the prevailing organization of production, either the entrepreneur or the supplier engages in negotiations with the workers. We use the efficient bargaining model developed by MacDonald and Solow (1985). It is based on the generalized Nash bargaining solution. Wages and employment are the solution to:

$$\max_{w,l} \Omega_v = [\pi - \bar{\pi}]^\lambda [(w - \omega)l]^{1-\lambda} \quad (2)$$

subject to $\pi - \bar{\pi} > 0$ and $(w - \omega)l > 0$.

Inside brackets is the utility that each party obtains from joint production, net of the utility that it would receive in the event of a breakdown in negotiations (outside options are evaluated at zero employment). π are profits derived from production and $\bar{\pi}$ is the payoff obtained in case of strike. Two features of our framework are worth highlighting. First, $[\pi - \bar{\pi}]$ can refer to net profits of the entrepreneur or the supplier, depending on organizational form. Second, $\bar{\pi}$ is determined by whether capital is specific or not. The second term in brackets is the union's net gain from production. w is the wage, ω the exogenous reservation wage, determined elsewhere in the economy, and l is employment. The union's net gain is the surplus that employed members receive with respect to ω .¹²

The parameter $\lambda \in (0, 1)$ represents the firms' bargaining power and will be central to the analysis. Throughout we will think of λ as determined by the laws and regulations affecting the balance of power of firms and workers during industrial conflicts. Importantly, λ is independent of the identity of the negotiator.¹³

Contracting environment

We consider different contracting environments.

¹¹Note that we *assume* the existence of the trade union, taking it as a feature of the institutional environment where production takes place rather than deriving it as an equilibrium outcome. We have developed a version of the model in which unionization happens randomly according to an exogenous probability (which can be deemed to depend on the labor market institutions) and have obtained qualitatively similar results (available upon request). Readers interested in endogenous union formation might refer, for example, to Horn and Wolinsky (1988).

¹²One way of obtaining this expression is by assuming, as in Grout (1984), that the union maximizes the total income of its membership: $U(w, l) = wl + \omega(L - l)$. Evaluating at $l = 0$ and subtracting we get $U(w, l) - U(0) = (w - \omega)l$. The same formulation obtains when union utility is represented by a Stone-Geary function and it is assumed that the union values employment and wages equally. Peterson (1998) shows this is the case when union members and leaders have equal bargaining power.

¹³Since λ in our model is thought to describe features of the institutional profile of the economy determining the division of rents between firms and workers, there is no apparent reason to believe that λ should change across firms. One could easily adapt the model to understand λ as the equilibrium share obtained by firms. In this case, if the disagreement payoff varies across firms due, for example, to the possibility of shifting production across plants, then λ can become firm-specific. This feature has been extensively studied in the literature, and we prefer to abstract from it here to focus on the novel implications of our model.

Incomplete contracts: Our benchmark model assumes a setting of incomplete contracts. Under this approach, the precise nature and quality of the intermediate component is observable to both firms in the relationship, but not verifiable by third parties. Similarly, capital investments are specific, having no value for other producers, and they are unverifiable by outside parties such as courts. Hence, no contracts specifying the amount of ex ante investments or the price (or quantity) of the intermediate good can be enforced. Further, sales revenues are equally assumed to be not contractible.¹⁴ Following Grossman and Hart (1986), we assume that the only contractibles in the vertical relationship are the allocation of property rights over the component and any ex ante monetary transfer between firms (we will focus on an outsourcing arrangement where the component is the property of the supplier). As argued by Hart and Moore (1999) and Segal (1999) among others, firms in this setting cannot commit not to renegotiate ex post any arrangement that has been agreed upon ex ante. In keeping with the bulk of recent literature, we model the ex-post negotiation process using a generalized Nash bargaining framework.

As is well known, the impossibility of enforcing quality-contingent contracts can lead to a potential hold-up problem (Klein et al., 1978; Williamson, 1985). We assume that the contractual incompleteness equally affects union-firms contracts. In particular, the union cannot credibly commit to any agreement that has been signed ex ante, before investments take place. Hence it is not possible to write and enforce labor contracts which are contingent on the capital stock.¹⁵ A potential hold-up problem arises for the entrepreneur when he runs an integrated firm, even absent agency problems with an internal manager.¹⁶

Our assumptions imply that, under incomplete contracts with specific investments, vertical integration would be the optimal organizational form if labor markets were competitive. We take this extreme view to highlight how worker bargaining power distorts decisions away from this first-best.

Alternative contracting environments: While the incomplete contracts environment allows comparison of our results with the recent strand of literature, it is important to consider alternative environments. The extensions are useful robustness checks, and will also help guiding the empirical analysis of Section 3. We solve the model under two alternative settings. In the first extension we allow for enforceable revenue-sharing contracts between the entrepreneur and the supplier. We consider a simple linear contract that stipulates the supplier's compensation before production and bargaining with the union takes place.¹⁷ Secondly, we lift the assumption about the specificity of capital. We consider a revenue-sharing contract where investment has full value outside the relationship. In this case, the hold-up problem is absent in

¹⁴Hart and Moore (1999) and Segal (1999) provide foundations for incomplete contracts that naturally apply in the present context.

¹⁵Union opportunism in collective bargaining has been widely studied - Simons (1944) provides the earliest analysis. More recent work includes Baldwin (1983), Grout (1984), Hirsch (1989), Anderson and Devereux (1988), and Bronars and Deere (1991 and 1993). Other than the specific nature of capital we consider here, the literature has identified a number of reasons. Other than the cost of writing and enforcing contracts, it can also be the consequence of the long-lived nature of investments. The stream of returns associated with specific plant and equipment usually spans over a longer period of time than the typical union-firm contract (Bronars and Deere, 1993). Credible commitment beyond the span of a contract is at the least very difficult to ensure. Furthermore, later bargains are likely to involve union members who were not employed by the firm when the initial contract was signed. Moreover, in some countries, labor contracts are not legally binding. Grout (1984) notes that in the UK, the Trade Union Immunity Laws prevent firms from suing a trade union to recover losses incurred during a collective dispute (e.g. the union can costlessly deviate from any predetermined employment commitment).

¹⁶There is, of course, reason to believe that workers can also be held up by firms. This would be the case where employment requires the acquisition of firm-specific skills. Williamson (1985, Ch. 10) notes that one of the purpose of unions is to protect employees' investment in human capital from firm opportunism. We absent from this possibility for the sake of analytical simplicity, based on two main reasons. First, we are interested in studying firms' organizational responses to expropriation from labor. Second, the existence of a wedge between the resale and purchase price seems more descriptive of the reality of firm-specific capital than unskilled labor.

¹⁷See Bai et al (2004) for a similar assumption and Lafontaine and Slade (2007) for a survey of this contractual approach in the study of vertical integration.

both organizational arrangements.

2.2 Solution: incomplete contracts

The time line of events is the following. At date $t = 0$, the entrepreneur chooses the organizational structure from the two alternatives introduced above. If outsourcing is chosen, a contract is offered to the supplier that might include a monetary lump-sum transfer. At $t = 1$, the entrepreneur makes investments in capital. Next, at period $t = 2$, wages and employment are bargained over with the trade union. Importantly, if outsourcing was chosen at $t = 0$, the supplier bargains with the trade union (otherwise, it is the entrepreneur). If an agreement with the workers is found, the component is produced. Otherwise, the game ends. At $t = 3$, the component and the capital stock are combined to produce the final good. If outsourcing prevails, before production there is a bargaining stage $t = 2'$, where the entrepreneur and the supplier split the revenues to be derived from production.

We start at stage 3 and work backwards to trace the subgame perfect equilibrium of the game. Subscript v refers to vertical integration and o to outsourcing.

Vertical integration

At $t = 3$, revenues $R(k_v, l_v)$ are generated. Anticipating this, at $t = 2$, the firm and the workers engage in the bargaining game described by equation (2). By closing a deal the firm obtains revenues net of factor costs $\pi_v = R(k_v, l_v) - w l_v - r k_v$. With specific capital, the firm's fallback option is negative and equal to $\bar{\pi}_v = -r k_v$ (evaluate π_v at $l_v = 0$). Wages and employment are the solution to:

$$\max_{w_v, l_v} \Omega_v = [R(k_v, l_v) - w_v l_v]^\lambda [(w_v - \omega) l_v]^{1-\lambda}$$

subject to $\pi_v(w_v, l_v)$ and $(w_v - \omega) l_v$ being nonnegative. Denote R_t the derivative of the revenue function with respect to variable $t \in \{k, l\}$. First order conditions are characterized by:

$$w_v = (1 - \lambda) \frac{R(k_v, l_v)}{l_v} + \lambda \omega \quad R_{l_v} = \omega \quad (3)$$

Wages paid by the integrated firm are a weighted sum of revenues per worker and the reservation wage, with weights equal to the power of workers and the firm. The greater the firm's bargaining power λ , the closer the wage to the competitive level and the smaller the extent of rent-sharing.

At $t = 1$ the entrepreneur chooses the amount of investments. Incorporating $w_v l_v$ into the profit function, we have:

$$\max_{k_v} \pi_v = \lambda R(k_v, l_v) - \lambda l_v \omega - r k_v$$

With FOC: $R_{k_v} = \frac{r}{\lambda}$. The optimal solution features underinvestment in capital. Capital investments are discouraged because the final good producer is able to recover only a fraction $\lambda < 1$ of the marginal returns to her investments. Underinvestment reduces value but it constitutes a rational response to the threat of expropriation by organized labor. It proves useful to follow Antràs (2003) and calculate the equilibrium price. Using $\{k_v, l_v\}$, the fact that $m_v = l_v$, and the inverse demand function $p = y^{\alpha-1} A^{1-\alpha}$

we obtain:¹⁸

$$p_v = \frac{r^\beta \omega^{1-\beta}}{\alpha \lambda^\beta}$$

In this framework where demand features a constant elasticity the price includes a fixed markup α^{-1} over unit costs. The markup is scaled-up by $\frac{1}{\lambda^\beta} > 1$. This term is decreasing in λ because a larger share of rents retained by the firm in the negotiations reduces the hold-up problem, encouraging investment and reducing inefficiencies. It is also increasing in β for a given λ . Intuitively, the greater the marginal contribution of capital, the more damaging underinvestment is to efficiency. Changes in λ impact efficiency disproportionately more the more capital-intensive the technology is, as $\frac{\partial^2(\frac{1}{\lambda^\beta})}{\partial \lambda \partial \beta} > 0$.

Profits for the vertically integrated firm are:

$$\pi_v = \lambda(1 - \alpha)A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \lambda^\beta} \right)^{\frac{-\alpha}{1-\alpha}} \quad (4)$$

This expression neatly shows the two effects that labor market bargaining has on profits. The *efficiency effect*, as displayed by the presence of $\frac{1}{\lambda^\beta}$ inside the parenthesis, reduces total profits. The *rent-sharing effect*, reduces the profits left to the firm because the union obtains a share $(1 - \lambda)$. As λ approaches 1, these two effects vanish and profits approach those that would obtain under a competitive labor market.

Rents captured by the union are given by the wage bill:

$$w_v l_v = (1 - \lambda(1 - \beta)\alpha)A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \lambda^\beta} \right)^{\frac{-\alpha}{1-\alpha}} \quad (5)$$

Outsourcing

At $t = 2'$, right before k^o and m^o can be combined to yield revenues $R(k^o, m^o)$, the entrepreneur and the supplier bargain over the split of revenues. We model this process with a generalized Nash bargaining where the bargaining power of entrepreneur is $\phi \in (0, 1)$ and that of the supplier the complement $(1 - \phi)$. In the case with fully-specific investments, outside options are nil for both parties and equilibrium payoffs are $\phi R(k^o, m^o)$ and $(1 - \phi)R(k^o, m^o)$.

Wages and employment are determined by (2), with the arguments adjusted to the fact that the supplier negotiates with the workers. Both agents perfectly forecast the supplier's future profits (which are conditional on reaching an agreement with the union). These equal revenues net of labor costs: $\pi_o^S = (1 - \phi)R(k_o, l_o) - w_o l_o$. Should negotiations fail, the supplier would be left with zero profits, $\bar{\pi}_o^S = 0$. Hence:

$$w_o = (1 - \lambda)(1 - \phi)R(k_o, l_o) \frac{1}{l_o} + \lambda \omega \quad R_{l_o} = \frac{\omega}{(1 - \phi)} \quad (6)$$

A key difference with the integrated production case is that, under outsourcing, the wage is a weighted sum between the reservation wage and the suppliers' per-worker revenues. A second difference is that employment is distorted away from optimal levels. The reason is that the supplier only recovers a fraction

¹⁸The solution to the system of two equations composed of the first-order conditions gives optimal quantities as:

$$k_v = \frac{\beta \alpha}{r} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \lambda^\beta} \right)^{\frac{-\alpha}{1-\alpha}} \lambda A, \quad l_v = \frac{(1 - \beta)\alpha}{\omega} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \lambda^\beta} \right)^{\frac{-\alpha}{1-\alpha}} A$$

$(1 - \phi)$ of total resources $w_o l_o$ spent in manufacturing the component (i.e. a classical hold-up problem).

At $t = 1$ the entrepreneur chooses k_o by solving $\max_{k_o} \pi_o^F = \phi R(k_o, l_o) - rk$, with solution $R_{k_o} = \frac{r}{\phi}$. This condition and expression (6) show that both capital and the intermediate component are distorted away from first-best levels.¹⁹ However, in this case, the incompleteness of labor contracts does not have any direct effects on the choice of capital stock. Underinvestment in capital is a reaction to the threat of opportunism from the supplier. The equilibrium price is (see footnote 19 for the expressions for $\{k_o, m_o\}$):

$$p^o = \frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \quad (7)$$

The factor $\frac{1}{\phi^\beta (1 - \phi)^{1-\beta}} > 1$ depends on ϕ but is unaffected by λ . In this simple framework, outsourcing eliminates the *efficiency effect* of unionization. This extreme result would not hold in a more general model where the supplier undertakes ex ante investments to produce the component (see the appendix for such a model). However, the key issue is that, in the bargain with the union, the outside option of the supplier is higher than the outside option of the entrepreneur when he runs an integrated plant: $\bar{\pi}_o^S = 0 > -rk_v = \bar{\pi}_v$. The quasi-rents bargained with the workers are strictly lower. Hence, vertical fragmentation weakens union power and reduces its effect on investments. This comes at the cost of introducing a risk of opportunistic behavior from the supplier (hence, the effect of β depends on the value of ϕ).

Equilibrium payoffs for the entrepreneur, the supplier and the union write:

$$\begin{aligned} \pi_o^F &= \phi(1 - \beta\alpha)A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}} \\ \pi_o^S &= \lambda(1 - \phi)(1 - (1 - \beta)\alpha)A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}} \\ w_o l_o &= (1 - \lambda)(1 - \phi)(1 - (1 - \beta)\alpha)A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}} \end{aligned}$$

Only the payoff of the supplier is scaled-down by λ . In this model, outsourcing provides a strategy for reducing the revenues available for the union to extract. Vertical fragmentation weakens union power by reducing the share of rents captured by the union, mitigating the *rent-sharing effect*.

Let us define π_o^T as total profits net of labor costs: $\pi_o^T = \pi_o^F + \pi_o^S$. We focus on the case where the entrepreneur's payoff from outsourcing equals $\psi \pi_o^T$, with $0 < \psi \leq 1$. Under this assumption the entrepreneur chooses the organizational form that maximizes total corporate profits, net of labor costs. Following the seminal Grossman and Hart's (1986) paper, recent work on multinational firms' boundaries under competitive labor markets (Antràs 2003, Antràs and Helpman 2004) study a similar situation. In those works, ex ante transfers are used by final producers to ensure suppliers' participation. They assume an infinitely elastic supply of intermediate good producers. Competition among intermediate good producers drives profits to zero. Hence, transfers are set equal to the supplier's ex post payoffs. In such a setting, final good producers choose the organizational structure that maximizes joint profits. Assuming $\psi = 1$ is a "reduced-form" way of obtaining the same result.²⁰ Notice that while the value of ψ does affect the surplus that each party obtains from participating in production, it does not affect the levels of investments.

¹⁹We have:

$$k_o = \frac{\alpha \beta \phi}{r} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}} A, \quad m_o = l_o = \frac{\alpha(1 - \beta)(1 - \phi)}{\omega} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}} A$$

²⁰In that framework, $0 < \psi < 1$ can arise as a consequence of credit constraints on the supplier's side, as formalized in Carluccio and Fally (*forthcoming*) and in other work reviewed in Antràs (2011).

We solve the model for the case with $\psi = 1$, stressing that all of our results hold qualitatively for lower values of ψ (obviously, the lower ψ , the less attractive outsourcing becomes). In our framework, it seems quite reasonable to assume that a key difference between the union and the supplier is that the former's monopolistic position holds both ex ante and ex post (using Williamson's words, we assume that the "Fundamental Transformation" applies to suppliers only). That is, $\psi = 1$ is equivalent to assuming a perfectly elastic supply of intermediate good producers but only one trade union.

Under these assumptions, the entrepreneur's equilibrium payoff under outsourcing is:

$$\pi_o^T = [\phi(1 - \beta\alpha) + \lambda(1 - \phi)(1 - (1 - \beta)\alpha)] A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha \phi^\beta (1 - \phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}} \quad (8)$$

Before continuing, we stress that all of the results that follow hold if we forbid any kind of ex ante transfers and allow the entrepreneur to retain only π_o^F (with the model becoming substantially simpler). Similarly, we could also allow for the entrepreneur to retain only a fraction of total surplus (net of labor costs) under vertical integration, without qualitative changes (this could arise for example the entrepreneur had to hire a manager to produce the component in-house).

Worker bargaining power and firm boundaries

Roll now the clock back to $t = 0$. At this point in time, the entrepreneur makes organizational choices by comparing the profits he perfectly anticipates he will derive from each strategy. Using expressions (4) and (8), we can express the ratio of profits under both organizational forms as a function of the exogenous parameters of the model:

$$\Gamma_1(\lambda, \alpha, \beta, \phi) = \frac{\lambda^{\frac{1-(1-\beta)\alpha}{1-\alpha}} (1 - \alpha)}{[\phi(1 - \beta\alpha) + \lambda(1 - \phi)(1 - (1 - \beta)\alpha)] \left(\phi^\beta (1 - \phi)^{1-\beta} \right)^{\frac{\alpha}{1-\alpha}}}$$

We are now able to study how the relative strength of firms and workers in industrial relations shape the optimal boundaries of the firm. This amounts to analyzing how the value of λ determines whether the function $\Gamma_1(\lambda, \alpha, \beta, \phi)$ takes values higher or lower than one. The following lemma provides a valuable intermediate result:

Lemma 1 *The function $\Gamma_1(\lambda, \cdot)$ is monotonically increasing in λ in the range $\lambda \in (0, 1]$.*

Proof. See the appendix.

The first result is stated in the following proposition:

Proposition 1 *There exists a unique cutoff $\lambda^*(\beta, \phi, \alpha) \in (0, 1)$ such that for $\lambda > \lambda^*$ the entrepreneur chooses to setup a vertically integrated plant, for $\lambda < \lambda^*$ the entrepreneur chooses to outsource the intermediate component, and for $\lambda = \lambda^*$ the entrepreneur is indifferent between the two organizational forms.*

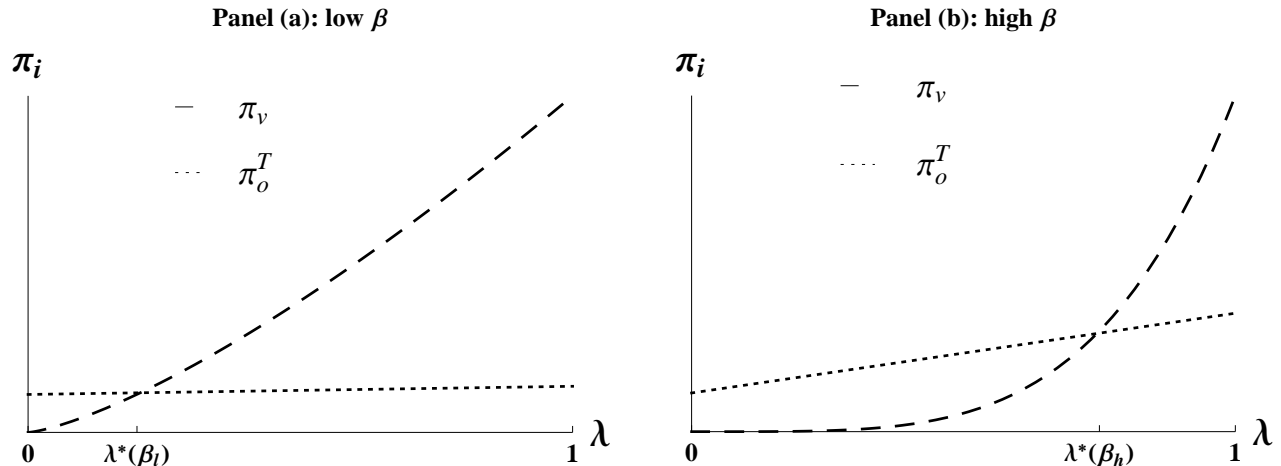
Proof. See the appendix.

Empowering workers increases the profitability of outsourcing over vertical integration. Figure 1 provides an illustration by plotting both π_v (dashed) and π_o^T (dotted) as a function of λ .²¹ When the power

²¹Values used are $\alpha = 0.78$, $\phi = 0.5$, $r = \omega = 2$. Panel (a) has $\beta = 0.2$, and Panel (b) has $\beta = 0.8$.

of firms in wage negotiations is high, the optimal organizational form is that of vertical integration. Decreases in λ force the entrepreneur to share revenues with the union. As λ decreases, it reaches a point where he prefers to outsource the production of the component in spite of the inefficiencies entailed by subcontracting under incomplete contracts.

Figure 1: Worker Bargaining Power, Capital Intensity and Organizational Choice



The convex shape of the π_v curve results from the multiplication of the efficiency and rent-sharing effects. Increases in λ boost investment and this effect adds to the reduction of the rent-sharing effect conferred by higher bargaining power. Put simply, higher values of λ result in the entrepreneur creating a larger “pie” and giving away smaller shares of it. The absence of the efficiency effect under outsourcing is the reason behind the linearity of the π_o^T curve.²²

We have shown that the strength of the efficiency effect depends on the extent to which production relies on capital - see (2.2). Hence the impact of wage negotiations on organizational choices should be sensitive to the capital intensity of the production technology. In particular, the following result holds:

Proposition 2 *The cutoff $\lambda^*(\beta, \phi, \alpha)$ is:*

- i. *increasing in β for $\phi > 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$*
- ii. *decreasing in β for $\phi < 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$*
- iii. *independent of β for $\phi = 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$*

Corollary 1 *$\phi \geq \frac{1}{2}$ is a sufficient condition for $\frac{\partial \lambda^*}{\partial \beta}(\beta, \phi, \alpha) > 0$*

Proof. *See the appendix.*

Intuitively, outsourcing is a way of trading away one risk of opportunism (that of the union) for another risk of opportunism (that of the supplier). λ and ϕ measure the exposure of the entrepreneur to

²²In a model where production of the component requires an additional investment, an efficiency effect would persist under outsourcing, giving it a convex shape. However, it would also strengthen the efficient effect under vertical integration to the same extent, leaving relative profits unchanged (see the appendix).

the opportunism of the union and the supplier respectively. α determines the degree of competition. The higher α , the more elastic demand is, and the more damaging underinvestment is to profits. When ϕ is high, union opportunism tends to be relatively stronger and underinvestment relatively more severe under integration. This problem is aggravated when the firm operates a capital intensive technology. When, on the contrary, ϕ is low, the attractiveness of vertical integration is increasing in capital intensity because the hold-up problem is relatively stronger in the commercial partnership. All else equal, the higher α , the larger the effect that a decrease in λ has on π_v . Thus, larger values of α are associated with lower minimum values of ϕ that make the entrepreneur switch to outsourcing ($g(\alpha) = 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$ is a decreasing function of α with a maximum equal to $1/2$).

To understand the logic behind Corollary 1, note that the effect of capital intensity on efficiency under outsourcing naturally depends on the value of ϕ . For $\phi > \frac{1}{2}$, the markup in (7) is decreasing in β . Increasing the relative importance of capital in production decreases overall underinvestment when the firm has relatively strong bargaining power. For $\phi < 1/2$ the markup is increasing in β . The case of Nash bargaining (i.e. $\phi = \frac{1}{2}$) is an interesting one because with symmetric bargaining power the efficiency effects of β in outsourcing cancel each other out. Hence, the efficiency impact of β on λ^* is driven solely by the power of the efficiency effect of λ . Figure 1 shows a numerical example of equilibrium profits contrasting the cases of two production technologies: one labor-intensive - panel (a)-, the other capital-intensive - panel (b)-. Profit curves from both strategies lie to the right for the capital-intensive technology. π_o^T shifts right with β because the rent-sharing advantages of outsourcing decrease with capital intensity. Bear in mind that under outsourcing the trade union captures a share of the rents accruing to the supplier. But profits retained by the supplier are higher the more capital intensive the production is - see (2.2). The net effect on relative profits results from the relative strength of these two forces. The numerical example shows graphically the general result that the distance between the curves is greatest for π_v . Because the ratio (2.2) is increasing in λ , it implies that the cutoff value λ^* is higher for the capital-intensive technology. As mentioned, for $\phi > \frac{1}{2}$, the markup in (7) is decreasing, adding an additional positive effect of β to the profits from outsourcing. Hence, for $\phi \geq \frac{1}{2}$ Proposition 2 always holds.

Together with Corollary 1, Proposition 2 shows that, for plausible parameter values, outsourcing is more likely when the technology is capital intensive and the power of firms in the bargaining with workers is weak. To appreciate this point, assume $\alpha = 1 - \frac{1}{\sigma}$, where σ is the constant elasticity of demand. Using $\sigma = 3.1$ (see Broda and Weinstein, 2006 - Table IV), we obtain $\frac{\partial \lambda^*}{\partial \beta}(\beta, \phi, \alpha) > 0$ whenever $\phi > 0.37$. Estimates of ϕ are scarce unfortunately. One example is Feenstra and Hanson (2005), who provide an empirical investigation on the property rights theory of the firm with Chinese data. Their estimates suggest a bargaining power of 0.7 for the multinational firm and 0.3 for the supplier firm (these values, however, are not statistically different from 0.5).

Notice that throughout we have assumed that the entrepreneurs' profits are unaffected by the power of workers under outsourcing. However, our results hinge on vertical fragmentation *reducing* the rent-sharing and efficiency effects of labor bargaining power.

2.3 Alternative contractual environments

Allowing for revenue-sharing contracts

We now solve the model under the assumption that revenue-sharing contracts are enforceable. This extension allows testing the robustness to changing the timing of the game.

Consider the following time line. At date $t = 0$, the entrepreneur chooses the organizational structure. If outsourcing is chosen, a contract is offered to the supplier that might include a monetary lump-sum transfer. At $t = 1$, the entrepreneur makes ex ante investments in capital. At period $t = 2$, if outsourcing was chosen in $t = 0$, the entrepreneur and the supplier bargain over the latter's compensation for producing the input. Call this compensation P . The commitment on P is enforceable. At $t = 2'$, the supplier and the union bargain over wages and employment. If they reach an agreement, the component is produced. At $t = 3$, the component and the capital stock are combined to produce the final good.²³ We continue to assume capital is specific (and thus sunk at the moment of bargaining over P).

There is no change in the vertical integration case. Under outsourcing, wages and employment are equivalent to (6), with P replacing $(1 - \phi)R(k^o, m^o)$. Anticipating this, both firms bargain over P following a generalized Nash bargaining process:

$$\max_P \Psi = [R(k_o, l_o) - P]^\phi [P - w_o l_o]^{1-\phi}$$

Ex-ante payoffs are given by $P = \lambda(1 - \phi)(R(k^o, m^o) - \omega m^o)$ and $R - P = \phi(R(k^o, m^o) - \omega m^o)$. As expected, the possibility of committing on P increases the ex-ante payoff to the supplier. The condition determining the optimal l_o is $(1 - \phi)R_{l_o} + \phi\omega = \omega$, giving: $R_{l_o} = \omega$. Allowing for contractible revenues eliminates the hold-up problem affecting the choice of labor. Organizational choices are governed by:

$$\Gamma_2(\lambda, \alpha, \beta, \phi) = \frac{\lambda^{\frac{1-\alpha(1-\beta)}{1-\alpha}}(1-\alpha)}{[\phi(1-\alpha) + \lambda(1-\phi)(1-\alpha(1-\beta))] \phi^{\frac{\beta\alpha}{1-\alpha}}}$$

The following results hold:

Proposition 3 *In the game with contractible sales revenues:*

- (i) *There exists a unique cutoff $\lambda^*(\beta, \phi, \alpha) \in (0, 1)$ such that for $\lambda > \lambda^*$ the firm chooses to setup a vertically integrated plant, for $\lambda < \lambda^*$ the firm chooses to outsource the intermediate component, and for $\lambda = \lambda^*$ the firm is indifferent between the two organizational forms.*
- (ii) *The cutoff $\lambda^*(\beta, \phi, \alpha)$ satisfies the following:*
 - *For given α , $\lambda^*(\beta, \phi, \alpha)$ is increasing in β for large values of ϕ .*
 - *For given ϕ , $\lambda^*(\beta, \phi, \alpha)$ is increasing in β for low values of α .*

Proof. *See the appendix.*

²³This timeline of events would not be sustainable in the incomplete contract framework of Section 2.2. Imagine the entrepreneur and the supplier agree on a price for the component at the beginning of the game. With no enforceable revenue-sharing contracts, the entrepreneur has incentives to optimally overrun this agreement and offer a lower price right before production. Given that the component has no value to other producers, the supplier would optimally accept. That is, absent the possibility of writing contracts contingent on revenues, the model collapses to the one in Section 2.2.

The intuition for the above is analogous to those in the benchmark model. In this case the conditions determining how the cutoff moves with β cannot be solved for analytically. Nevertheless, the cutoff $\lambda^*(\beta, \phi, \alpha)$ behaves qualitatively the same as in the baseline model.

Revenue-sharing contracts with general-purpose capital

When capital has full value for other purposes, the outside option of the entrepreneur equals the value of ex ante investments when bargaining with either agent. The *efficiency effect* disappears from both organizational structures. Hence, organizational choices do not depend on either β or α . The function determining organizational choices at $t = 0$, $\Gamma_3(\lambda, \phi)$ is:

$$\Gamma_3(\lambda, \phi) = \frac{\lambda}{\phi + \lambda(1 - \phi)}$$

Outsourcing is chosen for any value of $\lambda < 1$. While this is an extreme case, it is useful to illustrate the mechanisms at play in the more realistic versions of the model developed above. *In particular, it emphasizes the idea that capital-intensity matters only as long as capital investments are specific.*

2.4 Firm scope and wages

We now present an extension of our framework that sheds light on the relationship between individual wages and organizational forms (full derivation in the appendix). The functional forms that have been used thus far generate a constant revenues-to-employment ratio. This property allows tractable expressions and simplifies the analysis. But it implies that revenues per head are independent of the level of revenues bargained over, hence: $w_v = w_o$ irrespective of λ and organizational form. The insensitivity of wages to changes in revenues when the production function is Cobb-Douglas is well-known in the labor economics literature (Abowd and Lemieux, 1993; MacDonald and Solow, 1981). Eckel and Egger (2009) stress that bargained wages are independent of a revenue shifter when demand features constant elasticity .

A straightforward and realistic way of breaking this proportionality is by introducing some degree of scale economies.²⁴ Assume that production of the intermediate good requires a (contractible) setup cost rf in terms of capital. Wages become:

$$w^v = \max\{\omega, (1 - \lambda)\frac{R(k^v, m^v)}{l^v} + \lambda\omega - \frac{rf}{l^v}(1 - \lambda)\} \text{ , } w^o = (1 - \lambda)(1 - \phi)\frac{R(k^o, m^o)}{l^o} + \lambda\omega - \frac{rf}{l^o}(1 - \lambda) \quad (9)$$

The presence of the fixed cost implies that π_v becomes negative for low values of λ . In that case, there is no production and workers get their outside option (nonnegativity constraints bind). Rearranging we obtain:

$$\frac{w^v - w^o}{\omega} = \frac{rf(1 - \lambda)}{(1 - \beta)\alpha} \left(\frac{1}{(1 - \phi)R(k^o, m^o)} - \frac{1}{R(k^v, m^v)} \right) \quad (10)$$

Which gives the following condition for $w^v > w^o$: $\lambda > \phi(1 - \phi)^{\frac{1 - \alpha\beta}{\alpha\beta}} \equiv \lambda^w$.²⁵ When λ is high, vertical integration is more efficient, which translates into higher wages. For low values of λ , underinvestment

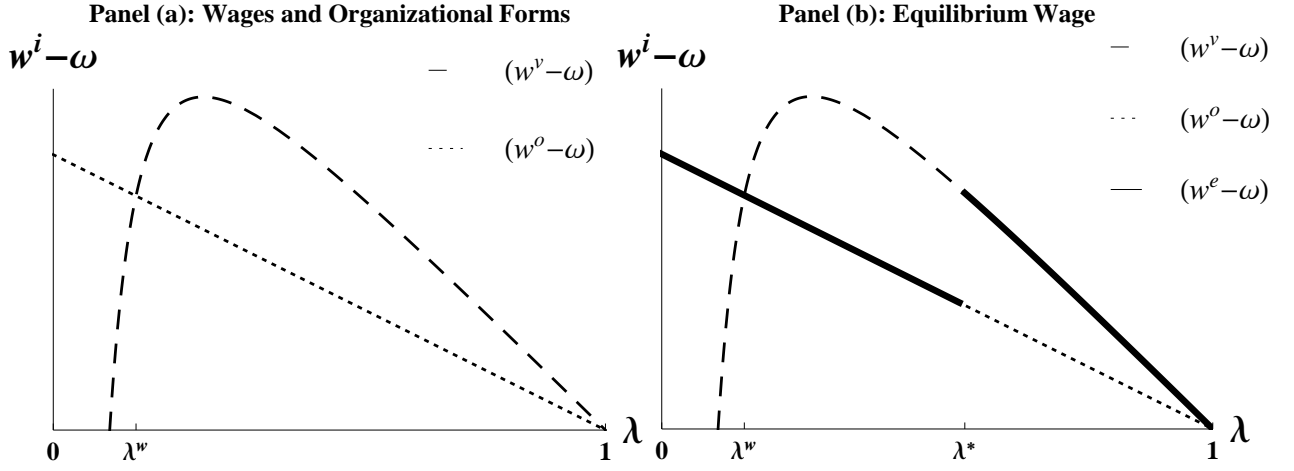
²⁴One could obtain similar by writing down a more general model and assume the elasticity of revenues to employment increases with employment. The advantage of this formulation is that achieves the same results while remaining tractable.

²⁵In the baseline model we have $\frac{w^v - w^o}{\omega} = \frac{1 - \lambda}{\omega} \left(\frac{R(k^v, m^v)}{l^v} - \frac{(1 - \phi)R(k^o, m^o)}{l^o} \right) = 0$.

becomes severe and both profits and wages are larger under outsourcing.

Panel (a) of Figure 2 plots the excess wage ($w - \omega$) for both organizational forms against λ (as in Figure 1, $(w^v - \omega)$ is the dashed line and $(w^o - \omega)$ the dotted line).²⁶ Under integration, wages are decreasing in λ when λ is large, and increasing in λ when λ is low. This nonmonotonicity comes from the holdup problem. w_o is linear because, as discussed before, the efficiency effect is absent under outsourcing (but the result is robust to adding an additional investment to produce the component as argued in footnote 22). We obtain the result of Grout (1984): under incomplete labor contracts, there is a region where increasing union power (decreasing λ) decreases wages.

Figure 2: Wages and Organizational Form



The above, together with our previous results, allows us to study equilibrium wages as a function of λ . The following lemma applies:

Lemma 2 *The following two statements hold: 1) There is a unique value of λ , labeled λ^w , such that $w_v > w_o$ for $\lambda > \lambda^w$ and 2) This value is strictly smaller than the organizational cutoff derived in Proposition 1: $0 < \lambda^w < \lambda^* < 1$.*

Proof. See the appendix.

The implications of Lemma 2 can be seen graphically in Panel (b) of Figure 2 where $(w^e - \omega)$ gives the equilibrium excess wage.²⁷ In the neighborhood of λ^* , increasing union power (decreasing λ) leads to a decrease in wages (wages are undetermined at the knife-edge case $\lambda = \lambda^*$). Hence, there is a region where increasing union power distorts organizational choices and decreases wages. This insight adds an “organizational channel” to Grout’s seminal contribution, who obtain a similar result in a model with no outsourcing. The same result applies to union welfare (see the appendix).

²⁶The figure plots expressions in (9) using the following parameter values: $\alpha = 0.78$, $\beta = 0.51$, $\phi = 0.6$ and $rf / \left(\frac{r^\beta \omega^{1-\beta}}{\alpha} \right)^{\frac{\alpha}{1-\alpha}} = 0.01$. They imply $\lambda^w = 0.169$.

²⁷Panel (b) uses same parameter values as Panel (a). λ^* was arbitrarily set to equal 0.55 for illustrative purposes.

The multinational wage premium

It is an empirical fact that foreign-owned firms tend to pay higher wages than domestic ones. In the studies surveyed in Barba-Navaretti and Venables (2004), the MNE wage premium ranges between 10 and 15% for the US and between 6 and 26% in the UK. This differential is larger for developing countries, going up to 50% in the case of Indonesia (see also the survey in Lipsey, 2002), and it is not explained by compositional effects alone. Available theoretical explanations resort to differences in monitoring abilities between foreign and domestic firms, the risk of technology dissipation and the theory of compensating differentials. We provide here theoretical support for rent-sharing is one plausible explanation.²⁸

An obvious concern is selection: the wage premium might be driven by more productive firms self-selecting into multinational production. To account for it, we introduce firm heterogeneity, by embedding the model in the Antràs and Helpman (2004) model of global sourcing (expressions in the appendix). Consider heterogeneous final goods producers seeking to import an intermediate good from a foreign country (ignore home country sourcing for simplicity). Imagine that the foreign location is characterized by $\lambda > \lambda^*$: integration maximizes variable profits. There are, however, fixed organizational costs. As in Antràs and Helpman (2004), they are assumed to be larger for integrated firms. Under these conditions, the most productive firms choose vertical integration -i.e. become MNEs - while the less productive ones choose to outsource.²⁹

Now consider two firms i and j that differ in productivity such that at equilibrium firm i chooses integration while firm j chooses outsourcing. Wages paid by the more productive firm will be higher, *ceteris paribus*, because variable profits will be larger. However, in the range where $\lambda \in (\lambda^*, 1)$, there is an extra increase in wages above what productivity differentials alone predict. Through bargaining, workers reap a share of the efficiency gains of integration through higher wages. Therefore, in the model with firm heterogeneity, firm-level wages are affected by *both* exogenous productivity *and* the choice of organizational form. This has implications for empirical research. Usually, empirical works look at wage differences by regressing average firm-level wages on a binary variable that equals one if the firm is an MNE. According to the theory, the coefficient associated with the MNE dummy confounds two effects: 1) underlying inherent productivity differences (unobserved for the econometrician) and 2) endogenous differences in what might be called organizational efficiency. Hence, only a portion of the MNE wage premium is due to productivity differences and, even after controlling for those, an MNE dummy should have explanatory power. Failing to control for productivity differences is likely to result in an upward bias in the MNE dummy coefficient. The surveys in Barba-Navaretti and Venables (2004) and Lipsey (2002) reveal that the wage differential is reduced, but still present, when studies account for plant characteristics such as industry, location, size, capital- and skill-intensity (imperfect proxies for productivity). The same occurs when data on worker characteristics is available. As mentioned, Budd et al (2005) and Martins and Yang (2010) give evidence of international rent-sharing in multinational firms.

²⁸Egger and Kreickemeier (2011) argue for a rent-sharing channel in a fair wages model.

²⁹A result consistent with some empirical studies, e.g. Corcos et al *forthcoming* using French data and Kohler and Smolka, 2009 using Spanish data.

3 Empirical Analysis

Testable predictions: global firms' boundaries

The theoretical model delivers predictions about firm-level integration decisions. It is straightforward to apply the intuitions to an international set-up and exploit firm-level variation in the extent to which products are imported within or across firm boundaries. This approach allows overcoming the lack of firm-level data on domestic outsourcing and, more importantly, exploiting the large observable variation in worker bargaining power across countries. Consider the following simple setup. Final goods' producers are located in the reference country 0 (France), and suppliers in one of $c = 1, \dots, C$ countries. In each country there is a representative consumer with quasi-linear preferences between a CES aggregator of differentiated varieties and a freely traded homogeneous good. The reservation wage is determined by the productivity in the homogeneous sector. Each producer of differentiated final goods i belongs to a particular industry n . To produce, they import intermediate inputs p from the rest of the world. Inputs are manufactured with labor and can be produced in-house through FDI or by subcontracting with suppliers located in c . In each country, production requires bargaining with local workers, with λ_c indicating firms' bargaining power in country c . Organizational decisions in the differentiated sector follow the mechanisms highlighted in the theory section. In particular, the functions Γ_k , $k \in \{1, 2, 3\}$, synthesize how organizational decisions are affected by the model's parameters. According to the theory, $\Gamma_1(\cdot)$ and $\Gamma_2(\cdot)$ apply when ex ante investments have no outside value. They depend on the power of firms/workers in collective bargaining at the country level (λ_c), the capital intensity of the importer's industry ($\beta_{i(n)}$), the demand elasticity of faced by the industry ($\alpha_{i(n)}$), and the bargaining power of the final producer (ϕ_i). $\Gamma_3(\cdot)$ applies when investments have full value outside a particular relationship. It depends only on (λ_c) and (ϕ_i).

The functions Γ_k cannot be directly estimated with the data at hand. However, the theory gives predictions about how they should be affected by the relevant parameters and hence firm's decisions. We can write a stochastic version by adding an error term $\mu_{ipc} = \theta_p + \delta_i + \epsilon_{ipc}$. θ_p and δ_i are unobservable product- and firm-specific effects (such as managerial preferences) and ϵ_{ipc} is assumed to be i.i.d. with zero mean.³⁰ Call I_{ipc} a variable equal to one if firm i imports product p from an affiliate in country c , and zero if imports are from an independent supplier. The theory predicts:

$$I_{ipc} = \begin{cases} 1 & \text{if } \Gamma_k(\lambda_c, \alpha_{i(n)}, \beta_{i(n)}, \phi_i, \epsilon_{ipc}) - 1 > 0 \\ 0 & \text{if } \Gamma_k(\lambda_c, \alpha_{i(n)}, \beta_{i(n)}, \phi_i, \epsilon_{ipc}) - 1 \leq 0 \end{cases} \quad (11)$$

It also predicts $\frac{\partial \Gamma_k}{\partial \beta} \neq 0$ for $k \in \{1, 2\}$. In what follows we will use firm-level data to test the following empirical predictions:

Empirical Prediction 1 *The likelihood of intra-firm imports at the firm-product-country level is decreasing in the bargaining power of workers in the origin country.*

Empirical Prediction 2 *In industries characterized by ex-ante investments with no outside value (specific), the effect of worker bargaining power on the likelihood of intra-firm imports depends on capital intensity. For industries where investment have outside value (non-specific), there is no such differential effect.*

³⁰Although we will allow for correlations across c in ϵ_{ipc} by clustering at the country level.

Empirical Prediction 1 follows from Proposition 1 and point (i) of Proposition 3. Empirical Prediction 2 follows Proposition 2 and point (ii) of Proposition 3.

3.1 Data description

Firm-level data on global sourcing

Our main dataset is the *Enquete Echanges Internationaux Intra-Groupe* produced by the French Office of Industrial Studies and Statistics (SESSI). It is based on a firm-level survey of manufacturing firms belonging to groups with at least one affiliate in a foreign country and with international transactions totaling at least one million euros. The survey year is 1999.³¹

The SESSI dataset provides, for each firm, details of all the international transactions carried out in 1999 including product, country of origin or destination and value. Products are classified at the 4-digit level of the harmonized system (HS4). The survey provides the share of the value that was traded with affiliated firms versus independent firms. This information is detailed by importing firm, product traded, and exporting country. It should be noted that the trading partner is considered to be an affiliate when the group controls at least 50% of equity.³² It also provides some basic firm-level information. The firm's industry affiliation is provided at the 4-digit NAF 1993 level. The *Nomenclature d'Activités Française* 1993 corresponds closely to the 4-digit NACE Rev 1 Classification (although slightly more disaggregated), which in turn is close to the 4-digit ISIC Rev3 Classification. Carluccio and Fally (*forthcoming*) use these data to study the link between sourcing modes and financial development. Corcos et al (*forthcoming*) use it to test several predictions of property rights models of multinational firms (see also Antràs, 2011).

The data provide a good representation of the activity of international groups located in France. They account for around 82% of total trade flows by multinationals, and 55% and 61% of total French imports and exports respectively. The dataset was cross-referenced with alternative sources to check their validity. The trade flow data were found to be consistent with customs data and the intra-firm trade flows consistent with data on the location of the French affiliate (INSEE's Financial Links Survey "LIFT", Bank of France and French General Treasury and Economic Policy Directorate (DGTPE) data). Reassuringly, the value of intra-firm trade in our data accounts for around half of total French imports, a figure that is in line with other developed countries, notably the US. The data are very rich, but they have one potential drawback, common in survey data, which is non-response.³³ If non-response is non-random, failing to correct for it might result in biased estimators. We do not believe this is a serious concern for our results. First, all of our results include firm dummies. Second, in all regressions we use an inverse probability weighted estimator.³⁴ Finally, as a third robustness check, we report in the data appendix the results with correction

³¹Access to the survey data requires formal permission from the National Statistical French Office (INSEE). No nationality or other restrictions apply.

³²Thus, the database considers only cases where there is a relationship of control over the affiliate. This contrasts with other datasets where the equity threshold is typically 10%, if not 6% as in the case of US Customs data.

³³The response rate was of around 52 %

³⁴The weighted M-estimator $\hat{\theta}_w$ solves (Wooldridge, 2002):

$$\min_{\theta \in \Theta} \sum_{i=1}^N [s_i / p(z_i, \hat{\gamma})] q(w_i, \theta)$$

where w_i is the outcome of interest and s_i a binary indicator such that $s_i = 1$ if w_i is observed and $s_i = 0$ otherwise. The problem arises since w_i is only observable if $s_i = 1$. Hence, failing to control for selection might result in biased estimators when s_i is correlated with the error term. $p(z_i, \hat{\gamma})$ is the estimated probability of being in the sample. The sampling probability function $p(\cdot)$ is typically estimated using binary response models for s_i , the solution of which is given by $\hat{\gamma}$. z_i is a random

for sample selection proposed by Corcos et al (*forthcoming*).³⁵

Data on worker bargaining power across countries

Testing the model’s implications calls for an empirical counterpart to λ . An important determinant of the balance of power between firms and workers is the regulations governing the labor markets. Industrial relations laws regulate relationships between firms and organized workers, providing the framework within which the bargaining process takes place.

The most comprehensive database on labor market regulations across countries is the one developed by Botero et al. (2004). These authors have assembled country-level data on three different categories of labor law for the year 1997.³⁶ We use an index that measures the protection of employees engaged in collective disputes, which we label “Worker bargaining power” (it is the “Collective disputes index” in the Botero et al database). It considers several aspects of labor law that determine the balance of power between employees and employers during conflicts. These include whether the right to collective action is permitted by law, whether strikes are legal and, if so, the ease with which they can take place, and the extent to which employers can react with lockouts or by replacing striking workers. This index varies between 0 and 1, with higher values representing increased regulation and power on the workers’ side. It provides an empirical proxy for $(1 - \lambda_c)$. The data appendix provides more details.

Table 1 lists the countries used in the regression, together with the index value. The table reveals a large variation that does not seem to be driven by any clear pattern, be it geographical or by per capita income level. The variation is remarkably strong across OECD countries, which represent an otherwise homogeneous group in terms of economic development and institutional environment. The sample median is 0.44 (std dev. 0.15). The median across OECD and non OECD countries is of 0.45 (std dev 0.12) and 0.42 (std dev 0.16) respectively. Labor market regulation varies a great deal across countries and development levels worldwide. We exploit this strong cross-country variation in our econometric analysis.

In robustness checks we use the “Collective relations laws index,” from the same source (which synthetically enlarges the “Collective disputes index” with variables measuring the statutory protection of trade unions). We also use data on labor market institutions from Nickell (2006), for a group of OECD countries (listed in the appendix). We use the measure of union coverage, defined as the number of workers covered by collective agreements normalized on employment for 1999. This measure has been commonly used as a proxy for union power (e.g. Hirsch, 1991).

In a subset of regressions we restrict to imports from the US and exploit variation in unionization rates and union coverage across industries within the US (from where detailed industry-level data is available). The data come from the Current Population Survey (CPS) conducted by the US Census Bureau.

vector that is a good predictor of selection and that it is always observed. Wooldridge (2002) and others have shown that $\hat{\theta}_w$ is consistent under weak ignorability conditions: $P(s = 1|w, z) = P(s = 1|z) = p(z)$. That is, conditional on z_i , w_i does not affect s_i . This assumption seems reasonable in our context. The sampling probabilities we use are provided by the SESSI. They are obtained using a Logit estimation with the following explanatory variables: trade flows, nationality of the controlling group, 2-digit sector classification, and an indicator of how many INSEE surveys the firm answers. More details can be made available from the author upon request.

³⁵In a first stage, a Probit model is run on the group of firms belonging to the survey target population, with the dependent variable equal to one if firm i has responded to the survey. Explanatory variables are total value of imports, number of imported products, number of origin countries and 3-digit sector dummies. The inverse mills ratio is then used as a regressor in the second stage. We thank Giordano Mion for kindly sharing the codes to run this estimator.

³⁶The data are available online at <http://www.economics.harvard.edu/faculty/shleifer/files/>. The World Bank has updated some of these data for the 2004-2008 period, available at <http://www.doingbusiness.org>. Previous works using this database include Cunat and Melitz (2010), Lafontaine and Sivasadan (2007).

Table 1: Worker bargaining power index by country (Botero et al, 2004)

OECD			
	Worker bargaining power		Worker bargaining power
Denmark	0.13	Germany	0.50
Finland	0.21	Hungary	0.50
Canada	0.25	Ireland	0.50
Austria	0.29	Netherlands	0.50
Korea	0.38	New Zealand	0.50
Turkey	0.38	Switzerland	0.50
UK	0.38	Greece	0.54
US	0.38	Japan	0.54
Belgium	0.42	Mexico	0.58
Poland	0.42	Norway	0.58
Australia	0.46	Portugal	0.58
Spain	0.46	Italy	0.83
Sweden	0.46		
Non OECD			
Jamaica	0.17	Malaysia	0.38
Kenya	0.17	Uruguay	0.38
Egypt	0.25	Zimbabwe	0.46
Ghana	0.25	Indonesia	0.50
Taiwan	0.25	Venezuela	0.50
Zambia	0.25	Bolivia	0.54
South Africa	0.38	Colombia	0.54
Chile	0.33	Singapore	0.54
Israel	0.33	Argentina	0.58
Jordan	0.33	Sri Lanka	0.58
Thailand	0.33	Hong Kong	0.63
Tunisia	0.33	India	0.63
Uganda	0.33	Panama	0.63
Pakistan	0.33	Senegal	0.63
Brazil	0.38	Peru	0.71
China	0.38	Ecuador	0.75

The data appendix provides a detailed description of the labor market data and other country-level variables. Correlations are shown in Table 4 in the appendix.

Measuring Capital Specificity

We also need to distinguish empirically the industries where the importer’s investments have relatively large value outside the relationship from those where this value is substantially lower. To obtain an industry-specific empirical measure of specificity we use the measure developed in Rauch (1999). It classifies commodities according to whether they are sold on organized exchanges, referenced priced, or neither of both. Goods sold in an organized exchange tend to be standardized and to have potentially many buyers and sellers (“thick” markets). On the contrary, goods that are not sold in organized exchanges tend to be differentiated and are traded in thinner markets. The value of standardized goods for a particular

buyer-seller pair does not differ much from the value they have for other pairs of agents. Differentiation, however, tends to create a wedge between the value of a good inside a particular relationship and the value it has outside this particular relationship. Goods that are reference-priced lie in between these two cases. Nunn (2007) develops a measure of relationship-specific inputs based on these intuitions.

We map Rauch’s product classification into 4-digit NAF industry codes. We then calculate the weighted average specificity of industry n as the share of production of differentiated products in total production: $Av_spec_n \in [0, 1]$. This measure has a mean of 0.66 (std. dev. 0.47). It’s distribution is skewed to the left, with 169 industries having $Av_spec_n = 1$. Based on this, we create a dummy variable:

$$Spec_n = \begin{cases} 1 & \text{if } Av_spec_n = 1 \\ 0 & \text{if } 0 \leq Av_spec_n < 1 \end{cases}$$

Note we use the most restrictive possible criteria in constructing this variable.³⁷ For illustrative purposes, Table 2 provides a list of five industries with $Spec_n = 1$ and five with $Spec_n = 0$.

Table 2: Industry classification according to specificity: examples (NAF700 codes, 4-digit)

Classified as non-specific (average specificity <1) Total number: 85	Classified as specific (average specificity=1) Total number: 169
Code	Code
151E Industrial production of meat products	292A Ovens, furnaces and furnace burners manufacturing
274G First processing of lead, zinc and tin	295M Plastics and rubber machinery manufacturing
265E Plaster manufacturing	363Z Musical instruments manufacturing
241C Dyes and pigments manufacturing	300C Computers and peripheral equipment manufacturing
171A Spinning of cotton textiles	286D Mechanical tool manufacturing
Total number of industries with information on $(k/l)_n$ and specificity: 254	

Notes: Author’s calculation based on Rauch’s (1999) commodity classification. See the data appendix for details.

We also construct a measure of capital intensity for industry $(k/l)_n$ - an empirical proxy for β - based on firm-level data. Details for the construction of these variables are provided in the data appendix. The empirical analysis will combine these two variables. The correlation of $(k/l)_n$ with Av_spec_n is of -0.24 . The relationship is however non-linear: industries with low $(k/l)_n$ and industries with high $(k/l)_n$ tend to have lower values of Av_spec_n ³⁸. For illustration, Table 5 in the appendix provides a list of the five industries with the highest value of capital intensity, five with the lowest values, and five around the median. Industries with values around the median have $Spec_n = 1$ (with the exception of “Other textiles”). Industries at the extreme have $Spec_n = 0$ (excepting from “Ind. manuf. of bread and fresh pastry”).

Estimating Sample

We restrict the sample to importers that belong to manufacturing industries and import products classified as manufactures (NACE Rev1 2-Digit codes 15 to 37). The appendix provides further details of how the data was cleaned.³⁹

³⁷Results hold if we lower the threshold, for example, using $Av_spec_n > 0.75$ as the criterion.

³⁸An OLS regression gives $Av_spec_n = 0.419(4.91)(k/l)_n - 0.0506(-5.39)((k/l)_n)^2$, t-stats in parenthesis.

³⁹Importantly, we drop retailers. Also for consistency we exclude Tobacco (16) and Coke (23) industries, since, as pointed out by Antràs (2003) and Defever and Toubal (2011), sourcing modes in these industries are likely to be determined by other factors such as national sovereignty. All of our results are robust to their inclusion (they represent only 211 observations).

Our empirical analysis focuses solely on imports from countries for which measures of labor market regulations and other country-level controls are available. The list of these countries (corresponding to positive imports), is provided in Table 1 (see Section 2). Using the detailed HS4 classification we obtain a baseline estimating dataset comprising 3,102 firms that import 1,028 HS4 products from 57 origin countries, including both developing and developed economies (see data appendix). The average number of imported products by firm is 10, with a standard deviation of 12 and a maximum of 164. The average firm imports from 7 countries (standard deviation 5) and the maximum number of countries by firm in the data is 37. 84% of observations correspond to the firms importing the same product from at least two different countries. These features of the data allow us to exploit within-firm variation across countries in the econometric analysis. Table 3 provides summary statistics on the main variables used in the analysis.

Table 3: Summary statistics of main variables

	Mean	Std. Dev.	Min	Max	Obs.
Dependent variable					
Share of intra-firm imports	0.28	0.43	0	1	85,909
Labor market variables					
Worker bargaining power	0.43	0.15	0.13	0.88	57
Collective relations index	0.43	0.13	0.19	0.71	57
Labor rigidity index	0.45	0.18	0.15	0.82	57
Union coverage 1999	0.66	0.28	0.15	0.98	18
Industry-level variables					
(log) Capital intensity	5.35	0.82	3.33	7.77	254
Average Specificity Av_spec_n	0.76	0.40	0	1	254
Dummy Specific $Spec_n$	0.66	0.47	0	1	254
Country-level variables					
(log) Capital endowment	10.5	1.3	6.5	12	57
Trade openness	68	14.4	24	90	57
FDI openness	65.5	12	30	90	57
Rule of law	0.65	0.20	0.3	0.97	57
(log) Skill endowment	2.4	0.82	0.26	3.7	57
IPR protection	364	83	174	487	57
Entry costs	0.37	0.69	0	4.6	57
Creditors' rights	1.9	1.2	0	4	57
Corporate tax	31.3	5.8	15	45.1	57

Notes: The dependent variable is the share of intra-firm imports at the firm level of each HS4 product by country of origin. Industry level variables are calculated at the 4-digit NAF level (close to NACE Rev1 4-digit level).

The baseline estimating dataset contains 85,909 firm-product-country cells with information on the share of intra-firm imports. Of these, 65% are pure outsourcing (share of intra-firm trade equal to zero), 22% are pure intra-firm (share of intra-firm trade equal to one) and 13% are a combination of both (share of intra-firm trade between zero and one). The average share of intra-firm trade by firm-country-product is 0.28 (standard deviation 0.43). Over half of the firms in the sample reports imports using both sourcing

modes (1,788).

3.2 Results

3.2.1 Worker bargaining power and intra-firm trade

We start by confronting *Empirical Prediction 1* with the data. We estimate the following equation:

$$I_{ipc} = \gamma WBP_c + \rho X_c + \theta_p + \delta_i + \epsilon_{ipc} \quad (12)$$

where the dependent variable I_{ipc} is defined as the share of intra-firm imports of (HS4) product p from country c by firm i . WBP_c is the measure of the worker’s bargaining power in wage negotiations. Our theory predicts a negative sign for γ : firms are expected to engage in less vertical integration and intra-firm trade when offshoring in destinations where labor market regulations enhance workers’ bargaining power. X_c are controls at the country level derived from previous literature. $\{\theta_p, \delta_i\}$ are respectively a full set of imported product and firm dummies. (notice δ_i controls for the importer’s industry affiliation.) ϵ_{ipc} is an error term.

Before continuing, notice that equation (12) does not exactly corresponds to equation (11). As discussed above, around 13% of the observations have $0 < I_{ipc} < 1$. These correspond to firms importing the same product from the same country, but buying from more than one supplier. Unfortunately, the data is aggregated at the product-, not the supplier-level. Thus, we cannot estimate (12) directly. We choose to use I_{ipc} as a share in order not to lose information coming from these “mixed” observations. We estimate (12) by ordinary least squares. It allows us to include a large set of dummies and avoid the incidental parameter problem that arises with maximum likelihood estimation.

Identification of γ comes from the variation in WBP_c across countries. Our estimation equation includes firm and product dummies. Firm dummies δ_i control for any individual firm characteristics that are constant across products and countries and might systematically affect sourcing mode decisions (productivity, managerial preferences, etc.).⁴⁰ They subsume industry affiliation, thereby controlling for $\alpha_{i(n)}$ and $\beta_{i(n)}$, as well as any other industry relevant characteristic. The inclusion of product dummies holds constant any product attributes (observable and unobservable) that might affect I_{ipc} . Our empirical strategy accounts for these compositional effects, exploiting *within-firm* changes in sourcing decisions across countries with full controls for product characteristics.

Table 6 presents the results. Heteroskedasticity-robust standard errors are shown in parentheses. Given that WBP_c varies only across countries we cluster errors at the country level (see Moulton, 1986). In column (1) we run an univariate regression and obtain the expected sign. In the remaining two columns we add a large set of controls. Worker bargaining power has a negative and statistically significant effect, at the 1% confidence level, on the share of intra-firm imports. Take the estimate from column (3). Its interpretation is straightforward: going from the lowest value in the sample (Denmark, 0.13) to the highest (Italy, 0.83) reduces the share of intra-firm trade at the firm level by 10.8%. Hence, if Italy had Denmark’s bargaining institutions, the share of intra-firm exports to France would increase by 7.6% ($0.108 \times (0.83 - 0.13)$). This effect is sizeable and economically meaningful provided that the mean intra-firm share in the sample is of 28%.

⁴⁰In equation (11) we have assumed that ϕ is firm-specific. Thus, δ_i holds ϕ constant. It might be argued that ϕ varies across products, in which case, the product dummies control for it.

[Table 6 about here]

An empirically convenient fact is that labor market regulations tend to be uncorrelated with measures of economic and institutional development (see Table 4 in the appendix). We nevertheless include as many controls as possible to make sure we picking up the effect of WBP_c on the dependent variable. Our measure of worker bargaining power is based on statutory laws and regulations. Regulations are effective as long as the law is enforced in the exporting countries. Hence we control for the general level of contract enforcement with the rule of law index taken from Kaufmann, Kraay and Mastruzzi (2003). This variable comes out positive and significant at the 5% level in column (2) (although it losses some explanatory power when we enlarge the set of covariates). In column (3) we control for labor market frictions using the labor rigidity index from Botero et al (2004) (see Cunat and Melitz, 2012 and Helpman et al 2011 on how to interpret this index). Although more rigid labor markets tend to discourage intra-firm trade, the effect of bargaining power is larger and stronger statistically.

The remaining controls confirm findings from previous studies. We include FDI and trade openness indicators from the Heritage Foundation. As expected, in the case of France, intra-firm import shares are higher from countries with policies favoring foreign investors. Openness to trade, however, is associated with larger values of arm's length trade. Bernard et al. (2010) find qualitatively similar effects for US-based multinationals using the same policy variables. We also add a measure of creditor's rights from Djankov et al (2007). Antràs, Desai and Foley (2009) showed weak investor protection to be a determinant of multinational firms' activity. Carluccio and Fally (*forthcoming*) show that financial development creates incentives for outsourcing. Our results give support to both theoretical predictions. In the same column we include the top corporate tax rate from the World Tax Database. In addition, we include the Ginarte and Park (2000) index of intellectual property rights protection (IPR). Investors might be more reluctant to outsource in countries with weak intellectual property rights' protection, an intuition not supported by the data. Next, we next address an important concern. Countries that impose tighter regulations on the labor markets might tend to actively regulate other aspects of economic life as well (Botero et al., 2004). Hence, a negative sign of the labor market regulations variables might simply be picking up the effects of stricter overall regulatory systems. We control for the propensity to regulate firms' activities including a measure of the cost of obtaining legal status to operate a firm (normalized by per capita GDP in 1999), drawn from Djankov et al. (2002). As could be expected, this variable comes out negative and significant at the 1% level. Its inclusion does not affect the significance of the worker bargaining power index. We also include a dummy for French speaking country and physical distance. Speaking the same language tends to encourage arm-length's relationships. We control for factor price differences using factor endowments. We obtain an imprecise estimate of the effect of the capital endowment. This is possibly due to the large measurement errors likely to plague this variable, and our clustering strategy. We also find that, fully controlling for firm characteristics using dummies, the effect of skill endowment is negative.⁴¹

Results on the worker bargaining index remain robust to the inclusion of an extensive set of controls related to the regulatory and institutional profiles of exporting countries.

Sensitivity checks: samples, measures and within-country evidence

1) *Alternative samples and measures for WBP_c .* Table 7 presents a series of robustness checks. All regressions include the full set of controls as is column (3) of Table 6. The first column shows that

⁴¹The same result is obtained by Corcos et al (*forthcoming*) on a different sample -see column 4 of their Table IV.

results are stronger when we use alternative measures worker bargaining power. The Collective relations laws index from Botero et al. has a stronger effect than our main measure. The same result is obtained when using union coverage in the OECD (available for 18 countries listed in the data appendix). We next use two alternative subsamples. Column (3) includes only OECD countries (as of 1999).⁴² These countries constitute a homogeneous group in terms of economic development. They still display a large variation in the collective bargaining index (mean of 0.45 and std. dev. of 0.14) enabling us to check if the results provided so far are not driven by broad differences in income or institutional development.⁴³ Worker bargaining power appears statistically significant and with a higher coefficient than obtained in the full sample. In column (4), we restrict the estimating sample solely to firms that report positive imports under both sourcing modes across countries and products (“Switchers”). The significant and large coefficient associated with the collective bargaining index alleviates concerns about our results being driven by firm self-selection. In columns (5) and (6) we interact WBP_c with a dummy equal to one if the imported product is different from the main product of the importer (“int good dummy”). Consistent with the model, results hold for more refined definitions of vertical production chains. This is true even within the OECD. Notice the coefficient of interest almost doubles when we consider these alternative samples.

[Table 7 about here]

2) Within-country evidence: exploiting variation across US industries. We complement the above results with within-country cross-industry evidence. The US Census Bureau releases information on unionization rates across industries (classified with the Census Industry Classification CIC, comprising 82 manufacturing industries). Union membership and coverage are traditional proxies for worker bargaining power (Hirsch, 1991). Restricting to imports from the US, these data provide us with industry variation that completely controls for country-level characteristics. The US represents 11% of the value of imports in the data, and 8.7% of the number of transactions. The average share of intra-firm trade at the firm-product level is 0.4, above the sample mean of 0.28. The number of HS4 products is 589. Because of a lack of correspondence between HS4 and CIC codes, we aggregate the trade data at the HS3 level. We then map HS3 trade flows into CIC codes. (Details are provided in the data appendix.) We regress the share of intra-firm imports from the US at the HS3 level on unionization of the CIC industries to which each HS3 product map. We estimate:

$$I_{HS3.us} = \gamma(\text{Union membership})_{CIC.us} + \rho \text{Controls}_{CIC.us} + \eta \text{tariffs}_{HS3.us} + \epsilon_{HS3.us} \quad (13)$$

Where $I_{HS3.us}$ is the share of intra-firm imports from the US at the HS3 level, $(\text{Union membership})_{CIC.us}$ proxies for worker bargaining power at the industry level. We include a vector of industry-level (CIC) controls, $\text{tariffs}_{HS3.us}$ are ad-valorem tariffs imposed in the EU on US exports and $\epsilon_{HS3.us}$ is an error term.

Table 8 provides the results. Given that CIC codes encompass several HS3 products, we cluster standard errors at the CIC level. In line with cross-country evidence, unionization discourages intra-firm trade. The set of industry-level controls include factor intensities, the ratio of value added to total industry shipments (measuring average vertical integration), the share of differentiated goods in total production,

⁴²Excluding the Czech Republic and Iceland because they are not included in the Botero et al (2004) dataset.

⁴³As noted by Nunn (2007), a second advantage is that data for OECD countries (especially our country level controls) tend to be better. This means the results can be checked for robustness to the omission of lesser quality data.

and a measure of ad-valorem EU-US tariffs. Union membership is significant at the 1% level in all four specifications. In column (4) we use union coverage instead (due to US legislation, their correlation is 0.99).

[Table 8 about here]

3.2.2 Worker bargaining power, relationship-specific capital and intra-firm trade

A first look: specific capital and intra-firm trade

In Table 9 we estimate:

$$I_{ipc} = \phi(k/l)_n + \rho Spec_n + \vartheta((k/l)_n \times Spec_n) + \eta X_n + \chi x_i + \zeta_c + \theta_p + \epsilon_{ipc} \quad (14)$$

That is, we regress our dependent variable I_{ipc} on capital intensity of the industry $(k/l)_n$ where the firm operates, the specificity dummy $Spec_n$, and their interaction. Industry-level controls X_n include: skill intensity, value added over total output and median size. We add the following vector x_i of firm-level controls (in logs): total imports, size and labor productivity. In addition we include a full set of country dummies ζ_c and a full-set of product dummies θ_p . We conservatively cluster standard errors at the 4-digit industry (NAF) level. Notice ϑ measures the extra effect that specificity adds to the effect of $(k/l)_n$. The total effect of $(k/l)_n$ for a specific industry is $\vartheta + \phi$.

Column (1) shows that, in line with the seminal work of Antràs (2003), the share of intra-firm imports is increasing in capital intensity. The measure of headquarter intensity we use here (capital intensity of the *importer's industry*) differs from that used in previous works (capital intensity of the imported product). Hence, our results both complement and extend previous findings. The coefficient associated to the $Spec_n$ variable turns out positive and significant at 5%. On the average, capital specificity seems to be associated with more vertical integration. This result is consistent with Antràs and Helpman (2008). In Column (2), we add the interaction term between $(k/l)_n$ and $Spec_n$. The positive and significant coefficient indicates that increases in $(k/l)_n$ increase average intra-firm trade in specific industries with respect to non-specific ones. Further, the sum of the coefficients is significantly different from zero at the 1% level. This implies that the effect of $(k/l)_n$ is positive and significant for industries characterized by specific (non-contractible) investments. The average effect of $(k/l)_n$ is not different from zero. These results complement Nunn and Treffer (2011) and Antràs and Chor (2011). Both works use disaggregated data on different types of capital. Their results indicate that only those types of capital with lower expected value outside a particular relationship (specialized machinery and equipment) tend to have positive and significant effects on US intra-firm trade. Buildings and plants have little or negative effects. Notice that when we include the interaction term, the sign of $Spec_n$ is reversed. This result is consistent with Nunn and Treffer (2008)'s finding that improvements in contractibility raise intra-firm trade in capital intensive industries, but have negative or not significant in low capital intensity ones (see their Table 4).

We next look at the effect of $(k/l)_n$ across subsamples of worker bargaining power above and below the sample median (0.44). The coefficient of capital intensity is lower in the subsample of high WBP_c countries (although not significant). The interaction term turns out positive and significant at 1% in the low WBP_c subsample. The magnitude is higher than the one obtained in the high WBP_c subsample,

which also loses statistical significance.⁴⁴ These results pave the way for the next set of regressions where we look at whether WBP_c has a stronger negative effect in specific and capital intensive industries, as predicted by the theoretical model.

[Table 9 about here]

The effect of worker bargaining power across industries

We now look into *Empirical Prediction 2*. We test whether the effect of worker bargaining power is heterogeneous according to the capital intensity of the industry n where the firm operates. The theory predicts $\frac{\partial \Gamma_k}{\partial \lambda_c \beta_n} \neq 0$ only when capital has no outside value (i.e. $k \in \{1, 2\}$). We create a subsample of industries which the data strongly indicates as relying on ex ante investments: $Spec_n = 1$. We then rank specific industries according to $(k/l)_n$. Finally we interact WBP_c with two dummy variables. $((k/l)_n > median)$ equals 1 if $(k/l)_n$ is above the sample median and zero otherwise, and $((k/l)_n < median)$ equals 1 if $(k/l)_n$ is below the sample median and zero otherwise. We estimate:

$$I_{ipc} = \gamma_1(WBP_c \times (k/l)_n > median) + \gamma_2(WBP_c \times (k/l)_n < median) + \beta X_c + \theta_p + \delta_i + \epsilon_{ipc} \quad (15)$$

As before we expect $\hat{\gamma}_1 < 0$, $\hat{\gamma}_2 < 0$. Proposition 2 predicts $\frac{\partial \Gamma_k}{\partial \lambda_c \beta_n} > 0$ for $\phi > 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$. Corollary 1 shows $\phi \geq 1/2$ is a sufficient condition. Given this and the results of the previous subsection we thus expect the most likely outcome to be $|\hat{\gamma}_1| > |\hat{\gamma}_2|$. The ranking implies that the likelihood of intra-firm imports is lower for country-industry pairs for which both capital intensity and worker bargaining power are large. Results are in Table 10. In the first column we estimate (15) for the entire sample. In column (2) we re-estimate equation (15) for the subsample of specific industries (we recalculate the ranking of industries). In this case, $\hat{\gamma}_1$ is larger and more significant than $\hat{\gamma}_2$. These results support the idea that the effect of WBP_c is stronger in capital intensive industries. In column (3) we measure capital intensity with US data, to avoid the possibility of endogeneity in the capital intensity measures.⁴⁵ The values of $\hat{\gamma}_1$ and $\hat{\gamma}_2$ are remarkably similar to those obtained with French data.⁴⁶ For comparison, column (4) restricts the sample to industries with $Spec_n = 1$ but ignores the differential effect across $(k/l)_n$. The coefficient is very close to that in column (3) of Table 6. The reader might notice that the estimates of $\hat{\gamma}_1$ and $\hat{\gamma}_2$ are quite noisy. The large standard errors are not surprising given that we conservatively cluster errors at the country level and include a large set of controls, including a large set of product and firm dummies. With this in mind, we interpret the results as supportive of *Empirical Prediction 2*.

[Table 10 about here]

⁴⁴The mean $(k/l)_n$ is slightly larger in the high WBP_c countries (5.40 vs 5.37 in logs), reducing concerns about firms in high $(k/l)_n$ industries self-selecting into low WBP_c countries.

⁴⁵Using an industry-level based measure of $(k/l)_n$ also helps reducing endogeneity concerns. As our model shows, the choice of capital stock by multinational firms is endogenous to the organizational form). Further, this effect depends on the strength of the bargaining power of workers during negotiations. If, as the theory suggests, firms choose outsourcing in countries with high worker bargaining power to protect the returns to their investments and consequently have greater capital stocks in equilibrium, this could create an upward bias in our estimates. Under the assumption that industries' technological characteristics determine to a large extent the relative importance of capital in production at the firm level, using industry-level provide a measure of β that reduces concerns about this potential endogeneity bias.

⁴⁶The correlation between French and US capital data is of 0.70. In column (3) we lose some observations because of the imperfect mapping between SIC87 and NAF codes in the Food industry (corresponding to ISIC Rev2 2-digit code 15).

4 Concluding Remarks

In this paper, we develop a model of foreign sourcing under imperfect labor markets to study how global firms’ organizational choices are affected by labor market bargaining. The theoretical predictions are as follow. First, firms engage in outsourcing when worker bargaining power is strong. Second, the relative profitability of outsourcing increases with capital intensity, when capital has no outside value. This second prediction contrasts with the theoretical predictions of models based purely on incomplete contracts between firms, which have hitherto been the focus of the literature. Third, integrated firms pay higher wages than non-integrated firms. We use detailed firm-level data to directly test the internalization decision and find support for the first two predictions. Our results are robust to the use of alternative of labor market institutions, for both detailed definitions of vertical production networks and alternative samples. They also hold in the case of within-country, across-industry variations in worker bargaining power. We argue that the large body of literature that finds a multinational wage premium is consistent with the third prediction. Our results argue for a novel perspective on the role of labor market institutions in shaping the international organization of production.

Data Appendix

Labor Market Indexes: The *Worker Bargaining Power* variable is the “collective protection subindex” from Botero et al. (2004). It is constructed as the average of eight dummy variables that equal one: (1) if employer lockouts are illegal, (2) if workers have the right to industrial action, (3) if wildcat, political and sympathy/solidarity/secondary strikes are legal, (4) if there is no mandatory waiting period or notification requirement before strikes can occur, (5) if striking is legal even if there is a collective agreement in force, (6) if laws do not mandate conciliation procedures before a strike, (7) if third party arbitration during a labor dispute is mandated by law and (8) if it is illegal to fire or replace striking workers. The “Collective relations laws index,” used in column (1) of Table 7 is the average of “collective protection subindex” and the “union power subindex”. The former is constructed as the average of seven binary variables that equal one: (1) if employees have the right to unionize, (2) if employees have the right to collective bargaining, (3) if employers have the legal duty to bargain with a union, (4) if collective contracts are extended to third parties by law, (5) if the law allows closed shops, (6) if workers, or unions, or both have a right to appoint members to the board of directors, and (7) if workers’ councils are mandated by law.

In Table 7 we use union coverage in 1980 and 1999 from Nickell (2006) for 18 OECD countries.⁴⁷ The “Labor Rigidity Index” is the “Employment Laws Index” from Botero et al (2004).

Country-level controls: The “rule of law” variable is taken from Kaufmann, Kraay and Mastruzzi (2003). It weights a number of variables capturing the perceptions of individuals about contract enforcement. It covers the years 1997 and 1998. The log of capital stock per worker in 1999 is taken from the Penn World Tables and as the measure of skill endowment is the percentage of the population aged over 25 with at least secondary education in 1999 drawn from Barro and Lee (2000). Trade and FDI openness are respectively the Trade Freedom and Investment Freedom indexes produced by Heritage Foundation for

⁴⁷Australia, Canada, Belgium, Denmark, Finland, Germany, Japan, Ireland, Italy, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. The database also contains (other than France) Austria, for which there is no data for the selected variable.

2000. Trade freedom is based on the trade-weighted average rate (main source the World Bank WDR) and on non-tariff barriers. Investment freedom measures equal treatment for foreign and domestic investors. Protection of intellectual property rights in 2000, is drawn from Ginarte and Park (1997). The top tax rate for corporations is provided by World Tax Database (University of Michigan). A caveat is that the information refers to taxes on domestic companies, and different rates might apply on foreign owned firms. We use it due to the lack of wide cross-country information on corporate taxes to foreign firms. Distance is taken from CEPII. It measures bilateral distances between the biggest cities of any two countries, those inter-city distances being weighted by the share of the city in the overall country's population. French speaking equals 1 when French is the exporting country's official or national languages and languages spoken by at least 20% of the population of the country. Entry costs is a measure of the cost of obtaining legal status to operate a firm (normalized by per capita GDP in 1999) taken from Djankov et al. (2002). It includes all identifiable official expenses (fees, costs of procedures and forms, photocopies, fiscal stamps, legal and notary charges, etc.). The company is assumed to have a start-up capital of ten times per capita GDP in 1999. The index of Creditor's rights in 1999 comes from Djankov et al. (2007) and ranges from 0 (weak creditor rights) to 4 (strong creditor rights).

Industry-level variables:

Specificity: Our aim is to construct a measure of specificity at the 4-digit NAF industry level. We proceed as follows. First, we create a dummy equal to 1 if the 4-digit STIC4 rev2 commodity is classified as not being sold in organized exchange or reference-priced in Rauch's (1999) conservative classification. We then use a correspondence table from 4-digit STIC4 rev2 to HS4 (available in Jon Haveman's site).⁴⁸ Finally, we use a concordance table from HS4 to 4-digit NAF (provided by the INSEE) to construct a 4-digit NAF level measure of relationship-specificity using production (from the SESSI dataset) as weights. We have originally 282 4-digit NAF industries in the sample. There are 23 4-digit NAF industries for which we could not map any 4-digit STIC4 rev2 commodity, and 5 with no information on capital intensity. Observations corresponding to these industries are dropped from the regressions in Tables 9 and 10. The NAF codes are (the first two codes coincide with NACE Rev 1): 159Q 159L 173Z 201A 222E 223A 223C 262J 266E 266G 275A 275C 275E 275G 281C 282A 282B 284A 284B 284C 285A 285C 285D 287A 296A 333Z 371Z 372Z.

Capital intensity: Constructed using firm-level data from the EAE (*Enquete Annuel d'Entreprises*). It is an annually conducted survey that provides detailed firm-level data for all French firms with more than 20 employees whose main activity is in manufacturing.⁴⁹ We first use the firms in the sample with available information on capital stock to calculate the log of the ratio of the capital stock to total employment. The median of this firm-level measure is then calculated for each of the 254 4-digit NAF industries in our sample.

Industry-level controls in Table 9 include the industry median of the (log) ratio of wages to total employment at firm level,⁵⁰ the industry median of firm size and the industry median of the ratio of value added to sales. **Firm-level variables:** constructed from additional information present in the SESSI

⁴⁸There is no direct concordance between 4-digit STIC4 rev2 and the NAF or NACE classifications

⁴⁹In spite of the size threshold the data remains highly representative. Eurostat reports that firms in the EAE accounted for around 87% of manufacturing production value in 1999.

⁵⁰Clearly, this is an imperfect measure of skill intensity. Unfortunately, other commonly used measures such as the relative importance of non-production workers are not available. Using the same dataset, Corcos et al. (*forthcoming*) perform a robustness check on how well this variable captures differences in skills. Aggregating this measure at the 2 digit NACE Rev 1 industries, they report a correlation coefficient of 0.67 with the share of the workforce having at least secondary education.

dataset. Size is the log of the nr. of employees and labor productivity is the log of value added divided by the nr. of employees.

US data on industry unionization and factor intensities: Data on union membership (% of workers who are union members) coverage (% workers who are covered by union contracts) for 1999 for US manufacturing industries come from the Current Population Survey (CPS) conducted by the US Census Bureau. They are aggregated at the 3-digit CIC level (US Census Industry Classification, 82 manufacturing industries), which maps mostly into 3-digit 1987 SIC codes but sometimes 4- or 2-digit industries. The data were downloaded from www.unionstats.com. There is no concordance between HS4 and 4-digit SIC87 or the CIC classifications. We aggregate our HS4 trade data into HS3 codes and then map these flows into 4-digit SIC87 codes using a concordance table provided by the US Census Bureau. Each SIC87 code maps into a single CIC code, though many SIC87 codes may map into the same CIC (i.e. a many-to-one mapping). Restricting to imports from the US we have 138 HS3 codes with positive flows. Out of these, 22 map into a single CIC industry (though possibly into more than one 4-digit SIC87 codes). The remaining 116 HS3 mapped into two 4-digit SIC87 industries or more, which in turn mapped into different CIC codes. They were assigned SIC87 codes using data on US exports to France at 4-digit SIC level, produced by the US Census Bureau and available at Peter Schott's website: http://www.som.yale.edu/faculty/pks4/files/research/data/sic_naics_trade_20100504.pdf. First, SIC4 codes for which the Census reports a value of less than 50 thousand dollars were disregarded. Second, when a HS3 codes mapped into, for example, three SIC87 codes, we summed the values of exports of these three codes and calculated the percentage accounted for by each code in the group. Whenever a SIC87 code accounted for more than 75 percent of this value, we assigned the HS3 code to it. This gives us 88 HS3 codes mapped each into unique CIC codes. The correlation between intra firm trade and the probability of being assigned a particular code through this method is of -0.02. Finally, when a HS3 code mapped into SIC87 industries with similar trade values we assumed it was imported from all of them under the same intra firm trade share. The underlying assumption of this procedure is that the structure of trade in the SESSI dataset is close to the structure of US-France trade (i.e. the SESSI is a representative survey of bilateral trade, as shown by the INSEE). We experimented with different thresholds and found similar results. The coefficient of a regression like the one in column 3 of Table 8 run on observations with a clear mapping is -0.0154 (with t-stat -6.01), which is higher and even more significant.

Control variables come from the NBER productivity database website: <http://www.nber.org/nberces/nbprod96.htm>. They were downloaded originally in SIC4 codes and aggregated into CIC codes using the Census concordance Table. $(h/l)_{n(us)}$ is the natural log of total capital stock to production workers. $(h/l)_{n(us)}$ is the ratio of nonproduction to total workers. $(VA/shipments)_{n(us)}$ is the ratio of value added to total shipments. Ad valorem tariffs imposed by the EU to the US come from the BACI dataset available at CEPII. Tariffs are at the HS4 level. We aggregate at the HS3 level using imports from the US in the SESSI dataset as weights. $Av_spec_{n(us)}$ is the weighted average of the Rauch index, constructed as the main measure Av_spec_n described in Section 3.1. It was aggregated to HS3 using trade flows from the US in the SESSI dataset as weights. All concordance tables can be found online on Jon Haveman's website (<http://www.macalester.edu/research/economics/page/haveman/trade.resources/tradeconcordances.html>).

Estimating sample: The SESSI survey was answered by 4305 firms (both exporters and importers). Of these, 4,249 record positive imports. We keep only manufacturing imports (ISIC 15 to 37), which reduces the number of firms to 4,204. We drop observations that have France as origin country (6,633), leaving

4,177 firms. We finally drop firms whose main industry affiliation is outside manufacturing (mainly retailers) or is in extractive industries (ISIC 23), leaving 3,128 firms. Of these, 26 firms import from countries with no data on country variables of column (2) of Table 6. Our estimating sample thus contains 3,102 firms.

Sample selection: robustness. The table below replicates the regressions of column (2) of Table 6, taking out the firm dummies. Column (1) has no firm controls. Column (2) includes (log) firm size, (log) labor productivity. Column (3) adds the inverse Mills (IM) ratio obtained from Corcos et al (see their paper for details). The number of observations is slightly reduced due to the lack of firm-level data for 70 firms.

Dependent variable:	Share of intra-firm imports		
	(1)	(2)	(3)
Worker bargaining power	-0.079** (0.036)	-0.085** (0.036)	-0.075** (0.036)
# Clusters	57	57	57
Full set of country-level controls	Yes	Yes	Yes
Imported product dummies	Yes	Yes	Yes
Firm-level controls	No	size, labor productivity	IM, size, labor productivity
Observations	84,394	84,394	84,394
R-squared	0.088	0.090	0.099

Notes: **, indicates significance at the 5 percent level.

Table 4: Correlations between labor market indexes and country-level controls

Variables	Worker bargaining power	Collective rel. laws	Labor rig. index	Union cov. 1999	Rule of Law	Capital end.	Skill end.	FDI op.	Trade op.	Entry costs	IPR prot.	Creditor's rights	Corporate Tax	Distance	French speaking
Worker bargaining Power	1.000														
Collective relations laws	0.652	1.000													
Labor rigidity index	0.365	0.749	1.000												
Union coverage 1999	0.295	0.595	0.835	1.000											
Rule of Law	-0.281	-0.181	-0.073	-0.402	1.000										
Capital endowment	0.215	0.290	0.182	0.235	0.668	1.000									
Skill endowment	-0.279	0.060	0.030	-0.160	0.505	0.296	1.000								
FDI openness	0.107	0.073	0.208	0.328	0.318	0.497	0.098	1.000							
Trade openness	0.159	0.180	0.067	-0.244	0.565	0.777	0.174	0.562	1.000						
Entry costs	0.373	0.507	0.413	0.681	-0.433	-0.210	-0.108	-0.111	-0.291	1.000					
IPR protection	0.138	0.042	-0.056	-0.343	0.574	0.834	0.147	0.378	0.667	-0.377	1.000				
Creditor's rights	-0.085	-0.076	-0.019	-0.013	0.381	0.092	-0.006	0.088	0.133	-0.112	0.078	1.000			
Corporate Tax rate	0.240	-0.001	0.075	0.269	-0.218	0.213	-0.493	0.060	0.032	-0.025	0.332	-0.326	1.000		
Distance	-0.212	-0.311	-0.593	-0.686	-0.305	-0.401	0.101	-0.415	-0.271	-0.139	-0.339	-0.265	-0.234	1.000	
French speaking	-0.171	-0.166	-0.096	0.191	-0.050	0.124	-0.269	-0.004	0.039	-0.091	0.055	-0.290	0.442	-0.178	1.000

Notes: See the data appendix for variable definitions.

Table 5: Capital intensity at industry-level (APE, 4-digit)

Code	Highest		Around the median		Lowest	
	Code		Code		Code	
158A	Industrial manufacture of bread and fresh pastry	287P	Other metal objects manufacturing	273J	Ferroalloy production	
151A	Processing and preserving of meat	286D	Mechanical tool manufacturing	241N	Rubber products manufacturing	
151C	Processing and preserving of poultry meat	175G	Other textile industries	265A	Cement manufacturing	
152Z	Processing and preserving of fish	287L	Household metal objects manufacturing	265C	Lime manufacturing	
151E	Industrial production of meat products	294D	Soldering material manufacturing	241A	Industrial gas manufacturing	
median (log) capital intensity across industries: 5.35						

Notes: Source EAE. Industry capital intensity is calculated as the mean of the firm-level ratio of the capital stock to total employment (in logs).

Theory Appendix

4.1 Proofs

Proof of Lemma 1: Partial differentiation of Γ w.r.t λ gives:

$$\frac{\partial \Gamma(\lambda, \cdot)}{\partial \lambda} = \frac{\lambda^{\frac{1-(1-\beta)\alpha}{1-\alpha}} (1 - (1-\beta)\alpha) [\phi(1-\beta\alpha)\lambda^{-1} + (1-\phi)\beta\alpha]}{[\phi(1-\beta\alpha) + \lambda(1-\phi)(1 - (1-\beta)\alpha)]^2 (\phi^\beta (1-\phi)^{1-\beta})^{\frac{\alpha}{2(1-\alpha)}}} > 0$$

Proof of Proposition 1 $\Gamma(\lambda, \cdot)$ is a continuous and differentiable function of λ in the interval $(0, 1)$. Lemma 1 and two additional properties of Γ suffice to prove Proposition 1:

1. $\Gamma_1(1, \alpha, \beta, \phi) > 1$
2. $\Gamma_1(0, \alpha, \beta, \phi) = 0$

To show 1. we note:

$$\Gamma_1(1, \alpha, \beta, \phi) = \frac{(1-\alpha)}{[1 - \alpha[1 + \phi(\beta - 1) - \beta(1-\phi)]] (\phi^\beta (1-\phi)^{1-\beta})^{\frac{\alpha}{1-\alpha}}}$$

and $\Gamma_1(1, 0, \beta, \phi) = 1$. Thus, $\frac{\partial \Gamma_1(1, \alpha, \beta, \phi)}{\partial \alpha} > 0 \forall \alpha \in (0, 1), \forall \beta \in [0, 1], \forall \phi \in (0, 1)$ is a sufficient condition for $\Gamma_1(1, \alpha, \beta, \phi) > 1$. A necessary and sufficient condition for $\frac{\partial \Gamma_1(1, \alpha, \beta, \phi)}{\partial \alpha} > 0$ is:

$$\log \left(\frac{1}{\phi^\beta (1-\phi)^{1-\beta}} \right) > (1-\alpha) \frac{(\phi + \beta - 2\phi\beta)}{1 - \alpha(1 - \phi - \beta + 2\phi\beta)}$$

The right-hand side of this inequality is decreasing in α . Setting $\alpha = 0$ and rearranging the condition can be expressed as $f(\beta, \phi) > 0 \forall \beta \in [0, 1], \forall \phi \in (0, 1)$ with

$$f(\beta, \phi) = \beta \left[\log \left(\frac{1-\phi}{\phi} \right) - 1 + 2\phi \right] - \log(1-\phi) - \phi$$

Note that for $\phi > 1/2$, $\partial f(\beta, \phi)/\partial \beta < 0$ thus $f(1, \phi) = -\log(\phi) - 1 + \phi > 0$ is sufficient for $f(\beta, \phi) > 0$. For $\phi < 1/2$, $\partial f(\beta, \phi)/\partial \beta > 0$ thus $f(0, \phi) = -\log(1-\phi) - \phi > 0$ is sufficient for $f(\beta, \phi) > 0$. And $f(\beta, 1/2) > 0 \forall \beta > 0$. Hence $\frac{\partial \Gamma_1(1, \alpha, \beta, \phi)}{\partial \alpha} > 0$ and $\Gamma_1(1, \alpha, \beta, \phi) > 1 \forall \alpha \in (0, 1), \forall \beta \in [0, 1], \forall \phi \in (0, 1)$.

given that $\Gamma_1(0, \cdot) < 1$, $\Gamma_1(1, \cdot) > 1$ and $\frac{\partial \Gamma_1(\lambda, \cdot)}{\partial \lambda} > 0$ then by continuity it follows that there a unique $\lambda^*(\beta, \alpha, \phi) \in (0, 1)$ such that $\Gamma_1(\lambda^*, \cdot) = 1$, with $\Gamma_1(\lambda, \cdot) < 1$ for $\lambda < \lambda^*$ and $\Gamma_1(\lambda, \cdot) > 1$ for $\lambda > \lambda^*$. QED.

Proof of Proposition 2 By the implicit function theorem

$$\frac{\partial \lambda^*(\beta, \cdot)}{\partial \beta} = - \frac{\frac{\partial \Gamma_1}{\partial \beta}}{\frac{\partial \Gamma_1}{\partial \lambda}}$$

In the proof of Proposition 1 we show that $\frac{\partial \Gamma_1}{\partial \lambda} > 0$ for all $\lambda \in (0, 1)$. We now derive the conditions for $-\frac{\partial \Gamma_1}{\partial \beta} > 0$. Partial differentiation of Γ_1 gives

$$-\frac{\partial \Gamma_1(\beta, \cdot)}{\partial \beta} = \Omega \left[\frac{(1-\alpha)(\lambda^*(1-\phi) - \phi)}{[\phi(1-\beta\alpha) + \lambda^*(1-\phi)[1 - \alpha(1-\beta)]]} - \log \left(\frac{\lambda^*(1-\phi)}{\phi} \right) \right]$$

with $\Omega = \frac{\alpha \lambda^* \frac{1-(1-\beta)\alpha}{1-\alpha} (\phi^\beta (1-\phi)^{1-\beta})^{\frac{-\alpha}{1-\alpha}}}{\phi(1-\beta\alpha) + \lambda^*(1-\phi)[1-\alpha(1-\beta)]} > 0 \forall \lambda^* \in (0, 1)$. The term in brackets determines the sign of $-\frac{\partial \Gamma_1}{\partial \beta}$. Define

$$Z(\lambda^*, \beta, \alpha, \phi) = \frac{(1-\alpha)(\lambda^*(1-\phi) - \phi)}{[\phi(1-\beta\alpha) + \lambda^*(1-\phi)[1-\alpha(1-\beta)]]} - \log\left(\frac{\lambda^*(1-\phi)}{\phi}\right)$$

$Z(\lambda^*, \cdot)$ is a continuous and differentiable function of λ^* , $\forall \lambda^* \in (0, +\infty)$, and satisfies the following properties:

1. $\lim_{\lambda \rightarrow 0} Z(\lambda^*, \beta, \alpha, \phi) = +\infty$
2. $\frac{\partial Z(\lambda^*, \beta, \alpha, \phi)}{\partial \lambda^*} < 0$ for $\lambda^* \in (0, +\infty)$
3. $Z(\lambda^*, \beta, \alpha, \phi) |_{\lambda = \frac{\phi}{1-\phi}} = 0$

To prove 2., it can be shown that $\frac{\partial Z(\lambda^*, \cdot)}{\partial \lambda^*} < 0$ if the following condition is satisfied

$$\frac{(1-\alpha)[(2-\alpha)](1-\phi)\phi\lambda^*}{[\phi(1-\beta\alpha) + \lambda^*(1-\phi)[1-\alpha(1-\beta)]]^2} - 1 < 0 \quad (16)$$

The left-hand side of the inequality is a concave function of λ with maximum at $\lambda^* = \frac{\phi(1-\beta\alpha)}{(1-\phi)[1-\alpha(1-\beta)]}$. Replacing in, gives $\frac{(1-\alpha)(2-\alpha)}{4(1-\beta\alpha)[1-\alpha(1-\beta)]} - 1$ which is negative $\forall \alpha \in (0, 1)$, $\forall \beta \in [0, 1]$.

Given 1. and 2. then $\lambda^* = \frac{\phi}{1-\phi}$ is the unique root of Z in the interval $(0, +\infty)$. Therefore $Z(\lambda^*, \beta, \alpha, \phi) > 0$ for $\lambda^* \in \left(0, \frac{\phi}{1-\phi}\right)$ and $Z(\lambda^*, \beta, \alpha, \phi) < 0$ for $\lambda^* \in \left(\frac{\phi}{1-\phi}, 1\right)$, for $\alpha \in (0, 1)$, $\beta \in [0, 1]$, $\phi \in (0, 1)$. Hence, $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) > 0$ for $\lambda^* \in \left(0, \frac{\phi}{1-\phi}\right)$, $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) < 0$ for $\lambda^* \in \left(\frac{\phi}{1-\phi}, 1\right)$ and $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) = 0$ for $\lambda^* = \frac{\phi}{1-\phi}$.

Since $\Gamma_1(\lambda^*) = 1$ and $\frac{\partial \Gamma_1(\lambda^*)}{\partial \lambda} > 0$, $\Gamma_1(\frac{\phi}{1-\phi}) > 1$ implies $\lambda^* < \frac{\phi}{1-\phi}$, and conversely $\Gamma_1(\frac{\phi}{1-\phi}) < 1$ implies $\lambda^* > \frac{\phi}{1-\phi}$. We have $\Gamma_1(\lambda^* = \frac{\phi}{1-\phi}) = 1 - \frac{1-\alpha}{2-\alpha}(1-\phi)^{-\frac{1}{1-\alpha}}$ which implies $\Gamma_1(\lambda^* = \frac{\phi}{1-\phi})$ depending on whether $\phi 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha} \equiv g(\alpha)$. $g(\alpha)$ is a decreasing function of α in the interval $[0, 1]$ with a maximum at $g(1) = 1/2$ and $\lim_{\alpha \rightarrow 1} g(\alpha) = 0$. Therefore, $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) > 0$ for $\phi > 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$, $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) < 0$ for $\phi < 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$ and $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) = 0$ for $\phi = 1 - (\frac{1-\alpha}{2-\alpha})^{1-\alpha}$ (with $\phi \geq 1/2$ a sufficient condition for $\frac{\partial}{\partial \beta} \lambda^*(\beta, \alpha, \phi) > 0$).

QED.

Proof of Proposition 3

The proof of existence of a unique cutoff $\lambda^*(\beta, \phi, \alpha)$ (point i of Proposition 3) is analogous to that of Proposition 1. The proof of point ii is similar to that of Proposition 2. We need to derive the conditions for $-\frac{\partial \Gamma_2}{\partial \beta} > 0$. It can be shown that $-\frac{\partial \Gamma_2}{\partial \beta} > 0$ requires $Z'(\lambda^*, \beta, \alpha, \phi) > 0$, with

$$Z'(\lambda^*, \beta, \alpha, \phi) = \frac{(1-\alpha)\lambda^*(1-\phi)}{[\phi(1-\alpha) + \lambda^*(1-\phi)[1-\alpha(1-\beta)]]} - \log\left(\frac{\lambda^*}{\phi}\right)$$

$Z'(\lambda^*, \cdot)$ is continuous and differentiable in λ^* , $\forall \lambda^* \in (0, +\infty)$, and satisfies:

1. $\lim_{\lambda \rightarrow 0} Z'(\lambda^*, \beta, \alpha, \phi) = +\infty$
2. $\frac{\partial Z'(\lambda^*, \beta, \alpha, \phi)}{\partial \lambda^*} < 0$ for $\lambda^* \in (0, +\infty)$

3. $Z'(1, \beta, \alpha, \phi) < 0$

By continuity, there exists some λ_c^* such that $Z'(\lambda_c^*, \beta, \alpha, \phi) = 0$. Hence, $-\frac{\partial \Gamma_2}{\partial \beta} > 0$ for $\lambda^* < \lambda_c^*$, $-\frac{\partial \Gamma_2}{\partial \beta} = 0$ for $\lambda^* = \lambda_c^*$ and $-\frac{\partial \Gamma_2}{\partial \beta} < 0$ for $\lambda^* > \lambda_c^*$. It is not possible to solve for λ_c^* . However, using the implicit function theorem we can study how it behaves with respect to ϕ and α . Differentiation of $Z'(\lambda_c^*, \beta, \alpha, \phi)$ reveals that $\frac{\partial Z'(\lambda_c^*, \beta, \alpha, \phi)}{\partial \phi} > 0$ and $\frac{\partial Z'(\lambda_c^*, \beta, \alpha, \phi)}{\partial \alpha} < 0$ which implies $\frac{\partial \lambda_c^*}{\partial \phi} > 0$ and $\frac{\partial \lambda_c^*}{\partial \alpha} < 0$. Thus, holding α constant, the larger ϕ , the larger the range where $\lambda^* > \lambda_c^*$. And holding ϕ constant, the lower α the larger the range where $\lambda^* > \lambda_c^*$.

Proofs of subsection 2.4 The game is equal to the benchmark with incomplete contracts, with the difference that a (contractible) fixed cost rf is required to produce the input m . Under vertical integration, wages and employment are determined by:

$$\begin{aligned} \max_{\{w_v, l_v\}} \Omega_v &= [R(k_v, l_v) - w_v l_v - rf]^\lambda [(w_v - \omega) l_v]^{1-\lambda} \\ w_v &= (1 - \lambda) \frac{R(k_v, m_v)}{l_v} + \lambda \omega - \frac{rf}{l_v} (1 - \lambda) \quad R_{l_v} = \omega \end{aligned}$$

Investment is defined by $k_v = \underset{k_v}{argmax} \{ \lambda(R(k_v, l_v) - l_v \omega - rf) - rk_v \}$ with FOC: $R_{k_v} = \frac{r}{\lambda}$. Under outsourcing:

$$\begin{aligned} \max_{\{w_o, l_o\}} \Omega_o &= [(1 - \phi)R(k_o, l_o) - w_o l_o - rf]^\lambda [(w_o - \omega) l_o]^{1-\lambda} \\ w_o &= (1 - \lambda)(1 - \phi) \frac{R(k_o, l_o)}{l_o} + \lambda \omega - \frac{rf}{l_o} (1 - \lambda) \quad R_{l_o} = \omega \end{aligned}$$

Investment is defined by $k_o = \underset{k_o}{argmax} \{ \phi R(k_o, l_o) - rk \}$ with FOC: $R_{k_o} = \frac{r}{\phi}$. Rearranging gives expression (10) in the main text. Profits are $\pi_v^f = \pi_v - \lambda rf$ and $\pi_o^{Tf} = \pi_o - \lambda rf$, with π_v and π_o given by (4) and (8) respectively. Since λrf affects both profits functions equally, organizational choices are defined by $\Gamma(\lambda, \alpha, \beta, \phi)$. All results from the baseline model continue to hold.

Proof of Lemma 2. By definition of $\Gamma(\lambda)$: $\frac{\partial \Gamma(\lambda, \cdot)}{\partial \lambda} = \frac{\frac{\partial \pi_v}{\partial \lambda} \pi_o - \pi_v \frac{\partial \pi_o}{\partial \lambda}}{\pi_o^2} = \frac{\frac{\partial \pi_v}{\partial \lambda} - \frac{\partial \pi_o}{\partial \lambda} \frac{\pi_o}{\pi_v}}{\pi_o}$. Lemma 1 shows $\frac{\partial \Gamma(\lambda, \cdot)}{\partial \lambda} > 0$ for all λ which implies: $\frac{\frac{\partial \pi_v}{\partial \lambda}}{\pi_v} - \frac{\frac{\partial \pi_o}{\partial \lambda}}{\pi_o} = \frac{\frac{\partial \pi_v}{\partial \lambda}}{\frac{\partial \pi_o}{\partial \lambda}} - \frac{\pi_v}{\pi_o} > 0$. The functions π_v and π_o are continuous in λ . We have $\frac{\partial \pi_v}{\partial \lambda} = \Phi(\beta)(1 - (1 - \beta)\alpha)\lambda^{\frac{(\beta)\alpha}{1-\alpha}} - rf$, $\frac{\partial \pi_o}{\partial \lambda} = \Phi(\beta)(1 - (1 - \beta)\alpha)\phi^{\frac{\beta\alpha}{1-\alpha}}(1 - \phi)^{\frac{(1-\beta)\alpha}{1-\alpha}} - rf$, with $\Phi(\beta) = A^{1-\alpha} \left(\frac{r^\beta \omega^{1-\beta}}{\alpha} \right)^{\frac{-\alpha}{1-\alpha}}$. It is straightforward to check that $\pi'_v(\lambda^w) = \pi'_o(\lambda^w)$. Hence: $\frac{\frac{\partial \pi_v}{\partial \lambda}(\lambda^w)}{\frac{\partial \pi_o}{\partial \lambda}(\lambda^w)} = 1$. Therefore $\frac{\pi_v(\lambda^w)}{\pi_o(\lambda^w)} < 1$. By definition of λ^* : $\frac{\pi_v(\lambda^*)}{\pi_o(\lambda^*)} = 1$. Therefore: $\Gamma(\lambda^w) < \Gamma(\lambda^*) = 1$. Together with Lemma 1 and Proposition 1 this implies $\lambda^w < \lambda^* < 1$.

Union Welfare. We can do the same analysis for union welfare across organizational forms. We have:

$$U(w_v, l_v) - U(w_o, l_o) = (w_v - \omega)l_v - (w_o - \omega)l_o = (1 - \lambda)[R(k_v, l_v) - (1 - \phi)R(k_o, l_o)]$$

The condition for $U(w_v, l_v) > U(w_o, l_o)$ is the same for $w_v > w_o$ (see 10). Thus, all the above results hold for union welfare.

Extensions

A model with an specific investment to produce the component

Assume that production of the component requires a second capital investment, labeled k_m , according to the subproduction function $I = k_m^\xi l^{1-\xi}$ with $0 < \xi < 1$. Let k_f be the capital required to produce the final good. The production function is

$$f(k_f, k_m, l) = \left(\frac{k_f}{\beta}\right)^\beta \left(\frac{k_m}{\gamma}\right)^\gamma \left(\frac{l}{\theta}\right)^\theta \quad (17)$$

where $\gamma = \xi(1 - \beta)$, $\theta = (1 - \xi)(1 - \beta)$. $\beta \in [0, 1]$ implies $\beta + \gamma + \theta = 1$. Notice that under outsourcing the responsibility of investing in k_m is transferred to the supplier. The firm's problem under **vertical integration** is described by the following program:

$$\begin{aligned} \max_{k, m, l} \quad & \Pi^v = R(k_f, k_m, l) - w^v l - r k_f - c k_m \\ \text{s.t.} \quad & w^v = (1 - \lambda) R(k^v, m^v, l^v)^{\frac{1}{l^v}} + \lambda \omega \\ & R(k_f, k_m, l) = A^{1-\alpha} \left(\frac{k_f}{\beta}\right)^{\alpha\beta} \left(\frac{k_m}{\gamma}\right)^{\alpha\gamma} \left(\frac{l}{\theta}\right)^{\alpha\theta} \end{aligned}$$

where c is the unit cost of k_m . Equilibrium factor demands are

$$k_f^v = \frac{\beta\alpha}{r} \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^{(\beta+\gamma)}}\right)^{\frac{-\alpha}{1-\alpha}} \lambda \quad k_m^v = \frac{\gamma\alpha}{c} \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^{(\beta+\gamma)}}\right)^{\frac{-\alpha}{1-\alpha}} \lambda \quad l^v = \frac{\theta\alpha}{\omega} \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^{(\beta+\gamma)}}\right)^{\frac{-\alpha}{1-\alpha}}$$

Profits: $\Pi^v = \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^{(\beta+\gamma)}}\right)^{\frac{-\alpha}{1-\alpha}} \lambda(1 - \alpha)$. The firm's problem under **outsourcing** is described by the following program:

$$\begin{aligned} \max_{k_f, T} \quad & \Pi^F = \phi R(k_f, k_m, l) - r k_f + T \\ \text{s.t.} \quad & T \leq (1 - \phi) R(k_f, k_m, l) - w^o l - c k_m \\ & \{k_m, l\} = \operatorname{argmax}_{k_m, l} \{(1 - \phi) R(k_f, k_m, l) - w^o l - c k_m\} \\ & w^o = (1 - \lambda)(1 - \phi) R(k_f, k_m, l)^{\frac{1}{l}} + \lambda \omega \\ & R(k_f, k_m, l) = A^{1-\alpha} \left(\frac{k_f}{\beta}\right)^{\alpha\beta} \left(\frac{k_m}{\gamma}\right)^{\alpha\gamma} \left(\frac{l}{\theta}\right)^{\alpha\theta} \end{aligned}$$

The first constraint binds in equilibrium. The solution is characterized by

$$\begin{aligned} k_f^o &= \frac{(1 - \phi)\beta\alpha}{r} \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^\gamma \phi^\beta (1 - \phi)^{1-\beta}}\right)^{\frac{-\alpha}{1-\alpha}} \quad k_m^o = \frac{(1 - \phi)\gamma\alpha}{r} \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^\gamma \phi^\beta (1 - \phi)^{1-\beta}}\right)^{\frac{-\alpha}{1-\alpha}} \lambda \\ l^o &= \frac{(1 - \phi)\theta\alpha}{r} \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^\gamma \phi^\beta (1 - \phi)^{1-\beta}}\right)^{\frac{-\alpha}{1-\alpha}} \quad T = \lambda(1 - \phi)[1 - \alpha(1 - \beta)] \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^\gamma \phi^\beta (1 - \phi)^{1-\beta}}\right)^{\frac{-\alpha}{1-\alpha}} \end{aligned}$$

$$\text{Profits: } \Pi^o = [\phi(1 - \beta\alpha) + \lambda(1 - \phi)(1 - (\gamma + \theta)\alpha)] \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha\lambda^\gamma \phi^\beta (1 - \phi)^{1-\beta}}\right)^{\frac{-\alpha}{1-\alpha}}$$

Organizational choice Using the above the ratio of profits is:

$$\frac{\Pi^v}{\Pi^o} = \frac{\lambda(1-\alpha) \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha \lambda^{(\beta+\gamma)}} \right)^{\frac{-\alpha}{1-\alpha}}}{[\phi(1-\beta\alpha) + \lambda(1-\phi)(1-(\gamma+\theta)\alpha)] \left(\frac{r^\beta c^\gamma \omega^\theta}{\alpha \lambda^\gamma \phi^\beta (1-\phi)^{1-\beta}} \right)^{\frac{-\alpha}{1-\alpha}}}$$

it simplifies to Γ_1 in the main text. Hence, propositions 1 and 2 hold.

A simple version with heterogeneous firms

In the following we embed the model of Section 2.4 in the Antràs and Helpman (2004) model (keeping the partial equilibrium approach). Firms are heterogeneous in productivity, as indexed by φ_i . Upon paying an entry cost in terms of capital, firms draw φ_i from a generic distribution $G(\varphi)$ with support $(0, \infty]$. The production and revenue functions become:

$$y_i(k, m, \varphi) = \varphi_i \left(\frac{k}{\beta} \right)^\beta \left(\frac{m}{1-\beta} \right)^{(1-\beta)}, \quad R_i = \varphi_i^\alpha \left(\frac{k}{\beta} \right)^{\alpha\beta} \left(\frac{m}{1-\beta} \right)^{(1-\beta)\alpha}$$

Notice that φ_i^α is a firm-specific revenue shifter. With knowledge of φ , firms decide on the organizational form. There are fixed organizational costs which differ across ownership structures. As in Antràs and Helpman (2004) we assume fixed costs are paid in capital and are higher for integrated firms: $f_v > f_o$. Fixed costs are needed to generate a sorting of firms with different productivity into different organizational forms. *These fixed cost are in addition to the setup cost f introduced in the model above. But we could also assume that setup cost differ across organizations and obtain qualitatively similar results.* The rest of the game follows exactly as in subsection 2.4. Factor demands and wages are, under vertical integration (h refers to the heterogeneous firms version):

$$k_v^h = \varphi^{\frac{\alpha}{1-\alpha}} k_v \quad l_v^h = \varphi^{\frac{\alpha}{1-\alpha}} l_v \quad w_v^h = (1-\lambda) \frac{R(k_v, m_v, \varphi)}{l_v} + \lambda\omega - \frac{rf}{l_v}(1-\lambda)$$

And under outsourcing:

$$k_o^h = \varphi^{\frac{\alpha}{1-\alpha}} k_o \quad l_o^h = \varphi^{\frac{\alpha}{1-\alpha}} l_o \quad w_o^h = (1-\lambda)(1-\phi) \frac{R(k_o, l_o, \varphi)}{l_o} + \lambda\omega - \frac{rf}{l_o}(1-\lambda)$$

Where (k_v, l_v) and (k_o, l_o) are as given in footnotes 18 and 19. Equilibrium profits are:

$$\pi_v^h = \varphi^{\frac{\alpha}{1-\alpha}} \pi_v - \lambda rf - rf_v \quad \pi_o^h = \varphi^{\frac{\alpha}{1-\alpha}} \pi_o - \lambda rf - rf_o$$

where π_v and π_o^T are expressions (4) and (8) in the main text.

4.1.1 Productivity, union power, and organizational forms

The trade-offs driving organizational choices are the same as in the baseline model. The difference is that firms with different productivity levels self-select into different organizational forms. There are two cutoffs (φ_v, φ_o) characterizing the equilibrium. These are implicitly given by : $\pi_v^h(\varphi_v) - \pi_o^h(\varphi_v) = 0$ and $\pi_o^h(\varphi_o) = 0$, or:

$$\varphi_v = \left(\frac{r(f_v - f_o)}{\pi_v - \pi_o} \right)^{\frac{1-\alpha}{\alpha}} = \left(\frac{r(f_v - f_o)\pi_o}{\Gamma(\lambda) - 1} \right)^{\frac{1-\alpha}{\alpha}}, \quad \varphi_o = \left(\frac{rf_o}{\pi_o} \right)^{\frac{1-\alpha}{\alpha}}$$

There are two types of equilibria. For $\lambda > \lambda^*$, $\Gamma(\lambda) > 1$. In such a case, for $f_v - f_o$ sufficiently large we have $\varphi_v > \varphi_o$: most productive firms choose integration, while least productive firms outsource. Those with $\varphi_i < \varphi_o$ exit. The condition that ensures $\varphi_v > \varphi_o \forall \lambda \in (\lambda^*, 1]$ is $f_v - f_o > (\Gamma(\lambda) - 1)(f_o + f)$: when choosing vertical integration, the increase in fixed costs has to be large in relation to the increase in variable profits. For $\lambda \leq \lambda^*$, $\Gamma(\lambda) \leq 1$ no firm chooses vertical integration: surviving firms outsource and those with $\varphi_i < \varphi_o$ exit. The case discussed in Section 2.4 has $\lambda > \lambda^*$ and $\varphi_v > \varphi_o$. Compare two firms i and j such that both firms are active and firm i chooses integration and firm j outsourcing (i.e. $\varphi_o < \varphi_j < \varphi_v < \varphi_i$). The difference in wages is:

$$\frac{w_i - w_j}{\omega} = \frac{rf(1-\lambda)}{(1-\beta)\alpha} \left(\frac{1}{(1-\phi)R(k^o, m^o, \varphi_j)} - \frac{1}{R(k^v, m^v, \varphi_i)} \right) = \varphi_j^{\frac{\alpha}{1-\alpha}} \lambda^{\frac{\beta\alpha}{1-\alpha}} - \varphi_i^{\frac{\alpha}{1-\alpha}} (\phi^\beta (1-\phi)^{1-\beta})$$

The wage differential results from the combination of productivity and organizational advantages. The condition for $\frac{w_i - w_j}{\omega} > 0$ is

$$\lambda > \phi(1-\phi)^{\frac{1-\alpha\beta}{\alpha\beta}} \left(\frac{\varphi_j}{\varphi_i} \right)^{\frac{\alpha}{1-\alpha}} \rightarrow \lambda > \lambda^w \left(\frac{\varphi_j}{\varphi_i} \right)^{\frac{\alpha}{1-\alpha}}$$

With $\left(\frac{\varphi_j}{\varphi_i} \right)^{\frac{\alpha}{1-\alpha}} < 1$. Hence, Lemma 2 ensures that for any $\lambda > \lambda^*$ we have $w_i > w_j$: at equilibrium the most productive firms chooses to integrate (and become MNE) and pay higher wages. The wage differential arises because of φ and the choice of organizational form.

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Table 6: Worker bargaining power and intra-firm trade

Dependent variable:	Share of intra-firm imports		
	(1)	(2)	(3)
Worker bargaining power	-0.065** (0.028)	-0.102*** (0.034)	-0.108*** (0.037)
Labor rigidity index			-0.060* (0.035)
Rule of Law		0.194** (0.083)	0.144* (0.082)
FDI openness		0.002** (0.001)	0.002* (0.001)
Trade openness		-0.001 (0.001)	-0.001 (0.001)
Entry costs		-0.018 (0.058)	-0.023 (0.054)
IPR protection		0.000 (0.000)	0.000 (0.000)
Creditor's rights		-0.033*** (0.007)	-0.036*** (0.006)
Corporate tax rate		0.001 (0.001)	0.001 (0.001)
Distance (weighted)		0.000 (0.000)	-0.000 (0.000)
French speaking		-0.049*** (0.017)	-0.062*** (0.020)
Capital endowment		-0.013 (0.026)	0.007 (0.029)
Skill endowment		-0.042*** (0.015)	-0.040** (0.015)
# Clusters	57	57	57
Imported product dummies	Yes	Yes	Yes
Firm dummies	Yes	Yes	Yes
Observations	85,909	85,909	85,909
R-squared	0.599	0.604	0.604

Notes: The regressions are OLS estimations of (12). The dependent variable is the share of intra-firm imports of HS4-product p from exporting country c by firm i . Dummies by firm and imported product and a constant are included in all specifications. “Worker bargaining power” measures the power and protection of workers during industrial conflicts. Both are obtained from Botero et al. (2004)- details are provided in the data appendix. “Labor Rigidity Index” is the “Employment Laws Index” from Botero et al (2004). “Rule of law” is an index weighting variables capturing the perceptions of individuals about the enforcement of contracts from Kaufmann, Kraay and Mastruzzi (2003) in 1997 and 1998. “FDI openness” and “Trade openness” are from the Heritage Foundation. “Entry costs” measures of the cost of obtaining legal status to operate a firm (normalized by per capita GDP in 1999) from Djankov et al. (2002). “IPR Protection” in 2000 is drawn from Ginarte and Park (1997). “Creditor’s rights” in 1999 comes from Djankov et al. (2007) and ranges from 0 (weak creditor rights) to 4 (strong creditor rights). “Corporate tax” is the top tax rate to corporations from World Tax database (U. of Michigan). “Distance” is between the biggest cities of any two countries, weighted by population from CEPIL. “French speaking” equals one if French is the exporting country’s official or national language. “Capital endowment” is the log of the stock capital per worker from the Penn World Tables. “Skill endowment” is the percentage of the population over age 25 with at least secondary education from Barro and Lee (2000). Heteroskedasticity-robust standard errors clustered by country are reported in parentheses. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 7: Worker bargaining power and intra-firm trade: sensitivity

Dependent variable:	Share of intra-firm imports					
Sample:	Full	OECD 18	OECD	Switchers	Full	OECD
	(1)	(2)	(3)	(4)	(5)	(6)
Worker bargaining power			-0.181*** (0.031)	-0.151*** (0.051)	0.056 (0.043)	-0.009 (0.041)
Collective Relations index	-0.190*** (0.055)					
Union coverage 1999		-0.207*** (0.042)				
$WBP_c \times \text{int good dummy}$					-0.205*** (0.026)	-0.215*** (0.030)
# Clusters	57	18	25	57	57	25
Full set of country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Imported product dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85,909	76,488	79,881	63,986	85,909	79,881
R-squared	0.604	0.628	0.621	0.4613	0.610	0.627

Notes: The regressions are OLS estimations of (12). The dependent variable is the share of intra-firm imports of HS4-product p from exporting country c by firm i . Dummies by firm and imported product and a constant are included in all specifications. “Worker bargaining power” measures the power and protection of workers during industrial conflicts. The “Collective Relations index” synthetically enlarges the “Worker bargaining power index” with variables measuring the statutory protection of trade unions. Both are obtained from Botero et al. (2004)- details are provided in the data appendix. “OECD” includes all OECD members as of 1999. “OECD 18” includes OECD countries with data on union coverage (full list in the data appendix). “Switchers” includes only firms that report positive imports under both sourcing modes across countries and products (1788 firms). “int good dummy” equals one if the imported product is different from the main product of the importer. All regressions include the full set of country-levels controls of column (4) in Table 6. Heteroskedasticity-robust standard errors clustered by country are reported in parentheses. * indicates significance at the 1 percent level.

Table 8: Unionization rates across US industries (imports from the US only)

Dependent variable:	Share of intra-firm imports			
	(1)	(2)	(3)	(4)
(Union membership) $_{CIC-us}$	-0.011*** (0.002)	-0.012*** (0.003)	-0.012*** (0.003)	
(Union Coverage) $_{CIC-us}$				-0.011*** (0.003)
(k/l) $_{CIC-us}$		-0.014 (0.031)	0.012 (0.040)	0.004 (0.041)
(VA/shipments) $_{CIC-us}$			0.367 (0.355)	0.419 (0.356)
(h/l) $_{CIC-us}$		-0.098 (0.069)	-0.141* (0.077)	-0.126 (0.079)
Av_spec $_{CIC-us}$			0.044 (0.056)	0.043 (0.056)
EU-US tariffs (HS3)			-0.131 (0.243)	-0.140 (0.249)
# Clusters	50	50	50	50
Observations	162	162	162	162
R-squared	0.124	0.138	0.151	0.143

Notes: The regressions are OLS estimations of (13). The dependent variable is a weighted share of intra-firm imports aggregated at the HS3 level. “Union Membership $_{CIC-us}$ ” is the percentage of workers who are union members, and Union Coverage $_{CIC-us}$ is the percentage who are covered by union contracts. (k/l) $_{CIC-us}$ is the (log) of capital to employment ratio. (h/l) $_{CIC-us}$ is the ratio of non-production to total workers. Av_spec $_{CIC-us}$ is the production-weighted average of the Rauch (1999) index. All sector variables are defined at the 3-digit CIC level. EU-US tariffs (HS3) are ad valorem tariffs imposed by the EU to the US. Sources and details are in the data appendix. Heteroskedasticity-robust standard errors clustered by CIC codes are reported in parentheses. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 9: Capital Intensity across high and low WBP_c countries

Dependent variable:	Share of intra-firm imports			
	Full Sample		WBP_c above median	WBP_c below median
	(1)	(2)	(3)	(4)
$(k/l)_n$	0.043** (0.021)	0.015 (0.025)	0.014 (0.025)	0.021 (0.027)
$(k/l)_n \times Spec_n$		0.065*** (0.025)	0.055** (0.026)	0.078*** (0.029)
$Spec_n$	0.060** (0.026)	-0.310** (0.144)	-0.269* (0.150)	-0.352** (0.166)
# Clusters	254	254	251	249
Country dummies	Yes	Yes	Yes	Yes
Imported product dummies	Yes	Yes	Yes	Yes
Industry- + Firm- level controls	Yes	Yes	Yes	Yes
Observations	86,307	86,307	51,109	33,895
R-squared	0.115	0.117	0.110	0.129

Notes: The regressions are OLS estimations of (14). $(k/l)_n$ is the 4-digit NAF median of firm level (log) ratio of the capital stock to total employment. $Spec_n$ is a binary variable that equals 1 if the 4-digit industry is classified as specific (see Section 3.1 for details). Industry controls include: skill intensity, value added over total output and median size (precise definitions in the data appendix). Firm-level controls include (in logs): total imports, size and labor productivity. Column (3) and (4) restrict the sample to countries with value of worker bargaining power above and below the sample median respectively. Heteroskedasticity-robust standard errors clustered by industry are reported in parentheses. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 10: Worker bargaining power, specificity and capital intensity

$(k/l)_n$ measured with:	Full Sample	Relationship-Specific Industries		
	French data	US data		
	(1)	(2)	(3)	(4)
$WBP_c \times ((k/l)_n > median)$	-0.102** (0.041)	-0.133*** (0.047)	-0.125*** (0.043)	
$WBP_c \times ((k/l)_n < median)$	-0.115*** (0.038)	-0.082* (0.046)	-0.085* (0.044)	
WBP_c				-0.106** (0.043)
# Clusters	57	54	53	54
Full set of country-level controls	Yes	Yes	Yes	Yes
Imported product dummies	Yes	Yes	Yes	Yes
Firm dummies	Yes	Yes	Yes	Yes
Observations	85,725	58,976	53,026	59,055
R-squared	0.537	0.542	0.545	0.542

Notes: The regressions are OLS estimations of (15). WBP_c is “Worker bargaining power”. It measures the power and protection of workers during industrial conflicts, from Botero et al. (2004)- details are provided in the data appendix. $(k/l)_n$ is the 4-digit NAF median of firm level (log) ratio of the capital stock to total employment. $((k/l)_n > median)$ equals 1 if $(k/l)_n$ is above the sample median and zero otherwise, and $((k/l)_n < median)$ equals 1 if $(k/l)_n$ is below the sample median and zero otherwise. “Relationship-specific industries” is the subsample of industries with $Spec_n = 1$. $Spec_n$ is a binary variable that equals 1 if the 4-digit industry is classified as specific (see Section 3.1 for details). All regressions include the full set of country-levels controls of column (4) in Table 6. Heteroskedasticity-robust standard errors clustered by country are reported in parentheses. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.