

Schymik, Jan; Marin, Dalia; Tarasov, Alexander

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Trade in Tasks and the Organization of Firms*

Dalia Marin Jan Schymik Alexander Tarasov
University of Munich University of Munich University of Munich

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Abstract

We incorporate trade in tasks à la Grossman and Rossi-Hansberg (2008) into the international trade theory of firm organization of Marin and Verdier (2012) to examine how offshoring affects the way firms organize. We test the predictions of the model based on firm level data of 660 Austrian and German multinational firms with 2200 subsidiaries in Eastern Europe and we show that the data are consistent with the theory. We find that offshoring of production tasks leads firms to reorganize to more decentralized management improving competitiveness of offshoring firms. We show further that offshoring of skilled managers relaxes the 'war for talent' constraint but toughens competition and thus has an ambiguous impact on the level of decentralization and CEO wages of offshoring firms. In sufficiently open economies, however, managerial offshoring unambiguously leads to more decentralized management.

Keywords:

JEL classification:

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1 Introduction

In the last two decades the nature of international trade has been changing. Modern economic commerce involves movements across international boundaries – but often within the boundaries of the firm. It is often characterized by a 'war for talent' rather than a 'war for market shares'. Firms engaged in international trade have met these challenges of the new features of world trade by organizing production in an international value chain, by decentralizing their system of command in flatter corporate hierarchies, by making human capital to the new stakeholder of the firm, and by compensating their CEOs with skyrocket earnings. Thus, we ask: have offshoring and 'trade in tasks' been the driving forces behind these observed changes in the corporation?¹

In an international value chain or 'trade in tasks' firms separate geographically different production stages across the world economy to exploit differences in production costs. Trade in tasks is also discussed in the literature under the heading 'slicing the value chain', 'vertical specialization', 'fragmentation', or 'offshoring'. According to an estimate, such vertical specialization accounts for a third of the increase in world trade since 1970 (see Hummels et al. (2001)) and intra-firm imports account between 22 to 69 percent of total imports between old and new Europe (see Marin (2010)). World investment outflows increased 4.5 times between 1990 and 2005 from 202 billion US\$ to 916 billion US\$ (see World Investment Report (2006), UNCTAD).²

Data on the changing nature of the corporation have become available only recently. Rajan and Wulf (2006) and Marin and Verdier (2010) document that firms in the US, Germany, and Austria shifted to a more decentralized organization over time. Marin (2009) and Marin and Verdier (2010) show that firms in the larger economy, Germany, are more decentralized compared to firms in the smaller economy, Austria. Bloom, van Reenen, and Sadun (2010) report that firms in the US, UK, and Northern Europe have the most decentralized organization, while firms in Asian countries are most centralized.

The literature on organization and trade has so far examined how international trade in final goods affects the internal organization of firms. Marin and Verdier (2008,2010) and Caliendo and Rossi-Hansberg (2012) show based on, respectively, a Krugman (1980) model, a Melitz and

¹For the new corporation, see The Economist (2006) and Marin (2009).

²For the new features of globalization, see Hummels et al. (2001), Feenstra (1998), and Grossman and Rossi-Hansberg (2008). For the new international division of labour in Europe, see Marin (2006). For a recent estimate on global value added chains, see Johnson and Noguera (2012).

Ottaviano (2008) model, and a Melitz (2003) model of international trade, that North-North trade induces firms to reorganize their production and to decentralize decision making power to lower levels of management. Marin and Verdier (2012) examine the organizational implications of trade integration within a framework of a Helpman and Krugman (1985) model of North-South trade in which countries differ in factor endowments and they show that North-South trade leads in the integrated world economy to the emergence of the talent firm in which human capital becomes the new stakeholder in firms. All these models have in common that they do not consider how offshoring or trade in tasks affects the firm organization of offshoring firms. As the above figures show, however, trade in tasks and intra-firm trade have increased much stronger than final goods trade in the last two decades making offshoring an important candidate as a driver of organizational change. This will be particularly the case if one takes into account that the relocation of firm activities to other countries typically involves a major reorganization of the activity that remains in offshoring firms in the North. Thus, offshoring and the reorganization of firms appear to occur hand in hand.³

In this paper we incorporate trade in tasks à la Grossman and Rossi-Hansberg (2008) (GRH) into the international trade theory of firm organization of Marin and Verdier (2012) (MV) to explore how offshoring of different types of labour (production workers, managers) affects the internal organization of offshoring firms in a small open economy. By merging these two models, our paper contributes in several ways to the recent literature on globalization and the organization of firms. First, we show that offshoring of low-skill tasks by Northern firms to the South induces firms to reorganize to a more decentralized hierarchy, in which power is allocated to the skilled manager in Northern firms. In GRH this effect is absent, because they do not consider firms' choice of organizational form. However, relocating tasks to other countries typically involves major reorganization in offshoring firms resulting in productivity gains that go above and beyond the mere discovery of cheap production opportunities in the South. The latter effect is considered by GRH, which they call labour-augmenting technological change.⁴

Second, we find that Northern firms gain market shares vis-à-vis foreign rivals as a result of the productivity gains from offshoring. The improved competitiveness of Northern firms has

³One exception is Antras, Garicano, and Rossi-Hansberg (2006) who explore how the formation of international teams influences the organization of firms and the structure of wages.

⁴Marin (2010) shows that the discovery of cheap labour in Eastern Europe by German multinational firms has allowed German affiliate firms in Eastern Europe to cut unit labour costs relative to German parent firms by over 70 percent. Amiti and Konings (2007), and Halpern, Koren, and Szeidl (2011) quantify the productivity effect from offshoring for Indonesia and Hungary, respectively.

been an important argument in the empirical literature on the labour market effects of offshoring. This literature argues that offshoring to the South has not led to major job losses in the North, because it has helped Northern firms to gain market shares increasing the demand for labour in Northern firm. Improved competitiveness as a result of offshoring has so far not been shown in the literature, neither theoretically nor empirically. In GRH such a change in competitiveness in the North cannot arise, because they consider a framework with perfect competition.⁵

Third, Marin and Verdier (2012) show that trade liberalization triggers a 'war for talent' as market entry is constrained by the pool of available managers in the North. Firms compete for the limited amount of skilled managers available in the North pushing up the relative wage for skilled managers. By incorporating 'trade in tasks' into Marin and Verdier (2012), we find that when the country is not too open to foreign competition, offshoring of skilled managers to the South makes the 'war for talent' constraint on managers in the North less binding. As a result, offshoring may lead to lower relative wages for skilled managers and it may induce firms to recentralize decision making power to top management in Northern firms. Offshoring of managerial tasks to the South may explain why the rise in CEO compensation in Germany has been less pronounced compared to the US.⁶ In the empirical part of this paper, we show that offshoring of managerial tasks to Eastern Europe has occurred frequently (in about 60 percent of German and Austrian foreign direct investments) and it has contributed to lowering relative CEO wages by between 18 and 26 percent.

We consider an economy with two sectors and two factors of production (workers and managers). Sector Y produces a homogenous good under perfect competition. Sector X is monopolistically competitive à la Helpman and Krugman (1985). In the X -sector firms producing a variety of the differentiated product can choose between three types of organization: the centralized P -organization, in which the principal holds formal power in cooperation with the agent, the decentralized A -organization, in which the agent has formal power, and the centralized O -organization, in which the principal runs the firm without the cooperation of the agent. There is free entry into the industry. Workers (low-skilled labor) are used in production of both products, while managers (high-skilled labor) are only used for entry into the industry. In other words, firms need to hire a manager to run a firm.

⁵For the labour market effects of offshoring, see Brainard and Riker (1997), Marin (2004), Becker and Muendler (2010). For the increase in market shares of German and Austrian firms as a result of offshoring, see Marin, Schymik, Tscheke (2014).

⁶For the stylized features of the rise in CEO pay in Germany, see Fabbri and Marin (2013).

As a benchmark environment, we consider a small open economy. The price of the homogenous good is equal to the world price and, thereby, exogenous. To model a differentiated sector in a small open economy, we assume that the number of imported varieties and their prices are exogenously given. In addition, domestic firms producing varieties of the differentiated product face an exogenous foreign demand for their products.⁷

We analyze two types of offshoring activity in the X -sector: offshoring of production workers and offshoring of managerial tasks. We find that offshoring of production labor in the differentiated sector unambiguously increases firms' real profits. As a result, Northern firms delegate decision making power to middle managers and in this way firms become more decentralized. The intuition behind this finding is as follows. Since labor is offshored only in the differentiated sector, the wage level of low-skilled labor does not change (it is pinned down by the world price of the homogenous good). Therefore, we can divide the impact of offshoring on real profits into two effects. First, offshoring lowers marginal costs of production and increases profits. The increase in productivity of domestic firms allows Northern firms to win market shares from foreign rivals, which increases firms' profits. Second, the increase in profits induces firm entry, which makes domestic competition tougher lowering firms' revenues and profits. However, we show that in an open economy the positive productivity effect is always stronger than the negative competition effect and, as a result, profits unambiguously increase. When profits rise, principals in firms start to monitor more inside the firm potentially destroying the initiative of skilled managers. When the increase in offshoring is sufficiently large, profits rise and the trade-off between control and initiative in the firm moves in favor of keeping the initiative of the skilled manager alive. As a result, principals delegate decision power to the skilled manager.

Offshoring of managerial tasks to the South affects CEO relative wages and the internal organization of Northern firms in the following way. First, offshoring of managers lowers the demand for managers in the North, which relaxes the 'war for talent' constraint in the North lowering the relative wage of skilled managers and the level of profits that firms require to enter the market (the labor market effect). Second, lower start-up costs of a firm (recall that each firm has to hire a manager to start a firm) induce firm entry into the market, which increases competition and raises the demand for managers resulting in a rise in the relative wage of managers (the 'war for talent' effect). We show that when the economy is sufficiently open to

⁷For the small open economy framework, see Demidova and Rodriguez-Clare (2009).

international trade, the 'war for talent' effect dominates the labor market effect making it more likely that Northern firms decentralize management. We show further that when the economy is sufficiently closed to international trade, the labor market effect is large making it more likely that Northern firms pay their CEOs lower wages (relative to workers).

We test the predictions of the model based on original firm level data we designed and collected of 660 Austrian and German multinational firms with 2200 subsidiaries in Eastern Europe and we show that the data are consistent with the theory. We find that offshoring of production tasks unambiguously leads to more decentralized management structures inside parent multinational firms. Furthermore, we find that the effect of offshoring managerial tasks on the decentralization of management depends on the level of foreign product market competition. Managerial task offshoring leads to more a centralized management in parent firms if there is only little foreign competition. If however there is fierce foreign competition, management inside the parent firm is decentralized. Furthermore, we find that managerial offshoring lowers relative executive wages. This effect is reduced when the foreign competition is low.

The paper is organized in the following sections. Section 2 describes the model. Section 3 examines how offshoring of production workers and managerial labour affects the way firms organize. Section 4 describes the firm survey and the empirical results. Section 5 concludes.

2 The Model

We consider a small open economy with two goods and two factors of production: skilled and unskilled labor. The utility function of a representative consumer is given by

$$U(X, Y) = X^a Y^{1-a}, \quad a \in (0, 1), \quad (1)$$

where Y is a homogenous good and X is a differentiated good:

$$X = \left[\int_{i \in \Omega} x(i)^\rho di + \int_{i' \in \Omega_m} x_m(i')^\rho di' \right]^{1/\rho} \quad \text{and } 0 < \rho < 1.$$

Here Ω and Ω_m represent the set of domestic and foreign varieties, respectively. The homogenous good is produced in a perfectly competitive environment with a linear technology that requires only unskilled labor. Domestic varieties of the differentiated good are produced under

monopolistic competition with free entry.

2.1 Firm Organization

In modeling the internal organization of a firm producing a variety of the differentiated product in an international market, we follow Marin and Verdier (2012). We assume that the firm consists of an owner (the principal P) and a manager (the agent A). In particular, in each firm the principal hires a skilled manager to start a firm and employs unskilled workers to produce.

We assume that there are a number of alternative ways to run the firm that differ in terms of production costs and, therefore, payoffs. However, only two of them are worth doing from the perspective of the principal and the manager. One project has the lowest cost of production and, thereby, yields the highest possible profit B . The other project is the "best project" for the manager yielding the highest possible non-pecuniary benefit b for the manager (e.g. perks or career concerns). Thus, there is a potential conflict of interest between the principal and the manager. We denote αB ($\alpha \in [0, 1)$) as the principal's benefit when the best project for the manager is implemented. To simplify the analysis, we assume that the manager's benefit when the best project for the principal is implemented is zero. Here α captures the degree of conflict between the principal and the manager. B and b are supposed to be known ex ante, but the parties do not know ex ante which project yields such payoff.

To gather information on the payoffs of the projects, the principal uses a low skilled labor monitoring technology. Specifically, by investing some amount of unskilled labor L , the principal learns all the payoffs with probability $E = \min(1, \sqrt{L})$ and remains uninformed with probability $1 - E$. Similarly, by exerting some effort ke ($k < b$), the agent learns the payoff of all projects with probability $e \in [0, \bar{e}]$ and remains uninformed with probability $1 - e$. We assume that the principal is risk neutral and that the agent is infinitely risk averse with respect to income. As a result, the agent is not responsive to monetary incentives and receives a fixed wage q .

We also assume that, among available projects, there are some with very high negative payoffs to both the principal and the agent. This assumption implies that choosing a random project without being informed is not profitable. In particular, if the principal and the agent do not know the payoffs, there is no production. Thus, private information about the payoffs gives decision control to the informed party that, in this case, has "real power" rather than "formal power" in the firm.

In the X -sector principals in firms choose between three modes of organizations to maximize her utility: a P -organization, an A -organization, and an O -organization. In the P -organization, the principal has formal power. In the A -organization, the principal delegates formal power to the manager. Finally, in the O -organization, the principal also has formal power, but the manager puts zero effort into learning the payoffs of the available projects (one can think of the O -organization as the P -organization with zero effort put in by the manager).

2.1.1 The P -organization

Under the P -organization, the principal has formal power. In this case, if the principal is fully informed about the payoffs, then the best project for the principal is implemented and the principal's monetary payoff is B , while the manager receives zero. If the principal is uninformed and the manager is informed, then the manager has real power and suggests her best project (which is accepted by the principal). The principal receives a monetary payoff αB and the manager receives private benefit b . If both the parties remain uninformed, there is no production.

Hence, the expected payoffs of the principal and the agent are given by

$$\begin{aligned} u_P &= EB + (1 - E)e\alpha B - wE^2, \\ u_A &= (1 - E)eb - ke. \end{aligned}$$

Here w is the wage rate of unskilled labor (wE^2 is the principal's cost of learning the project payoffs). The first order conditions of the parties with respect to efforts E and e highlight the trade-off between control and initiative in the firm. They are

$$\begin{aligned} \text{Principal:} & \quad B(1 - \alpha e) = 2wE, \\ \text{Agent:} & \quad \begin{cases} e = \bar{e} & \text{if } k \leq b(1 - E), \\ e = 0 & \text{otherwise.} \end{cases} \end{aligned}$$

The principal invests in more monitoring the higher the monetary payoff B , the larger the conflict of interest between the principal and the manager (the lower α), and the lower the manager's effort e . The agent puts in more effort the higher her benefit b from the project and the lower the principal's interference (the lower E). Thus, the principal's control over the firm comes at cost of lower agent's initiative.

Marin and Verdier (2012) show that the equilibrium levels of effort under the P -organization are

$$\begin{aligned} E_P^* &= \frac{B(1 - \alpha\bar{e})}{2w}, e_P^* = \bar{e} & \text{if } B/w \leq \tilde{B}_P \\ E_P^* &= \frac{B}{2w}, e_P^* = 0 & \text{if } B/w > \tilde{B}_P, \end{aligned} \quad (2)$$

with the cutoff level of profits at which the effort of the agent is killed as

$$\tilde{B}_P = \frac{2(1 - k/b)}{1 - \alpha\bar{e}}.$$

Note that the case with zero effort put in by the manager corresponds to the O -organization.⁸ Thus, it is straightforward to show that the expected utility of the principal under the P -organization is

$$u_P^* = w(E_P^*)^2 + e_P^*\alpha B. \quad (3)$$

2.1.2 The A -organization

Under the A -organization, the principal delegates formal power to the manager. If both parties are informed, then the best project for the manager is implemented. When the principal is informed and the agent is uninformed, the principal suggests her preferred project and, thereby, has real power. The expected payoffs of the principal and the agent are

$$\begin{aligned} v_P &= e\alpha B + (1 - e)EB - wE^2, \\ v_A &= eb - ke. \end{aligned}$$

The first order conditions of the parties with respect to efforts E and e are

$$\begin{aligned} \text{Principal:} & \quad B(1 - e) = 2wE, \\ \text{Agent:} & \quad e = \bar{e}, \end{aligned}$$

as b is assumed to be greater than k .

⁸The O -organization can be thought of as a single managed P -firm (run by the principal) without an internal hierarchy. The skilled agent is employed but he is not doing anything useful, since the agent's effort is assumed not to be contractible.

The advantage of delegating formal power to the manager is that the manager has more incentives to become informed. Specifically, under the A -organization, the manager always puts in the maximum effort \bar{e} . In contrast, the principal has fewer incentives to invest in monitoring the projects and, as a result, the principal loses not only formal power, but also real power. The equilibrium values of E and e are

$$E_A^* = \frac{B(1 - \bar{e})}{2w}, \quad e_A^* = \bar{e}.$$

Hence, the expected utility of the principal under the A -organization is

$$v_P^* = w(E_A^*)^2 + e_A^* \alpha B. \quad (4)$$

2.1.3 The Choice of Decentralized Management

We now explore how the decision whether to delegate formal power to the manager or not depends on the firm's real payoff B/w . In particular, the following proposition holds (see Marin and Verdier (2012) for details).

Proposition 1 *Assume that*

$$\tilde{B}_P = \frac{2(1 - k/b)}{1 - \alpha \bar{e}} < \bar{B} = \frac{4\alpha}{2 - \bar{e}}.$$

It follows that, for $B/w < \tilde{B}_P$, the principal chooses the P -organization. For $\tilde{B}_P \leq B/w < \bar{B}$, the principal prefers the A -organization. Finally, for $B/w \geq \bar{B}$, the O -organization (the P -organization with zero effort put in by the manager) yields the highest utility to the principal.

Proof. For convenience we reproduce the proof of the proposition in the Appendix. ■

Intuitively, a trade-off between control and initiative arises at intermediate levels of profits and the trade-off disappears at low and high levels of profits. At $\tilde{B}_P \leq B/w < \bar{B}$, the principal delegates formal power to the manager to keep her initiative. As a result the A -organization is optimal. At high levels of profits ($B/w \geq \bar{B}$), the principal's stakes are so high that she puts a lot effort in monitoring the projects, which in turn leads to zero effort put in by the manager under any type of firm organization. As a result, the O -organization is optimal. At low levels of profits ($B/w < \tilde{B}_P$), the principal's stakes are small and, therefore, she monitors

and intervenes little and she does not destroy the initiative of the manager even when she keeps control. The manager puts in the maximum effort and the P -organization is optimal.

2.2 Product Markets and Trade Environment

In the previous section the profits of firms were exogenous. We now endogenize profits by introducing product market competition and trade in the model. In particular, we consider a small open economy where the number and the prices of foreign varieties are taken as given.⁹ In addition, we assume that there is some exogenous foreign demand for domestic varieties, which is given by $A_m/p(i)^\sigma$ (where A_m is some parameter).

Domestic demand for home and foreign varieties of the differentiated good X is

$$\begin{aligned} x(i) &= \frac{aRP^{\sigma-1}}{(p(i))^\sigma}, \\ x_m(i') &= \frac{aRP^{\sigma-1}}{(p_m(i'))^\sigma}, \end{aligned}$$

where R is the total expenditure in the economy, $p_m(i')$ is the price of an imported variety i' , and P is the CES price index given by

$$P^{1-\sigma} = \int_{i \in \Omega} p(i)^{1-\sigma} di + \int_{i' \in \Omega_m} p_m(i')^{1-\sigma} di'.$$

Here σ is the elasticity of substitution. Without loss of generality, we assume that $p_m(i') = p_m$ for any i' . Then,

$$P^{1-\sigma} = \int_{i \in \Omega} p(i)^{1-\sigma} di + n^* (p_m)^{1-\sigma}, \quad (5)$$

where n^* is the number of foreign varieties in the market (which is exogenous). To simplify the notation, we denote the level of import penetration, $n^* (p_m)^{1-\sigma}$, by IM .

Demand for the homogenous product is

$$Y = \frac{(1-a)R}{p_Y},$$

where p_Y is the world price of the good. It is assumed that the homogeneous good is produced

⁹Modeling a large open economy adds unnecessary complexity to the analysis. Moreover, under certain assumptions, we do not expect that the implications will be qualitatively different from those derived in the present framework.

with a linear one-to-one technology (requiring only unskilled labor). Hence, the wage rate of unskilled labor is pinned down by the world price:

$$w = p_Y.$$

We assume that the marginal cost of production of a firm producing variety i is $wc(i)/Z_X$, where $c(i)$ stands for the part of the cost that depends on which project is implemented. If the best project for the principal is implemented, then $c(i) = c_B$, otherwise, $c(i) = c_b$ with $c_b > c_B$. The idea here is that when the agent has 'real power' in the firm she does not necessarily pick the cost minimizing project but rather one which increases her perks. This is how the conflict of interest between the principal and the agent translates to the production side of the firm. The variable Z_X , in turn, describes the "productivity" gains from offshoring some production tasks abroad. Specifically, Z_X is strictly more than one, if some part of the production is offshored, and equal to one, if the firm does not offshore (we specify Z_X in the next section). Thus, given the demand for domestic varieties, the price of variety i is

$$p(i) = \frac{\sigma}{\sigma - 1} \frac{w}{Z_X} c(i),$$

This implies that the firm's total profits (taking into account sales abroad) are

$$\pi(i) = C (aRP^{\sigma-1} + A_m) \left(\frac{w}{Z_X} c(i) \right)^{1-\sigma},$$

where $C = \frac{1}{\sigma} \left(\frac{\sigma-1}{\sigma} \right)^{\sigma-1}$.

2.3 Trade in Tasks

To model offshoring of labor tasks, we adopt the framework in Grossman and Rossi-Hansberg (2008). In particular, we assume that production in the differentiated sector involves a continuum of tasks (of measure one) and performing each task requires $c(i)$ units of labor. Production of each task can be offshored abroad. The cost of offshoring task $j \in [0, 1]$ is $\gamma t(j)$, where $t(j)$ is increasing and continuously differentiable, implying that it is more costly to offshore high-indexed tasks.

It is profitable to offshore task j if and only if the cost of producing it domestically is higher

than the cost of offshoring. That is,

$$wc(i) > \gamma t(j)w^*c(i),$$

where w^* is the cost of unskilled labor abroad. The latter implies that tasks with index $j \in [0, I_X]$ are offshored, while the other tasks are performed domestically. Here I_X solves¹⁰

$$w = \gamma t(I_X)w^*. \quad (6)$$

Given the possibility of offshoring, the marginal cost of a firm producing variety i is

$$MC_i = wc(i)(1 - I_X) + w^*c(i) \int_0^{I_X} \gamma t(j) dj.$$

Taking into account (6), we have

$$MC_i = wc(i) \left(1 - I_X + \left(\int_0^{I_X} t(j) dj \right) / t(I_X) \right).$$

From the definition of Z_X ,

$$MC_i = \frac{w}{Z_X} c(i).$$

This means that the productivity gains from offshoring represented by Z_X are

$$Z_X = \frac{1}{1 - I_X + \left(\int_0^{I_X} t(j) dj \right) / t(I_X)} > 1.$$

As can be seen, Z_X is increasing in I_X . The more tasks are offshored, the more productive are the firms. If there is no offshoring ($I_X = 0$), then Z_X is equal to one and the marginal cost is $wc(i)$.

In the same spirit, we consider offshoring of managerial tasks as a continuum of tasks (of measure one) performed by a manager which may be offshored abroad. Performing each task

¹⁰Note that to guarantee the interior solution of (6), we need to assume that

$$\frac{1}{t(1)} < \gamma \frac{w^*}{w} < \frac{1}{t(0)}.$$

The condition states that the cost of offshoring of tasks with lower indexes should be sufficiently low, while the cost of offshoring of tasks with higher indexes should be sufficiently high. In this case, only a certain positive fraction of tasks is offshored.

requires one unit of managerial labor. Tasks that are not offshored are performed by a domestic manager who is paid according to the number of performed tasks. Note that the domestic manager searches for projects for the firm, as she receives a non-pecuniary benefit from the implemented project. We assume that the "foreign" manager does not receive any benefits from implemented projects and, therefore, does not have incentives to search for projects. That is, the foreign manager only performs some offshored tasks that are necessary to start a firm.

We assume that the fraction of tasks that can be offshored is exogenously given by I_S .¹¹ Offshoring of managerial tasks is profitable only if the cost of foreign managers is less than the cost of a domestic manager: i.e., $q > q^*$ (where q and q^* are the cost of skilled labor in the home and abroad, respectively). We assume that q^* is sufficiently low that the constraint on the number of tasks that can be offshored is binding: domestic firms find it profitable to offshore all the tasks they can offshore. In this case, the cost of entry into the market is given by $q(1 - I_S) + q^*I_S$.

2.4 The Equilibrium

Recall that the profits of a firm producing variety i are

$$\pi(i) = C (aRP^{\sigma-1} + A_m) \left(\frac{w}{Z_X} c(i) \right)^{1-\sigma}.$$

When the principal picks the project and she has real power in the firm, the marginal cost of production is c_B and her benefit is

$$B = C (aRP^{\sigma-1} + A_m) \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \quad (7)$$

with

$$\alpha = \left(\frac{c_b}{c_B} \right)^{1-\sigma} < 1.$$

Depending on the parameters in the model, there are three types of equilibria (with the P -organizations, the A -organizations, and the O -organizations). Each equilibrium is characterized by the free entry condition and the factor markets clearing conditions. The free entry condition means that the expected principal's profits are equal to the cost of starting a firm. Remember

¹¹Endogenizing I_S leads to unnecessary complexity of the analysis and does not substantially change the qualitative results.

that the expected principal's profits are given by $w(E_k^*)^2 + e_k^* \alpha B$ where k represents the type of the organizational equilibrium: $k \in \{P, A, O\}$. Thus, the free entry condition can be written as follows:

$$w(E_k^*)^2 + e_k^* \alpha B = q(1 - I_S) + q^* I_S. \quad (8)$$

Let us denote n as the number of firms in the market. Then, under the k -organization, $E_k^* n$ firms implement projects that are best for principals, $(1 - E_k^*) e_k^* n$ firms implement projects that are best for managers, and the rest leave the market (as both the principal and the manager remain uninformed). Hence, taking into account that some tasks are offshored abroad (specifically, only $1 - I_X$ tasks are performed domestically), demand for unskilled labor in the differentiated sector in the k -equilibrium is

$$L_X^k = n(1 - I_X) * \begin{cases} [E_k^* c_B x_B + (1 - E_k^*) e_k^* c_b x_b] & \text{if } k = P, O \\ [E_k^* (1 - e_k^*) c_B x_B + e_k^* c_b x_b] & \text{if } k = A \end{cases},$$

where x_B and x_b are outputs of firms with marginal cost c_B and c_b , respectively. Then, the unskilled labor market clearing condition is

$$L_X^k + Y^S + n(E_k^*)^2 = L, \quad (9)$$

where Y^S is the production of good Y , $n(E_k^*)^2$ is labor used by principals to monitor projects, and L is the total endowment of unskilled labor.

Finally, the demand for skilled labor is equal to the number of firms entering the market multiplied by the number of managerial tasks performed at home. Thus, the market clearing condition for skilled labor is

$$H = n(1 - I_S), \quad (10)$$

where H is the endowment of skilled labor in the economy. Hence, the number of domestic firms in the economy is exactly determined by the endowment of skilled labor and the number of managerial tasks offshored.

Note that if I_S is close to unity, the number of firms, n , is close to infinity. This, in turn, means that firms' expected profits can be sufficiently low. At the same time, however, firms' expected profits are pinned down by the cost of managerial labor abroad, q^* , and are therefore not necessarily as low as it is required to clear the skilled labor market. As a result, it is

possible that for sufficiently high values of I_S , the equilibrium in the model does not exist (this happens when the demand for skilled labor is lower than the supply). To avoid problems with the existence of an equilibrium, we impose an upper bound on I_S . Specifically, we assume that

$$I_S \leq \frac{wL}{wL + q^*H}.$$

In the Appendix, we show that this condition is sufficient to guarantee the existence of an equilibrium in the model. Notice that if q^* tends to zero, the upper bound tends to one.

As the wage rate of unskilled labor w is pinned down by the world price of the homogenous good and Z_X is exactly determined by the relative wage w/w^* and the cost of offshoring $t(j)$, the equilibrium values of q and B can be found from (8) and (7). Finally, the amount produced in the homogenous sector is determined by (9). Thus, we can find all the endogenous variables in the model.

To be consistent with the k -organization equilibrium, the equilibrium values of B/w must belong to the proper interval. Specifically, in order for the P -organization to exist, the parameters in the model must be such that the solution of the equilibrium system of equations (for $k = P$) results in the equilibrium value of B/w less than \tilde{B}_P (see Proposition 1). Similarly, in order for the A -organization to exist, the solution of the equilibrium equations (for $k = A$) needs to result in B/w between \tilde{B}_P and \bar{B} . Finally, for the existence of the O -organization, the equilibrium value of B/w implied by the equilibrium equations for $k = O$ needs to be higher than \bar{B} .

Note that in the present paper we do not explore under which conditions a certain type of equilibrium takes place in the model. For instance, it can be the case that for some parameters there are multiple equilibria with P - or A -organizations (see Marin and Verdier (2012) for details). What we do in this paper is to analyze how offshoring of different types of tasks affects the equilibrium outcomes assuming that the economy is either in the P -, A -, or O -equilibrium.

3 Decentralized Management and Offshoring

We now explore how offshoring of production and managerial tasks affects the type of firm organization principals choose. In particular, we examine how changes in I_X and I_S affect real profits B/w . The idea behind this exercise is the relationship between the type of firm

organization and real profits as stated in *Proposition 1*. In particular, *Proposition 1* suggests that the level of firm decentralization (the level of formal power delegated to a manager) has a hump shape as a function of real profits. Thus, understanding the relationship between offshoring and real profits sheds a light on the connection between offshoring and firm organization.

Since the results we formulate below hold in any type of the equilibrium (see Section 3.3 for details), without loss of generality, we consider the equilibrium with the P -organization. The free entry condition under the P -equilibrium is given by

$$w(E_P^*)^2 + e_P^* \alpha B = q(1 - I_S) + q^* I_S.$$

Taking into account the expressions for E_P^* and e_P^* (see (2)), the free entry condition can be rewritten to:

$$\frac{(1 - \bar{e}\alpha)^2}{4} \left(\frac{B}{w}\right)^2 + \bar{e}\alpha \frac{B}{w} = \frac{q(1 - I_S) + q^* I_S}{w}. \quad (11)$$

Recall from (7) that the principal's benefit when she picks the project is

$$B = C (aRP^{\sigma-1} + A_m) \left(\frac{w}{Z_X} c_B\right)^{1-\sigma},$$

where R is the total expenditure of the economy given by $wL + qH$. Thus, we have

$$\frac{B}{w} = C \left(\frac{w}{Z_X} c_B\right)^{1-\sigma} \left(aP^{\sigma-1} \left(L + \frac{q}{w} H\right) + \frac{A_m}{w}\right).$$

The price index in the economy is given by

$$P^{1-\sigma} = \int_{i \in \Omega} p(i)^{1-\sigma} di + IM.$$

As in the P -equilibrium $E_P^* n$ domestic firms implement projects with cost c_B and $(1 - E_P^*) e_P^* n$ firms implement projects with cost c_b , the price index can be written as follows:

$$P^{1-\sigma} = n \left(\frac{1}{\rho} \frac{w}{Z_X} c_B\right)^{1-\sigma} (E_P^* + (1 - E_P^*) e_P^* \alpha) + IM,$$

where $\rho = (\sigma - 1)/\sigma$. Moreover, using the expressions for E_P^* and e_P^* in (2), it is straightforward to show that

$$E_P^* + (1 - E_P^*) e_P^* \alpha = \bar{e}\alpha + \frac{(1 - \bar{e}\alpha)^2}{2} \frac{B}{w}$$

and the price index is equal to

$$P^{1-\sigma} = n \left(\frac{1}{\rho} \frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} \frac{B}{w} \right) + IM.$$

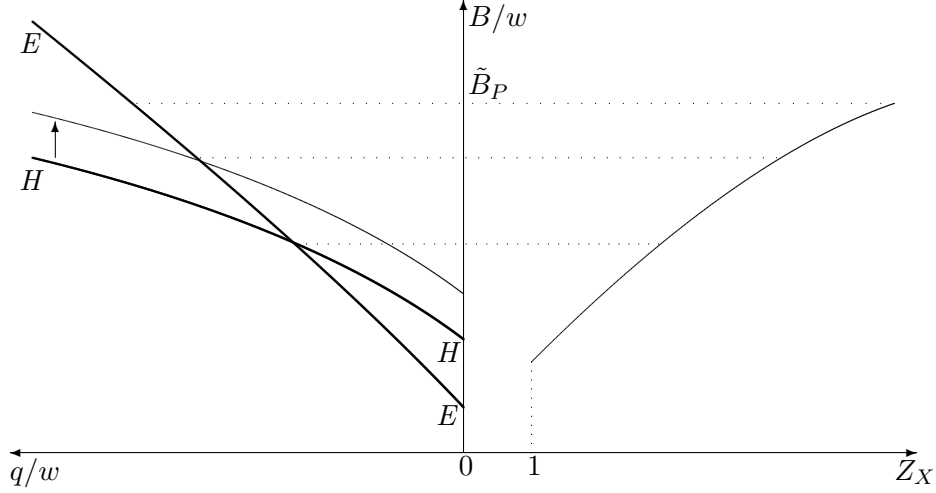
Taking into account that the supply of skilled labor is equal to H (implying that $n = H/(1 - I_S)$), the skilled labor market clearing condition can be written as follows:

$$B/w = C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{a(L + \frac{q}{w}H)}{\frac{H}{1-I_S} \left(\frac{1}{\rho} \frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} \frac{B}{w} \right) + IM} + \frac{A_m}{w} \right). \quad (12)$$

Thus, we have two conditions that determine the equilibrium values of B/w and q/w : the free entry condition (11) and the skilled labor market clearing condition (12), from which we solve for B/w and q/w . In the Appendix, we show that the solution of (11) and (12) exists and is unique. Hence, the P -organizational equilibrium exists if and only if B/w that solves (11) and (12) is less than \tilde{B}_P .

Figure 1 (left quadrant) illustrates the equilibrium. The HH -curve depicts the market clearing condition for skilled labor from (12) which equates the number of firms n requiring a manager to the supply of skilled managers $H/(1 - I_S)$. The HH -curve is upward sloping for two reasons. First, larger B/w requires larger q/w to satisfy (12). As B/w rises, there is an excess demand for managers as firms are attracted to enter the market. Therefore, q/w has to increase to distract these potential entrants. Second, larger q/w requires larger B/w to satisfy (12). When q/w is large, too few firms are looking for a manager and as a result there is an excess supply of managers in the domestic market. In order for (12) to hold, the number of firms n has to increase which is guaranteed by an increase in B/w . The EE -curve shows the free entry condition from (11). It equates expected profits to the fixed costs of market entry. It is upward sloping as well, because as B/w rises firms want to enter the market. As firms can enter the market only by hiring a skilled manager and the number of firms is fixed by the resource constraint on skilled managers, q/w has to rise. q/w rises, because entering firms try to compete away managers from incumbent firms pushing up q/w . For this reason the EE -curve may be called the 'war for talent' curve.

Figure 1: Equilibrium and Offshoring of Production Tasks



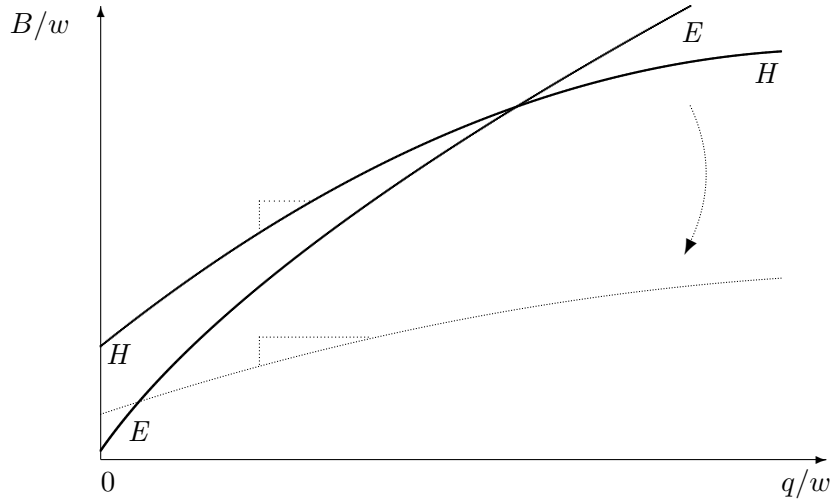
3.0.1 A Change in the Level of Openness

Next, we want to explore how a change in openness IM affects the labor market conditions for managers as given by (12). A rise in IM has two effects on the HH -curve. First, it shifts the HH -curve downwards as tougher foreign competition reduces firms' profits for any q/w . Second, with a rise in IM the slope of the HH -curve becomes flatter. To understand why, we take the derivative of B/w with respect to q/w . Taking into account (12), this derivative is given by

$$\frac{dB/w}{dq/w} = \frac{C\rho^{1-\sigma}aH}{\frac{H}{1-I_S} \left(\bar{e}\alpha + (1 - \bar{e}\alpha)^2 \frac{B}{w} - \frac{(1-\bar{e}\alpha)^2}{2} \frac{A_m}{w} C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \right) + IM \left(\frac{1}{\rho} \frac{w}{Z_X} c_B \right)^{\sigma-1}}.$$

As can be seen, a rise in IM decreases the value of the derivative for any B/w and q/w . The reason is that in economies with larger openness there are fewer domestic firms active in the market as at lower profits there is less of an incentive for domestic firms to enter the market (the downward shift of the HH -curve). With fewer domestic firms active in the market, an increase in B/w leads to a larger excess demand for managers as the increased number of firms entering and looking for a manager accounts now for a larger share of the domestic market. Hence, a stronger increase in q/w is required to distract these potential entrants to keep the labor market for managers in equilibrium. Consequently, the HH -curve flattens when the economy becomes more open. Figure 2 illustrates the effect of an increase in IM graphically.

Figure 2: Change in Openness and Managerial Labor Market Equilibrium



3.1 Offshoring of Production Tasks

We now explore how changes in the scale of offshoring of production tasks, I_X , affect the equilibrium value of B/w . Recall that

$$Z_X = \frac{1}{1 - I_X + \left(\int_0^{I_X} t(j) dj \right) / t(I_X)},$$

where I_X is determined from $w = \gamma t(I_X) w^*$. As w is pinned down by the world price of the homogenous good, the only effect of I_X on B/w is through changes in Z_X . In particular, a larger I_X results in higher productivity gains Z_X . Thus, we need to explore how a rise in Z_X affects real profits. The following proposition holds.

Proposition 2 *In the P-organizational equilibrium, a rise in Z_X leads to a higher value of real profits B/w and to a rise in q/w in equilibrium.*

Proof. The proof follows directly from (11) and (12). ■

We illustrate the intuition with the help of Figure 1. A rise in Z_X shifts the 'war for talent' curve HH upwards, while the free entry curve EE does not change (left quadrant). As a result, the equilibrium values of B/w and q/w rise. There are two opposing effects of a rise in Z_X on real profits. A rise in productivity Z_X lowers marginal costs $w c(i) / Z_X$ and increases firms' real profits for any q/w (productivity effect). At the same time, all other domestic firms become more productive as well, lowering firms' revenues and profits through a decrease in $RP^{\sigma-1}$ (revenue

effect). Note that the number of firms entering the market does not change as it is given by the resource constraint on managers $n = H/(1 - I_S)$. As can be seen from *Proposition 2* and Figure 1, the positive productivity effect dominates the negative revenue effect and, as a result, real profits B/w unambiguously rise with offshoring of production tasks Z_X (right quadrant). This is because we consider an open economy. When the domestic market is open to foreign competition (as captured by IM) the rise in Z_X affects only the productivity of domestic firms but leaves those of foreign rivals unchanged. The improved competitiveness of domestic firms weakens the negative revenue effect. Moreover, the presence of export markets (given by A_m) enhances the effect of lower marginal costs on profits.¹²

In the closed economy (when $A_m = 0$ and $IM = 0$), the system of equations (11) and (12) changes to

$$\begin{cases} \frac{q(1-I_S)+q^*I_S}{w} = \frac{(1-\bar{e}\alpha)^2}{4} \left(\frac{B}{w}\right)^2 + \bar{e}\alpha\frac{B}{w}, \\ B/w = \frac{Ca\rho^{1-\sigma}\left(\frac{L}{H}+\frac{q}{w}\right)(1-I_S)}{\bar{e}\alpha+\frac{(1-\bar{e}\alpha)^2}{2}\frac{B}{w}}. \end{cases} \quad (13)$$

and the two opposing effects on real profits are exactly cancelled out. Thus, in the closed economy, the rise in B/w (due to lower marginal costs) is exactly compensated by the decline in B/w (due to that all other firms serving the market become more productive as well) and offshoring of production tasks does not change real profits and the way firms organize.

When the increase in Z_X is sufficiently large, B/w rises and exceeds the cutoff \tilde{B}_P (see *Proposition 1*). As a result, firms switch from the P -organization to the A -organization and decentralize formal power to the skilled manager to keep her initiative alive.

3.2 Offshoring of Managerial Tasks

In this section, we consider offshoring of managerial tasks. In particular, we examine how offshoring of managerial labor affects firm's real profits, the level of decentralization in firms, and the relative wages for managers. As in the previous section, we analyze the P -equilibrium in the model. Recall that offshoring of managerial tasks takes place only if the cost of a foreign

¹²Actually, in the small open economy (SOE) we consider here, the foreign market share IM is exogenous and does not change when domestic firms become more competitive due to offshoring of production tasks. As a result, the foreign market share IM prevents revenues $RP^{\sigma-1}$ from falling proportionally to the rise in Z_X (as prices for foreign varieties do not fall when domestic firms become more productive). In a fully developed general equilibrium North-South model of offshoring, IM falls in response to a rise in Z_X , as domestic firms take some of the domestic market from foreign rivals. For the gain in market shares due to offshoring, see Marin, Schymik, and Tschke (2014).

manager is lower than the cost of a domestic manager i.e., $q > q^*$. In the model, q is endogenously determined and affected by offshoring. To guarantee $q > q^*$ for any value of I_S , we assume that q^* is such that

$$C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \frac{A_m}{w} > 2 \frac{\sqrt{(\bar{\epsilon}\alpha)^2 + \frac{q^*}{w} (1 - \bar{\epsilon}\alpha)^2} - \bar{\epsilon}\alpha}{(1 - \bar{\epsilon}\alpha)^2}. \quad (14)$$

Note that the latter inequality holds when q^* is sufficiently small. In this case, the equilibrium value of q is strictly greater than q^* for any size of the domestic market (see details in the Appendix).

Proposition 3 examines how changes in the number of managerial tasks offshored affect real profits and relative wages for managers.

Proposition 3 *In the P-equilibrium, there exists a cutoff level of openness of the economy, denoted by IM_P , such that for $IM > IM_P$: B/w and q/w are increasing in I_S ; and for $IM \leq IM_P$: B/w is declining in I_S , while the impact of I_S on q/w is ambiguous.*

Proof. In the Appendix. ■

We explain the intuition behind Proposition 3 with the help of Figures 3 and 4. The left quadrant of Figures 3 and 4 gives the free entry curve EE and the market clearing curve HH , while the right quadrant shows real profits B/w as a function of offshoring of managerial tasks I_S . Offshoring of managerial tasks has three distinct effects on the equilibrium outcome. First, a rise in I_S lowers the cost of market entry and shifts the free entry EE -curve down increasing B/w and q/w (the war for talent effect: a move from e_0 to e_T). Lower costs of entry make it attractive for firms to enter the market. However, firms can enter only if they hire a manager. As the number of firms is fixed by the resource constraint for managers, firms compete with incumbent firms for the available pool of managers in the economy pushing up the relative costs of managerial labor q/w and the level of profits firms require to enter the market B/w .

Second, a rise in I_S lowers the demand for skilled managers in the North and shifts the HH -curve down, decreasing the skill premium on managers q/w and real profits B/w (the labour market effect: a move from e_T to e_L). This relaxes the resource constraint on skilled managers in the North allowing more domestic firms to find a manager. As the number of domestic firms rises, competition in the domestic market intensifies and firms' real profits B/w decrease (the competition effect).

The overall effect on B/w and q/w depends on the relative size of these effects (the war for

talent effect, the labor market effect, and the competition effect). This depends on the exposure to international trade IM . When openness to trade is sufficiently large ($IM > IM_P$), the positive war for talent effect prevails over the negative competition effect and, as a result, real profits unambiguously rise with an increase in I_S (see Figure 3). To understand why, recall from the previous section that the derivative $\frac{dB/w}{dq/w}$ becomes smaller with larger IM . When the trade exposure is large, the number of foreign firms is large in the domestic economy and, thus, fewer domestic firms have an incentive to enter reducing real profits only little. As a result, a rise in I_S shifts the HH -curve down only little. Otherwise, when the level of import competition is sufficiently small ($IM \leq IM_P$), the competition effect dominates the war for talent effect and profits decline in response to a rise in I_S . As a result, an increase in I_S results in a large downward shift of the HH -curve (see Figure 4).

The impact of a rise in I_S on q/w remains ambiguous as the war for talent effect pushing up q/w and the labor demand effect lowering q/w cannot be ranked in magnitude. For $IM > IM_P$, a rise in I_S leads to an unambiguous rise in q/w as the war for talent effect prevails over the labor market effect. In an economy with many foreign firms only few domestic firms demand a manager as few firms find it profitable to enter the market. As the number of entrants is smaller in the open economy, changes in their demand for managers affects the relative wage for managers only little. As a result, the labor market effect is small for $IM > IM_P$.

For $IM < IM_P$, the direction of the change in q/w cannot be signed. On the one hand, lower IM makes the downward shift of the HH -curve larger with a stronger negative impact on q/w , via the labor demand effect. On the other hand, lower IM makes the slope of the HH -curve steeper (for $IM < IM_P$, changes in the demand for managers have a large effect on the relative wages of managers), which in turn makes the *positive* effect on q/w stronger through the war for talent effect (as a rise in the number of entrants pushes up the relative cost of skilled managers). Hence, for sufficient low IM we cannot determine the overall impact on q/w .

Proposition 3 suggests that the impact of offshoring of managerial labor on firm organization depends on the level of openness to foreign competition. If openness is sufficiently large, offshoring of managerial labor results in firm decentralization (the P -equilibrium becomes "closer" to the A -equilibrium). Otherwise, offshoring of managerial labor leads firms to recentralize power to top management.

Figure 3: Offshoring of Managerial Tasks: $IM > IM_P$

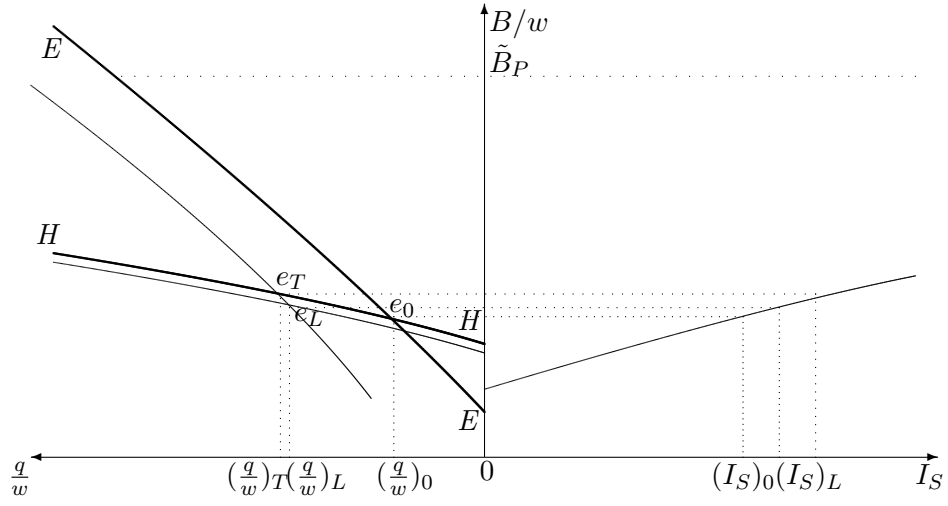
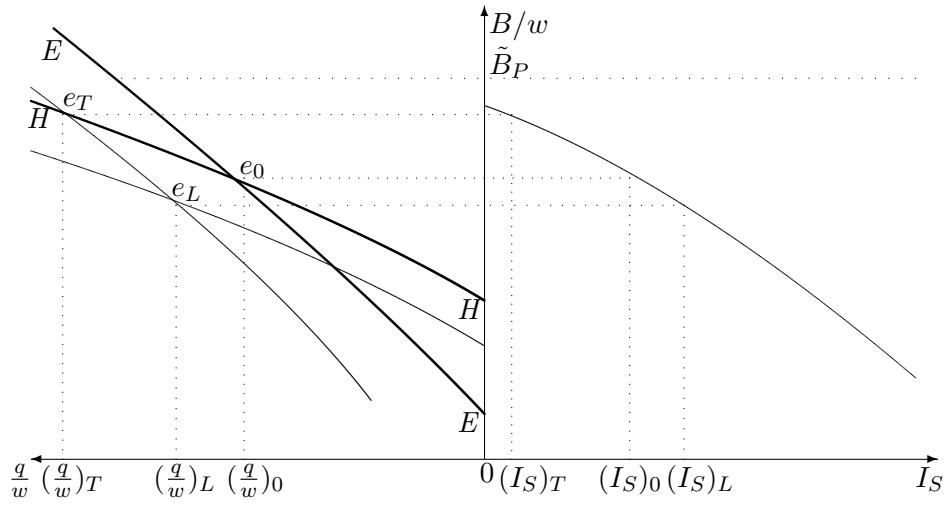


Figure 4: Offshoring of Managerial Tasks: $IM < IM_P$



3.3 Offshoring under the A - or O -organizations

In this section, we argue that *Propositions* 2 and 3 hold for A - and O -equilibria as well. Remember that the O -equilibrium is a special case of the P -equilibrium with \bar{e} being equal to zero. In particular, the O -equilibrium is described by

$$\begin{cases} \frac{q(1-I_S)+q^*I_S}{w} = \frac{1}{4} \left(\frac{B}{w}\right)^2, \\ B/w = C \left(\frac{w}{Z_X} c_B\right)^{1-\sigma} \left(\frac{a(L+\frac{q}{w}H)(1-I_S)}{H\left(\frac{1}{\rho}\frac{w}{Z_X} c_B\right)^{1-\sigma} \left(\frac{1}{2}\frac{B}{w}\right)+(1-I_S)IM} + \frac{A_m}{w} \right). \end{cases} \quad (15)$$

The O -equilibrium exists if the value of B/w determined by the above system of equations is greater than \bar{B} . As the proofs of *Propositions* 2 and 3 hold for any non-negative value of \bar{e} including the zero value, they obviously hold in case of the O -equilibrium as well. The only difference from the P -equilibrium is the threshold value of the level of foreign competition in *Proposition* 3, IM_P . In the O -equilibrium, it is different (as $\bar{e} = 0$). We denote it by IM_O .

In the A -equilibrium, the equilibrium equations are given by

$$\begin{cases} \frac{q(1-I_S)+q^*I_S}{w} = \frac{(1-\bar{e})^2}{4} \left(\frac{B}{w}\right)^2 + \bar{e}\frac{B}{w}, \\ B/w = C \left(\frac{w}{Z_X} c_B\right)^{1-\sigma} \left(\frac{a(L+\frac{q}{w}H)(1-I_S)}{H\left(\frac{1}{\rho}\frac{w}{Z_X} c_B\right)^{1-\sigma} \left(\bar{e}+\frac{(1-\bar{e})^2}{2}\frac{B}{w}\right)+(1-I_S)IM} + \frac{A_m}{w} \right). \end{cases} \quad (16)$$

As can be seen, the equilibrium equations describing the A -equilibrium correspond to the equations describing the P -equilibrium with α being equal to one. Since the proofs of *Propositions* 2 and 3 hold for any positive value of α including one, the propositions hold for the A -equilibrium as well. Again, in the A -equilibrium, the threshold value of the level of foreign competition in *Proposition* 3 is different from those in the P - and O - equilibria. We denote this value by IM_A .

Notice that, to guarantee that the cost of foreign skilled labor is lower than the cost of domestic skilled labor in equilibrium of any type (see (14)), we need to assume that

$$C \left(\frac{w}{Z_X} c_B\right)^{1-\sigma} \frac{A_m}{w} > \max \left(2 \frac{\sqrt{(\bar{e}\alpha)^2 + \frac{q^*}{w} (1-\bar{e}\alpha)^2} - \bar{e}\alpha}{(1-\bar{e}\alpha)^2}, 2 \frac{\sqrt{\bar{e}^2 + \frac{q^*}{w} (1-\bar{e})^2} - \bar{e}}{(1-\bar{e})^2}, 2\sqrt{\frac{q^*}{w}} \right).$$

4 Empirical Analysis

In this section, we test the predictions of the model using our survey of firm level data of Austrian and German multinational firms with subsidiaries in Eastern Europe. We start with a brief description of the data.

4.1 The Data

We conducted a survey among 660 multinational corporations in Austria and Germany with 2200 affiliate firms in Eastern Europe, Russia, Ukraine and other former Soviet Republics. The sample is a cross-section of 1200 German and 1000 Austrian foreign direct investments and it covers 80 percent of total German investment and 100 percent of total Austrian investment to Eastern Europe during the period 1990-2001 (the actual numbers are from the years 1997-2000 in Germany and 1999-2000 in Austria). In 1998-1999, about 90 percent of the total outgoing foreign direct investment of Austria was reoriented to Eastern Europe, while in Germany, Eastern Europe accounted for only about 4-5 percent of total outgoing foreign direct investment. This explains why the sample consists of relatively more Austrian multinational investments in spite of Austria being much smaller than Germany (with 8 million people, Austria's population is 10 percent of Germany's). Since foreign direct investment activity in Eastern Europe began with the fall of communism in 1990 and was prohibited under central planning, we were able to obtain a representative sample of foreign direct investment in spite of collecting detailed information on the internal organization of these firms.

4.1.1 Decentralized Management

The variable *level of decentralization of authority* measures the allocation of decision authority within the parental multinational firm. It is obtained from the question 'Who decides over the following issues concerning your corporation, top CEO/owner or the divisional manager, please rank between 1 (centralized decision taken at the top CEO/owner level) and 5 (decentralized decision taken at the divisional level)?'. The survey lists 13 corporate decisions which are ranked by headquarters of the parental firm in Austria and Germany. The decision categories include decisions over acquisitions, finance, budget, new strategy, transfer pricing, new product, R&D expenditures, firing and hiring of personnel, change of supplier, product pricing and wage increases. We then calculate a simple mean from the available scores of these 13 corporate

decisions. The average level of decentralization in the sample is 2.83. Additionally, we normalize the index to a z-score with a mean of zero and a standard deviation of one in order to facilitate the interpretation of the estimated effects. Values of the normalized index indicate the difference from the mean of the original decentralization index (2.83) in numbers of standard deviations (0.87).

4.1.2 Offshoring of Production Tasks

Our firm survey includes information on intrafirm trade flows between affiliate firms and the parent firm that we can use to measure *offshoring of production tasks*. The idea here is that the multinational firm is an offshoring firm if it imports intermediate inputs from its affiliates in Eastern Europe. The variable *intrafirm imports in percent of parent firm's sales* is defined by the sum over all intrafirm imports of intermediate inputs of one particular multinational firm from all its affiliates in Eastern Europe relative to the domestic sales of this multinational firm to get a measure of the share of offshored production tasks. Alternatively, we use the dummy variable *intrafirm imports* to capture whether or not the multinational firm is offshoring production labor at all.

As an instrument for offshoring of production tasks, we use the dummy variable *standardized input*. The variable indicates whether the affiliate firm delivers an input product that is standardized in both, quality and design. Table 4 of the Data Appendix shows that in 61 percent of the investments in Eastern Europe affiliate firms supplied a standardized input to the parent firm which may explain the prevalence of foreign direct investments with a 100 percent ownership share in the data. We discuss the instrumental variable in greater detail when we describe the empirical results in the next section.

4.1.3 Offshoring of Managerial Tasks

We measure *offshoring of managerial tasks* with the variable *managerial offshoring*. We obtain the variable from the survey question 'How many managers of your parent company have been sent to the affiliate firm?'. We assume that if no manager is sent to the affiliate, then the affiliate firm hires the manager from the local host country market. In this case, the manager is considered to be offshored to the affiliate firm. In other words, the dummy is given as *offshoring of managerial tasks = 1 - manager sent dummy*. To get a measure of the intensity of managerial

offshoring, we sum over all managers in the multinational firm's affiliates in Eastern Europe which have not been sent by the parent company and express it as a fraction of the sum of these affiliates' employment. Additionally, we express this sum of offshored managers as a fraction of parental employment with an academic degree. Alternatively, we use the dummy variable *offshored managers* to capture whether or not the multinational firm is offshoring one or more managers to its subsidiary in Eastern Europe. As can be seen from Table 4 in the Data Appendix, in 43 percent of the investment to Eastern Europe multinational firms from Austria or Germany have sent one or more managers to the affiliate firm in Eastern Europe and, as a consequence, they have offshored one or more managers in 57 percent of the direct investments. On average multinational firms have offshored 2.63 managers per investment project with a maximum of 39 managers.

4.1.4 Competition and Trade Openness

We use several measures to proxy for competition and international trade. The variable *domestic competition* and *foreign competition* are dummy variables which are subjective firm level measures of domestic and foreign competition as perceived by firms. They are obtained from the question 'How many competitors do you face on your local (Austrian or German) market and worldwide, respectively?' The dummy variables take the value of 1 if the parent firm faces many or very many competitors for their product in their local markets or worldwide, rather than no or few competitors. We calculate a sectoral measure of openness by taking the sample means of the firm level measure of foreign competition at the ISIC 3 digit level to get to a measure of the openness of the industry to which the firm belongs. Moreover, we use this measure of the openness of the industry to construct a dummy variable *large openness* and *small openness*, respectively. *Large openness* is a dummy when the sector's openness is above the 25 percentile and *small openness* indicates when the sector's openness is below the 40th percentile or the 10th percentile of the sample distribution. Additionally, we use the change in the number of establishments between 1997 and 1998 in Germany and Austria at the 4 digit ISIC level as a sectoral measure of domestic competition from the United Nations Industrial Development Organization INDSTAT database. We also control for the size of the parental firm which is measured by the logarithm of parental firm sales.

4.1.5 Human Resources

Our survey also includes information on the human resource policies of the multinational firms in our sample. Information on the compensation of executives in our multinational firms are based on two sources. First, we obtained executive payment data from Kienbaum Management Consulting. Kienbaum is a management consultancy specialized in remuneration policies which collects annual information on executive compensation of large German firms. The Kienbaum data allow us to calculate the average compensation per executive since the data contain information on the total compensation of the executive board and the number of executive board members. Since Kienbaum provides information only for the largest German firms, we additionally hand-collected this information from annual reports of the remaining firms whenever available. Likewise, we divided the aggregate earnings of executives by the number of executives working for the firm. All average executive payments are expressed relative to the average wage of the firm in logarithms. The latter information comes from our firm survey.

4.2 Empirical Results

4.2.1 Offshoring of Production Tasks and Decentralized Management

We start by examining the relationship between offshoring of production tasks to Eastern Europe and the level of decision making in parental firms of multinational corporations located in Austria and Germany. According to Proposition 2 and Figure 1, an increase in offshoring of production tasks leads to an increase in profits. According to 1, these increases in profits ultimately induce firms to switch from a P-Organization to a decentralized A-Organization. From this, we derive

Prediction 1: In a cross-section of firms in an economy open to trade, multinational firms will have more decentralized management when they are offshoring production tasks to low wage countries.

In order to test for Prediction 1, we consider the following econometric model for decentralized management:

$$dec_i = \partial_0 + \partial_1 offsh_i + \partial_2 foreign + \partial_3 W_i + \varepsilon_i, \quad (17)$$

where dec_i denotes the level of decentralization in a parental firm, $offsh_i$ indicates whether the multinational firm offshores production tasks, $foreign$ is a measure of openness, W_i is a

set of controls, and ε_i is the error term. According to Prediction 1, we expect $\partial_1 > 0$. The variable *foreign* is supposed to capture the improved competitiveness of offshoring firms vis-à-vis foreign rivals leading to a rise in profits and more decentralization. Thus, we expect $\partial_2 > 0$. Recall, that in the theory offshoring will lead to decentralized management only when firms face foreign rivals who do not undergo the same productivity increase as our offshoring firms. We also include a set of industry dummies and home and host country fixed effects. Note, that the unit of observation in all regressions is an investment project that comprises a parent firm with one of its affiliate firms. Therefore, multinational firms with more affiliates get a larger weight in the regression and have a stronger influence on the parameter estimates. Thus, standard errors are likely to be correlated between foreign direct investments of identical parental firms. To account for this, we use cluster-robust standard errors with clustering at the parental firm level when we calculate the significance of the estimated parameters.

Our main findings are given in columns (1) - (4) of Table 1 which presents ordinary least squares estimates of equation (18). As predicted by the theory, the estimated coefficients on *intrafirm imports in percent of parental sales* which proxies for the number of production tasks offshored are positive and significant at the 5 percent level (columns 1 and 2). Furthermore, as predicted, the estimated coefficient on *foreign competition* is positive and significant at the 1 percent level. Interestingly, the inclusion of *domestic competition* does not turn out to be significant. This is consistent with our theory, since offshoring firms do not gain competitiveness vis-à-vis other domestic rivals who all benefit from offshoring. In column (3), we rerun the regression of column (1) with a firm level measure of foreign competition with similar but less strong results. In column (4), we replace the measure of offshoring by *intrafirm imports dummy* to see if it makes a difference whether the firm offshores at all or how many tasks it offshores. The results are, however, similar. In column (5), we replace the dependent variable with an normalized decentralization index with mean 0 and standard deviation of one to facilitate the economic interpretation. An increase in the share of intrafirm imports in parental sales by one percentage point increases the level of decentralization by 0.03. In other words, this means that an increase in the share of of intrafirm imports by one standard deviation raises the level of decentralization by about 0.1 standard deviations.

In columns (6) - (8) we deal with potential endogeneity. There might a reversed causality problem in our regressions if firms that are more decentralized choose to offshore more. Further-

more, there might be additional omitted factors that affect the level of decentralization and are correlated with our explanatory variables. In order to account for these potential sources of endogeneity, we reestimate equation (18) by two stage least squares and instrument for offshoring. As an instrument, we use the dummy variable *standardized input*. The idea here is that when the affiliate firm delivers a standardized input to the parent firm, offshoring of production tasks will be rather organized outside the firm at arms length to an independent foreign input supplier than in the form of a foreign direct investment.¹³ Thus, we expect less intrafirm imports when the imported input is standardized. The first stage regressions support this explanation and confirm that the instrument is relevant. The Cragg-Donald F-statistics for weak identification exceed the critical value of 16.38 for 10 percent IV bias. Interestingly, offshoring is only significant with the intrafirm imports dummy and stops to be significant for the intensity measure of offshoring in our IV estimates. Since the organization of offshoring appears to depend on what the firm offshores (a standardized input with little hold-up problems) rather than how many tasks are offshored, this makes sense.

Table 1 about here

4.2.2 Offshoring of Managerial Tasks and Decentralized Management

Next, we study the relationship between offshoring of managerial tasks and the level of decentralized management in parental firms of multinational corporations. According to Proposition 3 and Figures 3 and 4, an increase in offshoring of managerial tasks leads to an increase in profits when the effect of lower costs of market entry on profits (the war for talent effect) outweighs the effect of an increase in the number of firms on lowering profits (the competition effect). This is the case when the economy is sufficiently open to foreign competition. An increase in profits, in turn, induces firms to switch from the P-Organization to the A-Organization as stated in Proposition 1. From this, we derive

Prediction 2: In a cross section of firms in an economy open to trade, the effect of offshoring managerial tasks to low wage countries on the level of decentralization in multinational firms depends on the level of openness. Firms will have more decentralized management when the economy is relatively open and less decentralized management when the economy is relatively autark.

¹³For this reasoning, see Antras and Helpman 2008.

We specify the following model for decentralized management to test for Prediction 2

$$dec_i = \partial_0 + \partial_1 offm_i + \partial_2 offm_i * openl + \partial_3 openl + \partial_4 X_i + \varepsilon_i, \quad (18)$$

where $offm_i$ indicates whether the multinational firm offshores managerial tasks, $openl$ is a dummy when the openness of the sector is above the 25th percentile, X_i is a set of controls, and ε_i is the error term. $offm_i$ captures the lower demand for managers as a result of managerial offshoring (the labor demand effect), lowering the level of profits that firms require to enter the market. Lower profits, in turn, induce firms to switch back to the P-organization resulting in more centralized management. Thus, we expect $\partial_1 < 0$. The interaction term $offm_i * openl$ is supposed to account for the prediction of the theory that profits and the level of decentralization will increase only in response to managerial offshoring when firms are sufficiently exposed to foreign competition. Hence, we expect $\partial_2 > 0$.

Table 3 reports the ordinary least squares estimates of equation (19). In column (1), we include the dummy *offshored manager* and the dummy large openness *openl*. The coefficient on *offshored manager* is not significant. In column (2), we add the interaction term *large openness * offshored manager*. Now the coefficient on *offshored manager* is negative and significant at the 5 percent level. Moreover, as predicted by the theory, the interaction term *large openness * offshored manager* becomes positive and significant at the 10 percent level. In columns (3) - (6), we include several alternative measures of the number of offshored managerial tasks, since we expect the number of offshored tasks to matter for the results. In columns (3) and (4) we replace the dummy *offshored manager* by the variable *sum of managers offshored to all affiliates of one particular parent firm as a fraction of the sum of total employment in those affiliates* which is now significant as well as the interaction term $offm_i * openl$. Alternatively, in columns (5) and (6) we use the *sum of offshored managers to all affiliates of one particular parent firm as a fraction of skilled employment in the parent firm* as the number of offshored managerial tasks. Managerial offshoring as well as the interaction term have the expected signs and are both highly significant at the 1 percent level. Also note, that the explanatory power (measured by R^2) substantially rises from 0.181 to 0.265 with the inclusion of the interaction term. This suggests that the interplay of offshoring managerial tasks with large openness plays an important role in explaining the variation in the level of decentralization across multinational firms. In column (7), we use the normalized index of the level of decentralization as the dependent variable and rerun

specification (6) to interpret the results. An increase of the fraction of all managers offshored by one (expressed in terms of the number of academics employed by the parent firm) reduces the level of decentralization by 0.10 standard deviations if foreign competition is below the 25th percentile and increases the level of decentralization by 0.13 standard deviations if foreign competition is above the 25th percentile. Note that the sample size has dropped substantially compared to Table 1, as we have fewer observations on managerial offshoring compared to production offshoring.

Table 2 about here

4.2.3 Offshoring of Managerial Tasks and CEO Wages

Finally, we examine the relationship between offshoring of managerial tasks and the relative wage of managers. According to Proposition 3 and Figures 3 and 4, an increase in offshoring of managerial tasks reduces the demand for managers, lowering CEO wages (the labor demand effect) and leads to more domestic competition, pushing up CEO wages (the competition effect). The relative size of these effects depend on the openness of the economy. When the economy is sufficiently closed to international trade, the competition effect as well as the labor market effect are large. From this, we have

Prediction 3: In a cross section of firms with small openness, multinational firms will pay their CEOs lower wages when they are offshoring managerial tasks to low wage countries and they will pay their CEOs higher wages when the number of firms in the domestic market increases.

We specify the following model for CEO wages to test for Prediction 3

$$wage_i = \partial_0 + \partial_1 offm_i + \partial_2 offm_i * opens + \partial_3 opens + \partial_4 \Delta firms + \partial_5 X_i + \varepsilon_i, \quad (19)$$

where $wage_i$ is the natural logarithm of the average executive wage in the parental firm i relative to its average firm wage. The variable $opens$ is a dummy when the openness of the sector is below the 40th percentile (or below the 10th percentile), $\Delta firms$ is the change in the number of firms in the sector, X_i is a set of controls, and ε_i is the error term. $offm_i$ captures the reduced demand for managers as a result of managerial offshoring lowering relative CEO wages (the labor demand effect). Thus, we expect $\partial_1 < 0$. The interaction term $offm_i * opens$ is supposed to account for the prediction that the effect of a lower demand for managers on relative CEO wages

is magnified in sectors with small openness. Hence, we expect $|\partial_1 + \partial_2| > 0$. $\Delta firms$ measures the increase in the number of firms in the sector of the firm, resulting in a larger demand for managers pushing up CEO wages (the competition effect). Thus, we expect $\partial_4 > 0$.

Table 3 reports the ordinary least squares estimates of equation (20) to test for the labor demand effect and the competition effect of managerial offshoring. Note, that our sample size is substantially smaller in our estimations of equation (20). This is due to the lack of data on executive remuneration in limited liability corporations in our sample. These firms do not have the disclosure requirements to prepare annual reports with information on executive remunerations. Nevertheless, we consider our estimates to be informative since our data are the first that allow to link the effect of offshoring managerial tasks to executive wages in stock companies. In column (1), we include the dummy *offshored manager* and the variable $\Delta firms$. The dummy *offshored manager* is not significant, suggesting that the status of a firm as an offshorer itself does not affect the relative wage it pays for its CEOs. As it can be seen in column (2), the number of managers that the parental firm offshores is what matters for the labor market outcome of executive pay. In column (2) we replace the dummy *offshored manager* by the number of managers the parental firm offshores (*# offshored managers*). As predicted by the theory, the more managerial tasks the parental firm offshores, the lower is the relative wage of its CEOs. Note, that by replacing *offshored manager* with *#offshored managers*, the explanatory power of the regression increases from 0.457 to 0.626. We add the *change in the number of establishments '97-'98* in both columns to test whether an increase in competition pushes up CEO wages. This is indeed the case. An increase in the number of firms in the sector by 1 unit increases the spread between executive pay and the average wage of parental firms by 2 percent. The effect is highly significant at the 1 percent level.

In columns (3) to (5) we examine the effect of openness. We expect the labor market and the competition effect to be larger when the economy is not too open to foreign competition. Due to limits of data, we can test for the role of openness on the labor market effect only. In column (3) we include the dummy *small openness <40th percentile* which is not significant. In column (4) we add the interaction term *small openness <40th pctl. x #offshored managers*. In column (5) we use the dummy *small openness <10th percentile* to examine whether the labor market effect becomes stronger for firms with less openness. This is indeed the case. The interaction term *small openness >10 x #offshored managers* is positive and significant at the 1 percent level and

small openness;10th percentile is negative and significant at the 5 percent level. Note that the R^2 substantially rises from 0.200 to 0.248 with the smaller openness measure. This suggests that the exposure to trade plays an important role for the magnitude of the effects, as is predicted by our theory.

Table 3 about here

5 Conclusion

To be written.

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Appendix

The Proof of Proposition 1

Case 1. Consider first the case when $B/w < \tilde{B}_P = 2(1 - k/b)/(1 - \alpha\bar{e})$. As $B/w < \tilde{B}_P$, the manager puts in the maximum effort, \bar{e} , under both types of the firm organization. Hence, the principal's utility in case of the P -organization is

$$\begin{aligned} u_P^* &= w(E_P^*)^2 + e_P^* \alpha B \\ &= w \left(\frac{B(1 - \alpha\bar{e})}{2w} \right)^2 + \bar{e} \alpha B. \end{aligned}$$

While in case of the A -organization, the utility is

$$\begin{aligned} v_P^* &= w(E_A^*)^2 + e_A^* \alpha B \\ &= w \left(\frac{B(1 - \bar{e})}{2w} \right)^2 + \bar{e} \alpha B. \end{aligned}$$

It is straightforward to see that $u_P^* > v_P^*$ (as $\alpha < 1$). As a result, the P -organization is optimal.

Case 2. Consider now the case when $\tilde{B}_P \leq B/w < \bar{B}$. In this case, the manager puts in zero effort under the P -organization and the maximum effort under the A -organization. As a result,

$$\begin{aligned} u_P^* &= w \left(\frac{B}{2w} \right)^2, \\ v_P^* &= w \left(\frac{B(1 - \bar{e})}{2w} \right)^2 + \bar{e} \alpha B. \end{aligned}$$

It can be shown that

$$v_P^* > u_P^* \iff B/w < \bar{B},$$

implying that the A -organization is optimal if $\tilde{B}_P \leq B/w < \bar{B}$.

Case 3. Finally, from the previous reasoning, it follows that when $B/w \geq \bar{B}$, the P -organization is optimal: $u_P^* > v_P^*$; and the manager puts in zero effort. That is, we have the O -organization as the equilibrium outcome.

Existence and Uniqueness of the Equilibrium

In this subsection of Appendix, we show that there exists a unique solution of (11) and (12) with respect to B/w and q/w . It is straightforward to see from (11) and (12) that B/w solves the following equation (we substitute the free entry condition into the skilled labor market clearing condition):

$$B/w = C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{a \left(L(1 - I_S) + \left(\frac{(1-\bar{e}\alpha)^2}{4} \left(\frac{B}{w} \right)^2 + \bar{e}\alpha \frac{B}{w} - \frac{q^* I_S}{w} \right) H \right)}{H \left(\frac{1}{\rho} \frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} \frac{B}{w} \right) + IM(1 - I_S)} + \frac{A_m}{w} \right). \quad (20)$$

Let us define $F(B/w)$ as the right-hand side of (20). Then, B/w solves

$$B/w = F(B/w).$$

It can be shown that $F(B/w)$ behaves as a linear function (of B/w) when B/w tends to infinity. The slope of this function is equal to $Ca\rho^{1-\sigma}/2$. Remember that $C = \frac{1}{\sigma} \left(\frac{\sigma-1}{\sigma} \right)^{\sigma-1}$ and $\rho = \frac{\sigma-1}{\sigma}$. Then, the slope of $F(B/w)$ in a neighborhood of infinity is $a/2\sigma$, which is strictly less than one (as $a < 1$ and $\sigma > 1$). Thus, for high values of B/w , $F(B/w) < B/w$. Moreover, it is straightforward to show that if $I_S \leq wL/(wL + q^*H)$, then $F(0) > 0$. This implies that, for low values of B/w , $F(B/w) > B/w$. This in turn immediately implies that the solution of (20) exists.

Note that equation (20) can be transformed in a quadratic equation of B/w and, therefore, cannot have more than two solutions. Taking into account the properties of function $F(B/w)$, one can see that equation (20) cannot have exactly two solutions as well. As a result, (20) has a unique solution. This in turn implies that (11) and (12) has a unique solution.

When Offshoring is Profitable

Notice that $q > q^*$ if and only if

$$\frac{q(1 - I_S) + q^* I_S}{w} > \frac{q^*}{w}.$$

The left-hand side of the inequality is the real cost of entry into the market if I_S tasks are offshored. That is, in the P -equilibrium,

$$\frac{q(1 - I_S) + q^* I_S}{w} = \frac{(1 - \bar{e}\alpha)^2}{4} \left(\frac{B}{w}\right)^2 + \bar{e}\alpha \frac{B}{w}.$$

Thus, $q > q^*$ if and only if

$$\begin{aligned} \frac{(1 - \bar{e}\alpha)^2}{4} \left(\frac{B}{w}\right)^2 + \bar{e}\alpha \frac{B}{w} &> \frac{q^*}{w} \iff \\ \frac{B}{w} &> 2 \frac{\sqrt{(\bar{e}\alpha)^2 + \frac{q^*}{w} (1 - \bar{e}\alpha)^2} - \bar{e}\alpha}{(1 - \bar{e}\alpha)^2}. \end{aligned}$$

As can be inferred from the equilibrium condition for B/w (see (??)), B/w is always strictly greater than $C \left(\frac{w}{Z_X} c_B\right)^{1-\sigma} \frac{A_m}{w}$. Hence,

$$\begin{aligned} C \left(\frac{w}{Z_X} c_B\right)^{1-\sigma} \frac{A_m}{w} &> 2 \frac{\sqrt{(\bar{e}\alpha)^2 + \frac{q^*}{w} (1 - \bar{e}\alpha)^2} - \bar{e}\alpha}{(1 - \bar{e}\alpha)^2} \implies \\ \frac{B}{w} &> 2 \frac{\sqrt{(\bar{e}\alpha)^2 + \frac{q^*}{w} (1 - \bar{e}\alpha)^2} - \bar{e}\alpha}{(1 - \bar{e}\alpha)^2} \implies \\ q &> q^*. \end{aligned}$$

The Proof of Proposition 3

The proof below establishes our predictions regarding the effect of managerial offshoring on firm organization as stated in Proposition 3. Specifically, we consider how the equilibrium real profits in equation (20) are affected by the fraction of offshored managerial tasks. First, we analyze the derivative of the equilibrium real profits from (20) with respect to the measure of managerial offshoring I_S . Then, we provide a necessary and sufficient condition for this derivative being positive (in this case, a rise in the number of offshored managerial tasks under the P -organization leads to an increase in the real profits and, thereby, prompts the transition to a decentralized A -organization).

Let us denote the right-hand side of (20) as $F(B/w, I_S)$. Then, the equilibrium value of B/w solves

$$B/w = F(B/w, I_S),$$

where

$$F(B/w, I_S) \equiv C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{a \left(L(1 - I_S) + \left(\frac{(1-\bar{e}\alpha)^2}{4} \left(\frac{B}{w} \right)^2 + \bar{e}\alpha \frac{B}{w} - \frac{q^* I_S}{w} \right) H \right)}{H \left(\frac{1}{\rho} \frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} \frac{B}{w} \right) + IM(1 - I_S)} + \frac{A_m}{w} \right).$$

It can be shown that

$$F'_{I_S}(B/w, I_S) = C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} aH \frac{G(B/w)}{\left(H \left(\frac{wc_B}{Z_X \rho} \right)^{1-\sigma} \left[\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} \frac{B}{w} \right] + (1 - I_S)IM \right)^2},$$

where

$$\begin{aligned} G(B/w) = & - \left(L + \frac{q^*}{w} H \right) \left(\frac{wc_B}{Z_X \rho} \right)^{1-\sigma} \left[\bar{e}\alpha + \frac{(1 - \bar{e}\alpha)^2}{2} \frac{B}{w} \right] \\ & + IM \left(\frac{(1 - \bar{e}\alpha)^2}{4} \left(\frac{B}{w} \right)^2 + \bar{e}\alpha \frac{B}{w} - \frac{q^*}{w} \right). \end{aligned}$$

Note that $G(B/w)$ is a quadratic function of B/w . As $G(B/w)$ is U shaped and $G(0)$ is negative, the equation $G(B/w) = 0$ has two solutions: positive and negative. Let us denote $(B/w)^*$ as the positive solution of

$$G(B/w) = 0.$$

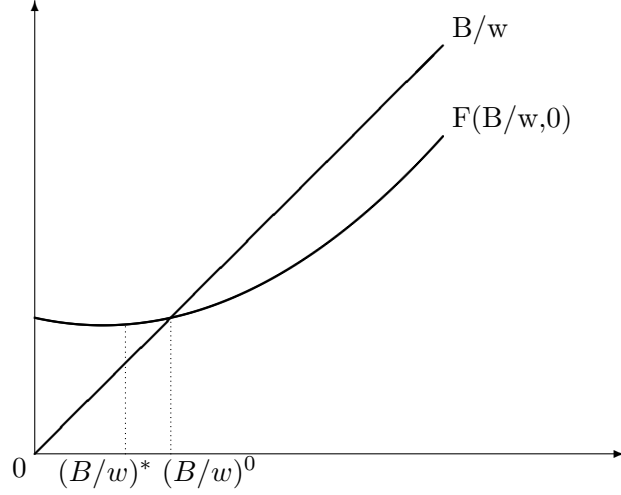
Specifically, $(B/w)^*$ solves the following equation

$$IM \left(\frac{(1 - \bar{e}\alpha)^2}{4} \left(\frac{B}{w} \right)^2 + \bar{e}\alpha \frac{B}{w} - \frac{q^*}{w} \right) = \left(L + \frac{q^*}{w} H \right) \left(\frac{wc_B}{Z_X \rho} \right)^{1-\sigma} \left[\bar{e}\alpha + \frac{(1 - \bar{e}\alpha)^2}{2} \frac{B}{w} \right].$$

Taking into account the properties of $G(B/w)$, it is straightforward to see that $G(B/w) > 0$ (for positive values of B/w) if and only if $B/w > (B/w)^*$. Hence, we can conclude that a rise in I_S raises $F(B/w, I_S)$ if and only if $B/w > (B/w)^*$. In other words, if the equilibrium value of B/w is greater than $(B/w)^*$, then a further marginal rise in I_S increases $F(B/w, I_S)$ and, thereby, B/w . Otherwise, $F(B/w, I_S)$ and B/w go down with a rise in I_S . A direct implication of this finding is that B/w is increasing in I_S on $[0, wL/(wL + q^*H)]$ if and only if $(B/w)^0 > (B/w)^*$, where $(B/w)^0$ is the solution of

$$B/w = F(B/w, 0).$$

Figure 5: The Equilibrium Value of B/w



That is, $(B/w)^0$ is the equilibrium value of B/w when $I_S = 0$ (there is no offshoring of managerial labor).

Next, we find the condition when $(B/w)^0 > (B/w)^*$. Since by definition $(B/w)^0$ solves $B/w = F(B/w, 0)$, one can see that $(B/w)^0 > (B/w)^*$ if and only if $F((B/w)^*, 0) > (B/w)^*$ (see Figure 5). We have that

$$F((B/w)^*, 0) = C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{A_m}{w} + \frac{a \left(L + \left(\frac{(1-\bar{e}\alpha)^2}{4} ((B/w)^*)^2 + \bar{e}\alpha (B/w)^* \right) H \right)}{H \left(\frac{wc_B}{Z_X \rho} \right)^{1-\sigma} \left[\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} (B/w)^* \right] + IM} \right).$$

As $G((B/w)^*) = 0$,

$$\left(\frac{wc_B}{Z_X \rho} \right)^{1-\sigma} \left[\bar{e}\alpha + \frac{(1-\bar{e}\alpha)^2}{2} (B/w)^* \right] = \frac{IM \left(\frac{(1-\bar{e}\alpha)^2}{4} ((B/w)^*)^2 + \bar{e}\alpha (B/w)^* - \frac{q^*}{w} \right)}{\left(L + \frac{q^*}{w} H \right)}.$$

Hence, we derive that

$$F((B/w)^*, 0) = C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{A_m}{w} + \frac{a \left(L + \frac{q^*}{w} H \right)}{IM} \right).$$

As a result, B/w is increasing in I_S on $[0, wL/(wL + q^*H)]$ if and only if

$$C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{A_m}{w} + \frac{a \left(L + \frac{q^*}{w} H \right)}{IM} \right) > (B/w)^*. \quad (21)$$

The next step is to consider an explicit expression for $(B/w)^*$. We introduce the following notation:

$$\begin{aligned} D_0 &= IM \frac{(1 - \bar{e}\alpha)^2}{4} > 0, \\ D_1 &= IM \bar{e}\alpha - \left(L + \frac{q^*}{w} H \right) \left(\frac{w c_B}{Z_X \rho} \right)^{1-\sigma} \frac{(1 - \bar{e}\alpha)^2}{2}, \\ D_2 &= \left(L + \frac{q^*}{w} H \right) \left(\frac{w c_B}{Z_X \rho} \right)^{1-\sigma} \bar{e}\alpha + IM \frac{q^*}{w} > 0. \end{aligned}$$

Then, $(B/w)^*$ solves

$$D_0 ((B/w)^*)^2 + D_1 (B/w)^* - D_2 = 0,$$

which implies that

$$(B/w)^* = \frac{\sqrt{D_1^2 + 4D_0D_2} - D_1}{2D_0} > 0.$$

Thus, inequality (21) is equivalent to

$$\begin{aligned} C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \left(\frac{A_m}{w} + \frac{a \left(L + \frac{q^*}{w} H \right)}{IM} \right) &> \frac{\sqrt{D_1^2 + 4D_0D_2} - D_1}{2D_0} \iff \\ C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \frac{A_m}{w} &> \frac{1}{IM} \left(2 \frac{\sqrt{D_1^2 + 4D_0D_2} - D_1}{(1 - \bar{e}\alpha)^2} - Ca \left(L + \frac{q^*}{w} H \right) \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \right). \quad (22) \end{aligned}$$

Let us denote the right-hand side of inequality (22) as $K(z)$ where z is $\frac{1}{IM}$. That is,

$$K(z) = 2 \frac{\sqrt{(\bar{e}\alpha - K_1 z)^2 + (K_2 z + \frac{q^*}{w}) (1 - \bar{e}\alpha)^2} - (\bar{e}\alpha - K_1 z)}{(1 - \bar{e}\alpha)^2} - K_3 z,$$

where

$$\begin{aligned} K_1 &= \left(L + \frac{q^*}{w} H \right) \left(\frac{w c_B}{Z_X \rho} \right)^{1-\sigma} \frac{(1 - \bar{e}\alpha)^2}{2}, \\ K_2 &= \left(L + \frac{q^*}{w} H \right) \left(\frac{w c_B}{Z_X \rho} \right)^{1-\sigma} \bar{e}\alpha, \\ K_3 &= C a \left(L + \frac{q^*}{w} H \right) \left(\frac{w}{Z_X} c_B \right)^{1-\sigma}. \end{aligned}$$

Next, we explore the properties of the function $K(z)$. It is straightforward to see that $K(0) > 0$.

The derivative of $K(z)$ with respect to z is given by

$$K'(z) = \frac{-2K_1(\bar{e}\alpha - K_1 z) + K_2(1 - \bar{e}\alpha)^2}{(1 - \bar{e}\alpha)^2 \sqrt{(\bar{e}\alpha - K_1 z)^2 + (K_2 z + \frac{q^*}{w})(1 - \bar{e}\alpha)^2}} + \frac{2K_1}{(1 - \bar{e}\alpha)^2} - K_3.$$

Hence,

$$K'(0) = \frac{-2K_1\bar{e}\alpha + K_2(1 - \bar{e}\alpha)^2}{(1 - \bar{e}\alpha)^2 \sqrt{(\bar{e}\alpha)^2 + \frac{q^*}{w}(1 - \bar{e}\alpha)^2}} + \frac{2K_1}{(1 - \bar{e}\alpha)^2} - K_3.$$

Since $-2K_1\bar{e}\alpha + K_2(1 - \bar{e}\alpha)^2 = 0$,

$$K'(0) = \frac{2K_1}{(1 - \bar{e}\alpha)^2} - K_3 > 0,$$

as $C a \rho^{1-\sigma} < 1$ (recall that $C a \rho^{1-\sigma} = a/\sigma < 1$). Thus, $K(z)$ is increasing in the neighborhood of zero. Moreover, $K'(\infty)$ is also positive, implying that $K(\infty) = \infty$. As, for any constant A , the equation $K(z) = A$ has at most two solutions and $K(\infty) = \infty$, we can conclude that $K(z)$ is an increasing function in z . Here we employ the following argument: if $K(z)$ is not increasing, then it has at least two local extremum (as $K'(0) > 0$ and $K'(\infty) > 0$). In this case, there exists such a constant \bar{A} that the equation $K(z) = \bar{A}$ has at least three solutions, which contradicts the properties of $K(z)$.

This in turn means that the right-hand side of inequality (22) is always positive and decreasing in IM with the value at infinity being equal to

$$K(0) = 2 \frac{\sqrt{(\bar{e}\alpha)^2 + \frac{q^*}{w}(1 - \bar{e}\alpha)^2} - \bar{e}\alpha}{(1 - \bar{e}\alpha)^2}.$$

As we assume that $C \left(\frac{w}{Z_X} c_B \right)^{1-\sigma} \frac{A_m}{w} > 2 \sqrt{\frac{(\bar{e}\alpha)^2 + \frac{q^*}{w} (1-\bar{e}\alpha)^2 - \bar{e}\alpha}{(1-\bar{e}\alpha)^2}}$ (see (14)), there exists such a value of IM (we denote it as IM_P) that inequality (22) holds if and only if $IM > IM_P$.

Table 1: Offshoring of Production Tasks and Decentralized Management

dependent variable:	(1) level of decentralization of authority OLS	(2) level of decentralization of authority OLS	(3) level of decentralization of authority OLS	(4) level of decentralization of authority OLS	(5) normalized level of decentralization of authority OLS	(6) level of decentralization of authority IV	(7) level of decentralization of authority IV	(8) normalized level of decentralization of authority IV
sum of intrafirm imports / parental sales	0.00251** (0.047)	0.00265** (0.048)	0.00404*** (0.001)		0.00304** (0.048)	0.0247 (0.148)		
intrafirm imports dummy				0.322** (0.025)			1.337** (0.034)	1.536** (0.034)
ln parental sales	0.140*** (0.005)	0.142*** (0.004)	0.145*** (0.003)	0.118*** (0.005)	0.163*** (0.004)	0.322** (0.019)	0.108** (0.014)	0.124** (0.014)
foreign competition (sample)	1.439*** (0.000)	1.342*** (0.002)		1.409*** (0.000)	1.542*** (0.002)	1.043** (0.025)	1.573*** (0.000)	1.807*** (0.0000)
domestic competition (sample)		0.192 (0.593)		0.199 (0.556)	0.220 (0.593)			
foreign competition (firm)			0.499** (0.041)					
Germany dummy	-0.224 (0.136)	-0.254 (0.103)	-0.167 (0.325)	-0.206 (0.155)	-0.292 (0.103)	-0.692* (0.060)	-0.198 (0.291)	-0.227 (0.291)
industry dummies	no	no	yes	no	no	no	no	no
host country region dummies	yes	yes	yes	yes	yes	yes	yes	yes
first stage F-statistic						1.07	1.77	1.77
IV: standardized input						-14.756 (0.108)	-0.272** (0.014)	-0.272** (0.014)
observations	640	640	615	640	640	637	637	637
R-squared	0.233	0.236	0.195	0.256	0.236	-	-	-

Notes: Standard errors are clustered at the parental firm level and p-values are reported in parentheses. The dependent variable *decentralization of decision authority* is an index that measures the degree of decentralization in decision making with values between 1 (decisions are taken by the CEO) and 5 (decisions are taken at the divisional level). Normalized decentralization of decision authority is a standardized version of this index with mean = 0 and standard deviation = 1. *Foreign competition (firm)* is a dummy that takes the value 1 if the firm faces many or very many foreign competitors and 0, else. The instrumental variable *standardized input* is a dummy that indicates if the input supplied by the affiliate firm is standardized in quality and design. The Cragg-Donald F-statistics for weak identification are: (6) 20.88; (7) 43.51; (8) 43.19; (9) 43.19 and therefore all larger than 16.38 (the critical value for 10% IV bias). *** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1.

Table 2: Offshoring of Managerial Tasks and Decentralized Management

dependent variable:	(1) level of decentralization of authority OLS	(2) level of decentralization of authority OLS	(3) level of decentralization of authority OLS	(4) level of decentralization of authority OLS	(5) level of decentralization of authority OLS	(6) level of decentralization of authority OLS	(7) normalized level of decentralization of authority OLS
offshored manager dummy	-0.129 (0.514)	-0.636** (0.033)					
Σ # offshored managers / Σ affiliate employment			-5.699*** (0.001)	-10.32*** (0.001)			
Σ # offshored managers / parent skilled employment					0.0102 (0.872)	-0.0843*** (0.000)	-0.0969*** (0.000)
<i>interaction terms:</i>							
large openness x offshored manager dummy		0.681* (0.063)					
large openness x (Σ # offshored managers / Σ affiliate employment)				6.066* (0.091)			
large openness x (Σ # offshored managers / parent skilled employment)						0.193*** (0.002)	0.222*** (0.002)
large openness	0.432* (0.071)	-0.0400 (0.880)	0.280 (0.130)	0.00710 (0.976)	0.359 (0.134)	0.00907 (0.970)	-0.0104 (0.970)
ln parental sales	0.178*** (0.329)	0.183*** (0.340)	0.138** (0.255)	0.132** (0.245)	0.226*** (0.402)	0.248*** (0.442)	0.285*** (0.442)
Germany dummy	-0.0581 (0.827)	-0.0653 (0.807)	0.189 (0.425)	0.0618 (0.802)	-0.266 (0.420)	-0.261 (0.405)	-0.299 (0.405)
industry dummies	no	no	no	no	no	no	no
host country region dummies	yes	yes	yes	yes	yes	yes	yes
observations	474	474	454	454	410	410	410
R-squared	0.174	0.196	0.230	0.246	0.181	0.265	0.265

Notes: Standard errors are clustered at the parental firm level and p-values are reported in parentheses. The dependent variable *decentralization of decision authority* is an index that measures the degree of decentralization in decision making with values between 1 (decisions are taken by the CEO) and 5 (decisions are taken at the divisional level). Normalized decentralization of decision authority is a standardized version of this index with mean = 0 and standard deviation = 1. *Large openness* is a dummy which takes the value 1 if the firm operates in an industry with very many foreign competitors and 0, else. Managerial offshoring: *Offshored manager dummy* is a dummy variable that indicates whether the firm offshored managers to the affiliate. Σ # *offshored managers / Σ affiliate employment* is the total number of offshored managers relative to the total employment over all affiliates; Σ # *offshored managers / parent skilled employment* is the total number of offshored managers relative to the number of university graduates employed in the parental firm. *** denotes $p < 0.01$, ** denotes $p < 0.05$, * denotes $p < 0.1$.

Table 3: Trade in Tasks and Relative Executive Wages

dependent variable:	(1)	(2)	(3)	(4)	(5)
	ln (average executive wage relative to average firm wage)				
sum of intrafirm imports / parental sales	0.00867 (0.247)	0.0122*** (0.002)	0.0100*** (0.002)	0.0125*** (0.001)	0.00919*** (0.006)
offshored manager dummy	-0.305 (0.257)				
# offshored managers		-0.0690* (0.055)	-0.0499* (0.070)	-0.0987** (0.021)	-0.0717** (0.025)
Δ establishments '97-'98	0.0220*** (0.008)	0.0229*** (0.002)			
small openness			-0.139 (0.636)	-0.368 (0.331)	-0.836** (0.029)
<i>interaction terms:</i>					
small openness x # offshored managers				0.0765 (0.138)	0.121*** (0.001)
ln parental sales	-0.0310 (0.870)	-0.0479 (0.807)	0.0597 (0.525)	0.0506 (0.580)	0.130 (0.255)
Germany dummy	1.137 (0.181)	0.809 (0.203)	0.220 (0.556)	0.222 (0.542)	0.00898 (0.982)
industry dummies	no	no	no	no	no
host country region dummies	no	no	no	no	no
observations	61	56	120	120	120
R-squared	0.457	0.626	0.170	0.200	0.248

Notes: Standard errors are clustered at the parental firm level and p-values are reported in parentheses. The dependent variable *ln (average executive wage relative to average firm wage)* is the natural logarithm of the average executive wage relative to the average wage paid in the multinational parent. *Small openness* is a dummy which takes the value 1 if the firm is within the 40th or 10th percentile of the competition distribution. *Offshored manager dummy* is a dummy variable that indicates whether the firm offshored managers to the affiliate. *# offshored managers* is the number of offshored managers to the affiliate firm. *** denotes $p < 0.01$, ** denotes $p < 0.05$, * denotes $p < 0.1$.

Table 4: Descriptive Statistics

variable:	obs.	mean	min	max	std. dev.	obs. with dummy =1/=0
<i>Decentralized Management:</i>						
level of decentralization of authority	1161	2.83	1	5	0.87	-
normalized level of decentralization of authority	1161	0.00	-2.10	2.50	1	-
<i>Offshoring of Production Tasks:</i>						
intrafirm imports in percent of parent firm's sales	1957	8.37	0	560.00	34.72	-
intrafirm imports	1995	0.39	0	1	0.49	776 / 1219
IV: standardized input	2073	0.61	0	1	0.49	1273 / 800
<i>Offshoring of Managerial Tasks:</i>						
managerial offshoring	809	0.57	0	1	0.49	464 / 345
Σ # offshored managers / Σ affiliate employment	797	0.047	0	0.479	0.066	-
Σ # offshored managers / parent skilled employment	685	1.48	0	13.6	2.49	-
# offshored managers	731	2.63	0	39	3.73	-
<i>Competition and Trade Openness:</i>						
foreign competition (firm)	2010	0.82	0	1	0.38	1657 / 353
foreign competition (sample)	2122	0.82	0	1	0.21	-
domestic competition (sample)	2120	0.57	0	1	0.28	-
large openness	2122	0.74	0	1	0.44	1566 / 556
small openness (below 10th percentile)	2122	0.074	0	1	0.263	158 / 1964
small openness (below 40th percentile)	2122	0.46	0	1	0.50	972 / 1150
Δ establishments '97-'98	1021	-91.76	-1357	313	155.78	-
<i>Human Resources:</i>						
ln average executive wage relative to average firm wage	561	2.22	-1.23	4.96	0.94	-
<i>Control Variables:</i>						
ln parental sales	1733	18.80	13.24	24.78	2.09	-
Germany dummy	2123	0.56	0	1	0.50	1186 / 937

Table 5: Variable Descriptions

variable:	
<i>Decentralized Management:</i>	
level of decentralization of authority	index that measures the degree of decentralization in decision making at the parent firm with values between 1 (decisions are completely made at the top by the CEO) and 5 (decisions are completely made at the divisional level); the index is the mean value of decentralization of 16 (for German parents) or 13 (for Austrian parents) types of decisions (e.g. decisions on acquisitions, new strategies, transfer pricing, human resources, R&D expenditure, new products or financing)
normalized level of decentralization of authority	z-score of the decentralization index; rescales the index to a mean of 0 and a standard deviation of 1; each value of this normalized index indicates its difference from the mean of the original decentralization index in number of standard deviations (of the original index)
<i>Offshoring of Production Tasks:</i>	
intrafirm imports in percent of parent firm's sales	sum of all intrafirm imports that a parent firm sources from its affiliates relative to the size of the parent firm (measured by the parent's domestic sales) multiplied with 100%
intrafirm imports	dummy that takes a value of 1 if the parent firm has intrafirm imports from any of its affiliates and 0 otherwise
IV: standardized input	dummy that takes a value of 1 if the affiliate firm supplies a product that is standardized in both, quality and design and 0 otherwise
<i>Offshoring of Managerial Tasks:</i>	
managerial offshoring	dummy that takes a value of 1 if there are managers in the affiliate firm that are not sent from the parent firm to this affiliate and 0 otherwise
Σ # offshored managers / Σ affiliate employment	sum of managers that work in all affiliate firms and are not sent from the parent firm relative to the total employment in all affiliate firms
Σ # offshored managers / parent skilled employment	sum of all managers that work in affiliate firms and are not sent from the parent firm relative to the number of university graduates employed in the parent firm
# offshored managers	number of managers in the affiliate firm that are not sent from the parent (absolute)
<i>Competition and Trade Openness:</i>	
foreign competition (firm)	dummy that takes a value of 1 if the parent firm faces many or very many foreign competitors and 0 otherwise
foreign competition (sample)	average of the dummy <i>foreign competition (firm)</i> at the ISIC 3 digit level
domestic competition (sample)	average of the dummy <i>foreign competition (firm)</i> at the ISIC 3 digit level
large openness	dummy that takes a value of 1 if the parent firm operates in an ISIC 3 digit industry that is above the 25th percentile of <i>foreign competition (sample)</i>
small openness (below 10th percentile)	dummy that takes a value of 1 if the parent firm operates in an ISIC 3 digit industry that is below the 10th percentile of <i>foreign competition (sample)</i>
small openness (below 40th percentile)	dummy that takes a value of 1 if the parent firm operates in an ISIC 3 digit industry that is below the 40th percentile of <i>foreign competition (sample)</i>
Δ establishments '97-'98	change in the number of establishments between 1997 and 1998 within the sector and home country of the parent firm; 4 digit information is used wherever available, if not then 3 or 2 digit information is used; data source: INDSTAT4 2013
<i>Human Resources:</i>	
\ln average executive wage relative to average firm wage	natural logarithm of the average executive wage relative to the average employee wage of the parent firm; data sources: average executive wages are obtained from Kienbaum and additionally hand-collected from annual reports of the firms; whenever only consolidated reports were available from a superordinated entity, executive payments are obtained from there; average employee wage come from the firm survey
<i>Control Variables:</i>	
\ln parental sales	natural logarithm of the parent firm's domestic sales in EUR
Germany dummy	dummy that takes a value of 1 if the parent firm is located in Germany and 0 if the parent firm is located in Austria