Trade, Technologies, and the Evolution of Corporate Governance

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Abstract

This study evaluates the impact of international trade and skill-biased technological change on governance standards within firms. Data on executive compensation and governance practices suggest that firms shifted incentive provisions from exercising strict corporate control towards performance pay during the last decades. I propose a general equilibrium theory of an open economy with an endogenous choice of firm governance that explains the link between this development in corporate governance and the real economy. The model links the distribution of corporate governance quality across firms to product markets and allows analyzing governance changes within firms as a response to trade or technological shocks. Trade and skill-biased technological change shift the reservation wages of the most productive managers upwards inducing firms to compensate managers with incentive payments instead of investing in better governance to improve monitoring. I test the model predictions using data on managerial entrenchment opportunities and equity compensation in a sample of public U.S. corporations between 1990-2006. The results provide support for the hypothesis that rises in sectoral openness and the importance of ICT led to increases in managerial entrenchment opportunities and equity-linked compensation within firms.

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1 Introduction

U.S. public firms typically incentivize managers with performance related payments instead of tight monitoring: between 1992 and 2008, the median share of performance payments in U.S. S&P 500 firms increased from 58 to 83 percent[1] while improvements in corporate governance to monitor managerial behavior have been rather absent.[2] This paper proposes an explanation of this development, by showing that trade and technological change lead to more competition for the most productive managers which can interact with the way how firms provide incentives. Labor economists frequently argue that globalization and skill-biased technological change have been major triggers of increases in the level and the slope of compensation at the very top of the income distribution.[3] Furthermore, skill intensity and openness to international trade also seem to matter for managerial compensation across industries: managers in skill intensive and open industries obtain a wage premium.[4] However, the understanding how real economic developments affect corporate governance outcomes is rather scant. Inspired by the impact of trade and technological change on incentives and the managerial skill premium, this paper investigates how trade openness and skill-biased technological change affect the quality of corporate governance as an alternative incentive device. If trade and technological advancements raise the role of incentives inside firms, it is a priori surprising that firms do not try to invest more in the quality of corporate governance over time to incentivize their management with better control mechanisms.

In order to explain why firms do not incentivize with strict corporate governance, I propose an open economy model with heterogeneous firms. The model considers an economy that is endowed with a measure of heterogeneous production technologies and a measure of agents with heterogeneous skill levels. Firms emerge after matching production technologies with agents which are employed as managers and agents employed as production workers. The quality of the production technology and the level of employed managerial skill jointly deter-

[1] See Frydman and Jenter (2010) who document the historical development of U.S. executive compensation.

[2] The two most prominent U.S. corporate governance indices from Bebchuk et al. (2009) and Gompers et al. (2003) indicate that the average corporate governance quality became inferior during the last two decades while there is large variation in the quality of corporate governance between firms.

[3] See for instance Baldwin and Cain (2000) who study the roles of trade and technology for shifts in relative U.S. wages, Bell and Van Reenen (2013) who study the role of globalization on extreme wage inequality in top management or Cuñat and Guadalupe (2005, 2009) who study the effects of globalization on incentive provisions.

[4] Figure 1 plots average CEO compensation for 4-digit SIC industries and illustrates that average compensation is larger in more skill-intensive and more open sectors

mine the productivity of firms. Technologies and managerial skills are both complements such that a positive assortative assignment arises in equilibrium. I borrow here from Monte (2011) when I model preferences, the endowments of the economy and the assignment of workers to production technologies.

I subsequently introduce a stylized theory of the firm with simple incentive contracts to establish a role for corporate governance. Principals offer incentive payments and make an upfront investment into the quality of the monitoring technology for the control of managers reflecting the strength of corporate governance in a firm. In particular, I follow Acharya et al. (2013) in modeling the contracting of performance pay and corporate governance. The objective of a contract between a manager and the firm owner is twofold. First, performance pay and governance should incentivize managers to take the desired action from the owner's perspective. Second, the expected performance pay should make the participation in the firm sufficiently attractive for a manager given his endogenously formed reservation wage.

To determine the distribution of managerial wages in equilibrium, I borrow from the literature on the assignment of managers to firms[5] and make use of the positive assortative matching of managerial skills to production technologies. An assignment implies that the marginal cost of a slightly higher skilled manager is equal to the marginal benefit of this manager in a competitive labor market equilibrium. Therefore, managerial wages depend on the productivity of managers and thus on the individual skill level, the production technology of the firm and industry characteristics.

The paper proceeds with two comparative static exercises. First, I consider the effects of skill-biased technological change on corporate governance investments and performance payments. More specifically, I model skill-biased technological change as an increase in the effectiveness of production technologies benefiting higher skilled managers relatively more. Second, I extend the model to an open economy version with two symmetric countries and intra-industry trade. The open economy version of the model allows to consider how trade integrations, modeled as a reduction of trade costs, affect corporate governance and performance pay.

In the model, trade and skill-biased technological change raise competition on managerial labor markets and thereby increase reservation wages of the most productive managers in the economy. This increase in reservation wages forces companies to compensate their managers

[5]See for instance Gabaix and Landier (2008) or Terviö (2008).

with larger sums. Firms respond to this effect with more performance payments and lower investments into their corporate governance.

The analysis of the impact of real economic outcomes on both, executive compensation and corporate governance structures, joins two prominent and competing explanations for the rise of CEO compensation during the previous decades: managerial power versus market competition. Some economists argue that the rise of executive compensation is due to more powerful managers that can influence their compensation contracts and extract rents from the firm more easily (see Bebchuk and Fried (2003)). Another strand of literature claims that competition for managerial talent, raised by increases in market capitalization, can account for the rise in executive payments to a large extent (see Gabaix and Landier (2008) and Terviö (2008)). The model combines those two strands by arguing that changes in the real economic environment have triggered a shift in the demand for managerial talent. Thereby, firms endogenously reduce investments in corporate governance which leads to powerful managers and a rise of performance payments at the top.

Using data on managerial entrenchment opportunities and equity compensation in a panel of large U.S. stock companies between 1990 and 2006 combined with information on trade openness and the importance of ICT at the industry level, I can test the comparative statics predictions of the model. The empirical results suggest that companies react to increases in trade openness at the sectoral level, measured as the share of exports relative to the effective market size of the industry, with weaker corporate governance and more equity compensation. Furthermore, the results suggest that the application of information and communication technologies, measured as the contribution of ICT services to the industry growth, led to similar albeit smaller effects: companies adopted weaker corporate governance and paid more equity compensation. I address potential sources of endogeneity by employing an instrumental variable strategy, where trade openness is instrumented with the real effective exchange rate of the industry-weighted most important trading partner countries.

The paper covers a question at the intersection of organizational and international economics and thus relates to various strands of the literature on the effects of trade and technological change on firm organization and corporate finance.

It contributes to the literature that considers incentive compensation in general equilibrium trade models. Wu (2011) and Chen (2012) focus on the managerial incentive provision in firms with moral hazard in general equilibrium models of intra-industry trade and firm heterogeneity à la Melitz (2003). Gersbach and Schmutzler (2014) show how the global integration of product and labor markets increases the heterogeneity of CEO remuneration in a model with Cournot competition. The focus of these models is the effect of trade integrations on the dispersion of incentive contracts and compensation levels.

The paper is also related to a literature that links the decision to delegate authority inside firms to globalization and the technological frontier. Marin and Verdier (2008, 2012a,b) show that globalization affects the delegation of formal and real authority in organizations. They embed the allocation of formal decision authority à la Aghion and Tirole (1997) into models of international trade and explain how economic integration leads to the delegation of power inside firms. Since agents are infinitely risk-averse with respect to income, performance payments cannot be used to incentivize agents. Consequently, their models do not allow to draw inferences on the choice between managerial power and performance pay. Additionally, the quality of managerial talent is homogenous such that variation in managerial power across firms within industries is absent. Marin et al. (2014) investigate how the allocation of power inside firms is affected by offshoring managers or production tasks in a small open economy model. Caliendo and Rossi-Hansberg (2012) show that exporting firms increase the control span of managers and the number of management layers within their hierarchies after trade liberalizations. Acemoglu et al. (2007) analyze how technology diffusion affects firm decentralization. They argue that decision rights are more decentralized when private information of agents is crucial. Consequently, the delegation of authority is more likely when firms are relatively close to the technological frontier such that technologies are not public knowledge. Compared to their model, technologies play a different role in this paper. While the quality of ideas and managerial skills are modeled as complementary inputs in my model, the complexity of technologies and the quality of the managerial talent is exogenous in their paper.

I add an integrated view to this literature that considers both, the choice of corporate governance and performance payment which are subject to labor market outcomes. This allows to draw novel conclusions on how trade and technological change affect the substitution patterns between both payment and governance to provide incentives.

The effects of product markets on either managerial power or incentive compensation have also been analyzed in several empirical papers. Here, the literature has primarily focused on the delegation of decision authority as a particular dimension of managerial power. Bloom et al. (2010) and Guadalupe and Wulf (2010) use data on the organization of firms to show how more import penetration leads to flatter firm hierarchies and more decentralized decision making. Marin and Verdier (2012a) show that German and Austrian multinationals have a more decentralized organization when they are faced by a stronger trade exposure. Cuñat and Guadalupe (2005) consider the appreciation of the British Pound as a quasi-natural experiment to quantify the effect of product market competition on executive performance pay within a panel of British manufacturing firms. They find that the implied import competition shock led to a higher pay to performance sensitivity for managers in more open sectors.

The paper is also related to recent research on assignment models that consider corporate finance decisions of the firm. Eisfeldt and Kuhnen (2013) present a model where CEOs and firms form matches based on multiple characteristics to explain low turnover rates in an industry equilibrium. Bénabou and Tirole (2013) analyze the impact of labor market competition and skill-biased technological change on the structure of compensation in a Hotelling framework. They demonstrate that competition for talent shifts effort from less easily contractible tasks, like long-term investments, towards more easily contractible tasks. In addition Baranchuk et al. (2011), Edmans et al. (2009) and Falato and Kadyrzhanova (2012) develop industry equilibrium models with moral hazard problems to show how CEO compensation interacts with the industry environment of firms. Dicks (2012) establishes a role for corporate governance regulation in an industry equilibrium model with moral hazard and assignment of CEOs to firms. Acemoglu and Newman (2002) consider the impact of labor supply and demand on the corporate structure of firms and show how the outside option of production workers affects production worker monitoring.

The remainder of the paper is organized as follows. Section 2 develops the model in the closed economy and characterizes the equilibrium solution. Section 3 addresses the effects of skill-biased technological change in a closed economy setting. Section 4 deals with the open economy case and considers the effects of globalization through a decline in trade costs. Section 5 describes the data, empirical modeling strategy and presents the evidence. Section 6 concludes.

2 The Model

In this section I present the model in a closed economy setting. I follow Acharya et al. (2013) in modeling the organization of firms subject to moral hazard. This partial equilibrium model of the firm is subsequently introduced into an industry environment with heterogeneous skills and technologies. Complementarities in the effectiveness of managerial skills and production technologies lead to a positive assortative matching of managers to production technologies in equilibrium. The structure of the general equilibrium model borrows from Monte (2011).

The outline of the timing structure is as follows:

$t = 0$: All firms that want to enter the market make an upfront investment into the level of corporate governance $g \in [0, 1]$ that they want to establish at their firm. Better corporate governance leads to more efficient control of their managers and thus to a closer alignment of the manager's incentives to the owner's interests.

$t = 1$: All firms that want to enter the market need to hire a manager. Owners make a 'take it or leave it' contract offer to a manager, taking into account the value of the manager's outside option. The prospective manager receives the offer which specifies a performance payment and the level of corporate governance investment chosen in $t = 0$. This level of corporate governance allows a prospective manager to infer how likely it is to pursue personal goals without being caught. Managers in more weakly governed firms have a higher chance to remain uncaught when shirking such that their incentives are less closely aligned with the owners' interests. Managers may decide to accept or decline the offer depending on their respective outside option. Labor market clearing requires that the remaining agents that do not get an offer for a CEO position become production workers.

$t = 2$: After a manager accepts the offer, he chooses to either behave (exert effort) or misbehave (shirk). Whenever the manager chooses to shirk, the output production will fail and whenever the manager chooses to spend effort, there is a positive chance that the firm produces output. The quality of corporate governance is introduced as a probability g with that firm owners receive a signal on the expected production outcome. If the signal indicates a failure of output production, firm owners can displace a manager in order to obtain some liquidation value.

$t = 3$: After the production occurred, all agents are compensated and profits are realized.

2.1 Preferences, Skills and Technologies

I continue with a description of the consumer preferences and the endowment of the economy. Preferences can be described by a standard CES utility function over a set of differentiated varieties J

$$U = \left[\int_{j \in J} y_j^{(\sigma-1)/\sigma} dj \right]^{\sigma/(\sigma-1)}, \tag{1}$$

where y_j is the amount that is consumed of variety j and $\sigma > 1$ is the constant elasticity of substitution. This implies that consumers spend $x_j = X \left(\frac{p_j}{P} \right)^{1-\sigma}$ on each variety that is produced, where $P \equiv \left[\int_{j \in J} p_j^{(1-\sigma)} dj \right]^{1/(1-\sigma)}$ is the price index in the economy and X the aggregate consumption expenditure. A firm needs three inputs in order to exist: a production technology, a manager and production labor in proportion to the firm's output. All firms are single product firms.

The economy is populated by a mass of agents L which can be employed either as production workers or as managers. Agents differ in their managerial skill but they are equal in the skills that they provide as production workers. The distribution of managerial skills is described by $L(s) = L/s$, where $s \in [1, \infty)$ is an agent's skill level and $L(s)$ is the measure of agents with managerial skills that are at least as good as the skill level s. Agents that fill an occupation as production worker provide one efficiency unit of production labor, independently of their managerial skills. The occupational choice between production work and managerial work will be endogenized later in the model. Note that, unlike in Melitz (2003), where the production labor supply is fixed and similar to Wu (2011), the allocation of agents into production worker jobs and managerial jobs endogenously determines the supply of production labor.

Besides the skill level of the employed manager, firm productivity is influenced by the quality of the production technology. All production technologies are owned by a mutual fund (the principal) maximizing the individual profits of firms and redistributing them equally across the population.[6] The quality distribution of technologies is given by $G(z) = T/z$, where $z \in (0, \infty)$ is the quality of a technology and $G(z)$ is the measure of technologies that are at least as

[6] This is a standard assumption in the literature on heterogeneous firms to abstract from any wealth effects among economic agents.

good as a technology with quality z. This implies that the number of available (however, bad) technologies is sufficient to accommodate any number of managers in equilibrium.

The production costs of a firm depend on the skill of the manager and the production technology: managerial talents and technologies complement each other regarding the production of output. This complementary relationship is implied by the firm's unit cost of production. In particular, if production with a technology of efficiency z is run by a manager with skill s, unit costs are $\varphi(z,s) = \underline{w} / (z^{\kappa} s^{\mu})$, where $\underline{w}$ is the production labor wage. The parameter $\mu > 0$ measures the influence of the manager's skill and the parameter $\kappa > 0$ the impact of the production technology on firm productivity.

Let $x(p_j) - \frac{x(p_j)}{\varphi(z,s)p_j}$ be the surplus (revenues net of production costs) of a firm that chooses the price level p_j for its variety. Standard optimization yields that the firm charges a constant markup over production costs: $p_j = p(z,s) = \frac{\sigma}{\sigma-1}\frac{\underline{w}}{z^{\kappa}s^{\mu}}$. The revenue function x_j and the optimal price $p(z,s)$ can now be used to state the surplus that a firm can obtain if it produces successfully, denoted by $Y(z,s)$, as

$$Y(z,s) = M\left(\frac{z^{\kappa}s^{\mu}}{\underline{w}}\right)^{\sigma-1}. \tag{2}$$

The term $M \equiv \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} XP^{\sigma-1}$ captures the size of the market from the perspective of an individual firm. Markets are large if the elasticity of substitution between varieties is low and the aggregate expenditure level X or the price index P are large.

Note that a marginal increase in the managerial skill s increases the surplus (2) for all firms but due to complementarities between skills and technologies the increase of surplus is larger, the better the quality of technology z: $\partial^2 Y(z,s) / (\partial s \partial z) > 0$. This property will be important when the assignment of managers to production technologies is discussed at a later stage of the paper.

2.2 Moral Hazard and Firm Governance

In this section, I explain the contracting between the firm owner and a prospective manager in a partial equilibrium setting, where I treat the outside option of the manager and the potential surplus of the firm as exogenous. I show that the optimal level of corporate governance depends on the expected value of the manager's outside option. Specifically, I borrow from Acharya et al. (2013) in modeling contracting with corporate governance investments under moral hazard.

As discussed previously, firm owners make an upfront investment into the level of corporate governance in $t = 0$ and hire a manager in $t = 1$ to become active on the market. A contract between both parties consists of a performance payment $w \geq 0$ and the strength of corporate governance $g \in [0, 1]$ that the owner has implemented in $t = 0$. Investments in corporate governance generate linear personal costs $C\underline{w}g$.[7] These costs reflect the owner's ex-ante effort cost to set up a system in order to monitor the manager ex-post. The benefit of stricter corporate governance is that it increases the chance of learning the productivity of the manager such that the manager may be displaced more easily whenever he is unproductive.

The manager chooses an unobservable and hence incontractible action $Z \in \{manage, shirk\}$ after a contract is signed. The action $Z = \{shirk\}$ generates a private non-pecuniary benefit B for the manager and no production output for the firm. The action $Z = \{manage\}$ instead generates no private benefits for the manager but positive surplus $Y > 0$ for the firm with likelihood ε and zero production output $Y = 0$, otherwise. Whenever the positive surplus $Y > 0$ is realized, the manager is compensated with his bonus w.

Before the surplus is realized, owners observe a signal $\tilde{x} \in \{Y, 0\}$ on the expected firm surplus with probability g. After observing this signal, owners can choose to displace the manager and liquidate the firm to obtain some liquidation value $R\underline{w}$. This liquidation value induces firm owners to displace managers whenever the signal on output production turns out to be negative.[8] In order to make the analysis interesting, I make the following assumptions:

Assumption.

(1) $C\underline{w} \in ((1 - \varepsilon) R\underline{w}, (1 - \varepsilon) R\underline{w} + B)$: the choice of g is non-trivial. If corporate governance investments were cheaper, the firm would always invest. If instead corporate governance investments were more expensive, investments would never be profitable.

(2) $\varepsilon Y > B$: incentivizing managers to exert effort is socially efficient.

[7] I choose to express the owner's costs and benefits of corporate governance in terms of the production labor wage rate $\underline{w}$ in order to simplify the notation when I derive the equilibrium solution in 2.4. This simplifies the characterization of an equilibrium in the open economy case and leaves the qualitative results of the comparative static analyses in 3 and 4 unaffected.

[8] An empirical counterpart of this liquidation value could be the owner's benefits of a merger or the acquisition by another firm.

(3) $\varepsilon Y > R\underline{w}$: owners have no incentive to displace the manager and obtain the liquidation value $R\underline{w}$ when they do not observe the signal $\widetilde{x}$.

A contract between both parties needs to be incentive compatible and to satisfy the manager's participation constraint. To sum up, the owner's problem is given by

$$\max_{w,g} \varepsilon (Y - w) + (1 - \varepsilon) gR\underline{w} - C\underline{w}g \tag{3}$$

$$s.t.$$

$$\varepsilon w \geq (1 - g) B \tag{4}$$

$$\varepsilon w \geq \overline{W}. \tag{5}$$

Firm owners choose the performance payment w and the level of corporate governance g to maximize their expected profits (3) subject to the manager's incentive compatibility constraint (4) and the participation constraint (5). If the manager chooses the action $Z = \{shirk\}$, firm output is always 0 and the manager receives his private benefit B whenever he is not displaced which occurs with probability $1 - g$. If the manager chooses the action $Z = \{manage\}$, he is compensated with performance payment w whenever the firm produces output $Y > 0$ which happens with probability ε. The incentive compability constraint (4) ensures that the manager's expected payoff from $Z = \{manage\}$ is weakly larger than his expected payoff from $Z = \{shirk\}$. The participation constraint (5) additionally requires that the manager's expected payoff from $Z = \{manage\}$ is weakly larger than his market wage $\overline{W}$.

Note that ex ante, corporate governance and performance pay are substitutes with respect to the provision of incentives. From the perspective of the manager, a stricter level of corporate governance reduces his power to obtain private benefits such that incentive compatibility is achievable with lower levels of performance pay. Vice versa, more performance pay makes effort provision more attractive such that less control is required. This substitutive relationship is impaired by the participation constraint that imposes a minimum payment requirement $\overline{W}$.

The optimal choice of corporate governance and performance payment is given in the following proposition.

Proposition 1. *The optimal contract for a manager is:*

$$w = \frac{\overline{W}}{\varepsilon}$$

$$g = \begin{cases} 1 - \frac{\overline{W}}{B} & \text{if } \overline{W} \leq B \\ 0 & \text{if } \overline{W} > B. \end{cases}$$

Proof. See Appendix. □

Intuitively, the optimal incentive contract depends on the value of the manager's outside option. If the manager has a valuable outside option $\overline{W} > B$, the incentive compatibility constraint becomes redundant since incentive pay is already sufficiently large to incentivize the manager to choose $Z = \{manage\}$ such that investments in corporate governance are inefficient. If the manager has a less valuable outside option $\overline{W} \leq B$, owners optimally choose the cheapest contract that keeps both constraints binding in equilibrium.

2.3 Assignment and Managerial Compensation

Proposition 1 describes the choice of performance pay and the upfront investment in corporate governance for an exogenous outside option $\overline{W}$. Next, I endogenize the managerial wage function in order to describe how firms choose their governance in equilibrium. I proceed in two steps. First, I describe the positive assortative matching of production technologies and agents to form firms. Then, I borrow from the assignment literature and obtain equilibrium managerial payments. A satisfied participation constraint then prevents all managers from switching firms.

Complementarities between the effectiveness of production technologies and managerial skills and a competitive labor market lead to a positive assortative matching of managerial skill levels and production technologies, as it is standard in the assignment literature.[9] The positive assortative matching of managerial skills to production technologies implies that the measure of the upper tail of the managerial skill distribution and the measure of the upper tail of the

[9] See for example Gabaix and Landier (2008) or Terviö (2008). Furthermore, consider the following intuitive argument: Suppose there were two technology-skill matches (z_1, s_2) and (z_2, s_1) that form firms in equilibrium with $z_1 < z_2$ and $s_1 < s_2$. The aggregate surplus could be increased by making the CEO with skill s_1 the head of the firm with production technology z_1 and the other CEO with skill s_2 the head of the firm with z_2 instead. Since any competitive equilibrium is efficient, this is a contradiction.

technology distribution need to be of equal size for each matched firm pair (s, z) such that

$$L/s = T/z \quad \Leftrightarrow \quad z = ts,$$

where $t \equiv T/L$ is a relative measure of the technology size in the economy. The equilibrium surplus (2) can be restated as a function of the managerial skill s and industry-specific parameters:

$$Y(s) = M\left(\frac{t^{\kappa}s^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1}. \tag{6}$$

In order to pin down the equilibrium function of managerial payments $\overline{W}(s)$, I make use of a standard assignment equation as in Gabaix and Landier (2008) or Monte (2011):

$$\frac{\partial \varepsilon Y(z,s)}{\partial s}_{|z=z(s)} = \overline{W}'(s). \tag{7}$$

Equation (7) implies that the marginal cost of a slightly better manager equals the marginal benefit of a slightly better manager from the perspective of the firm.[10] Differentiating the surplus (2) with respect to s and plugging $z(s) = ts$ in, then gives

$$\varepsilon M\left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1}\mu(\sigma-1)\,s^{(\kappa+\mu)(\sigma-1)-1} = \overline{W}'(s). \tag{8}$$

I integrate the left hand side of equation (8) over s and make use of the fact that the marginal manager with skill s_c is indifferent between an occupation as production worker or as manager such that $\overline{W}(s_c) = \underline{w}$. This gives the equilibrium function of managerial payments:

$$\overline{W}(s) = \int_{s_c}^{s}\frac{\partial \varepsilon Y(z,\iota)}{\partial \iota}_{|z=z(\iota)}d\iota + \underline{w} = \varepsilon M\left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1}\frac{\mu}{\kappa+\mu}\left(s^{(\kappa+\mu)(\sigma-1)} - s_c^{(\kappa+\mu)(\sigma-1)}\right) + \underline{w}. \tag{9}$$

Intuitively, the compensation of a manager increases with the skill difference between this manager and the marginal manager with skill s_c, the market size M, the relative technology size t and the contribution of managerial talent to firm productivity μ.

[10] Note, that the marginal cost of the CEO do not include any marginal corporate governance costs since corporate governance investments have been made in $t = 0$ and are therefore sunk in the hiring stage $t = 1$. See the Appendix for a discussion of the credibility of reservation wages.

2.4 Equilibrium

In this section, I establish the conditions that determine the equilibrium and characterize the choice of corporate governance and performance pay that firms offer in the economy. The following three conditions need to be satisfied in equilibrium. First, all firm owners offer the optimal mix between performance pay and corporate governance according to Proposition 1 after taking the managerial payments (9) into account. Second, only firms with non-negative expected profits are active on the market and hire a manager (the zero cutoff earnings condition). Third, the labor market clears (the labor market clearing condition).

Due to the positive assortative assignment, the marginal firm employs the least-skilled manager with managerial skills s_c. This manager must be indifferent between an occupation as production worker or an occupation as manager such that his outside option is $\overline{W}(s_c) = \underline{w}$. I make the following assumption in order to focus on the more interesting equilibria where at least some firms invest in corporate governance to monitor their managers:

Assumption. $\underline{w} < B$: *there are some firms in the economy that choose to invest in corporate governance such that there is variation in the quality of corporate governance across firms.*

According to Proposition 1, the contract offered by the marginal firm is characterized by a performance payment $w(s_c) = \underline{w}/\varepsilon$ and the highest level of governance in the economy $g(s_c) = 1 - \frac{\underline{w}}{B}$. The following zero cutoff earnings condition ensures that the marginal firm is indifferent between entering or leaving the market

$$\varepsilon\left[M\left(\frac{t^{\kappa}s_c^{\kappa+\mu}}{w}\right)^{\sigma-1} - \frac{\underline{w}}{\varepsilon}\right] - \left(1 - \frac{\underline{w}}{B}\right)(C - (1-\varepsilon)R)\,\underline{w} = 0. \tag{10}$$

Since the market size M depends on the price index which again depends on the cutoff skill level s_c, I restate M in terms of the aggregate expenditure X and the cutoff skill level s_c. The CES price index can be written as function of fundamentals and the managerial ability cutoff s_c itself, using $z_c = ts_c$ for the marginal firm[11]:

$$P = \frac{\sigma}{\sigma-1}t^{-\kappa}\underline{w}\left(\frac{\psi}{\varepsilon L}\right)^{1/(\sigma-1)} s_c^{\psi/(\sigma-1)}, \quad \psi \equiv 1 - (\sigma-1)(\kappa+\mu). \tag{11}$$

[11]See the Appendix for a more detailed derivation of the price index in the closed economy.

Here, I make the following assumption.

Assumption. $(\sigma-1)(\kappa+\mu)<1$: *the improper integral for the price index exists.*

Intuitively, this assumption implies that there is no single firm that is sufficiently productive to push the price index towards zero.[12] Plugging the price index (11) and the expenditure level X into the zero cutoff earnings condition (10) and rearranging terms, yields the following function $X(s_c)$:

$$X=\frac{\sigma L\underline{w}\lambda}{\psi}s_c^{-1}, \tag{12}$$

where $\lambda \equiv \left(\left(1-\frac{w}{B}\right)\left(C-(1-\varepsilon)R\right)+1\right)$ is the net cost of corporate governance for the marginal firm.

The zero cutoff earnings curve is downward sloping since an increase in the cutoff managerial skill s_c increases the productivity of the marginal firm. Therefore, the aggregate expenditures X must decrease in order to restore zero earnings of this firm.

Next, I consider the labor market clearing condition. In contrast to the classical Melitz (2003) model with heterogeneous firms, the labor supply is not fix in my model since the mass of production workers depends on the number of managers and the number of firms in the economy, respectively. The labor market clears when the aggregate expenditure on production workers that is required to produce the aggregate output of all active firms equals the aggregate earnings of those production workers:

$$\int_{s_c}^{\infty}\varepsilon\left(x\left(i\right)-Y\left(i\right)\right)Li^{-2}di=L\underline{w}(1-s_c^{-1}). \tag{13}$$

The left hand side of equation (13) integrates the difference between expected revenues and the expected surplus over all firms and thus corresponds to the aggregate expenditure on production labor in the economy. The right hand side of (13) corresponds to the aggregate earnings of production workers. Solving the integral on the left hand side gives rise to a simple term for the aggregate expenditure on production labor: $\varepsilon\frac{\sigma-1}{\sigma}X$.[13] This simplifies the labor market clearing condition to the following function $X\left(s_c\right)$:

$$X=\frac{L\underline{w}}{\varepsilon}\frac{\sigma}{\sigma-1}\left(1-s_c^{-1}\right). \tag{14}$$

[12] Also see Monte (2011) for a more detailed discussion.

[13] See the Appendix for a detailed derivation of the aggregate expenditure on production labor.

The labor market clearing curve (14) is upward sloping in s_c. Intuitively, a rise in s_c increases the supply of production labor. Therefore, the production labor demand has to rise as well and thus the aggregate expenditure level X needs to increase to keep the labor market in equilibrium.

Figure 3 about here

Figure 3 illustrates the zero cutoff earnings and the labor market clearing curve graphically. Since both curve intersect once, there exists a unique equilibrium solution for X and s_c. The subsequent proposition summarizes the closed form solutions of X and s_c in the closed economy version of the model.

Proposition 2. *The zero cutoff earnings condition and the labor market clearing condition uniquely determine the equilibrium solution of the cutoff skill s_c and the aggregate expenditure X in the closed economy:*

$$\begin{aligned} X &= \frac{\sigma L \lambda \underline{w}}{\varepsilon(\sigma-1)\lambda+\psi} \\ s_c &= 1+\frac{\varepsilon(\sigma-1)\lambda}{\psi}. \end{aligned}$$

Proof. See Appendix. □

Given the solution for X and s_c, it will turn out to be convenient to state the managerial payment function as follows:

$$\overline{W}(s)=\lambda\underline{w}\frac{\mu}{\kappa+\mu}\left(\left(\frac{s}{s_c}\right)^{(\kappa+\mu)(\sigma-1)}-1\right)+\underline{w}. \tag{15}$$

In the next subsection, I make use of the managerial payment function to characterize the distribution of corporate governance across firms in the economy.

2.4.1 The Distribution of Corporate Governance across Firms

Since the managerial wage function is increasing with managerial skills, firms are heterogeneous in their upfront investments in corporate governance. Firms that employ the managers with relatively little managerial skills choose to invest into corporate governance since the equilibrium payments are insufficient to incentivize their managers. On the contrary, firms that employ the managers with relatively high managerial skills also have to pay them more. These firms use the payments to incentivize their managers which makes investments into better corporate governance inefficient for them.

The following function summarizes the strength of governance g as a function of the managerial skill s, taking into account Propositions 1 and 2 and the payment function (15):

$$g = \begin{cases} 1 - \frac{\lambda \underline{w} \frac{\mu}{\kappa+\mu}\left(\left(\frac{s}{s_c}\right)^{(\kappa+\mu)(\sigma-1)} - 1\right) + \underline{w}}{B} & \text{if } s \leq \widetilde{s} \\ 0 & \text{if } s > \widetilde{s}. \end{cases} \tag{16}$$

Firms that employ a manager with skills above $\widetilde{s}$ leave all the power to their manager and choose not to invest in corporate governance. Firms that employ managers with skill levels below $\widetilde{s}$ choose to provide incentives with both instruments, stricter monitoring and performance payments. Consequently, the managers in smaller firms have less power to obtain their benefits from shirking. According to Proposition 1, the critical skill level $\widetilde{s}$ is defined as

$$\varepsilon M \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu}\left(\widetilde{s}^{(\kappa+\mu)(\sigma-1)} - s_c^{(\kappa+\mu)(\sigma-1)}\right) + \underline{w} = B. \tag{17}$$

Using the equilibrium values of X and s_c from Proposition 2 leads to

$$\widetilde{s} = \left(1 + \frac{(\kappa+\mu)\left(B - \underline{w}\right)}{\lambda \mu \underline{w}}\right)^{\frac{1}{1-\psi}} s_c. \tag{18}$$

Note, that $\widetilde{s}$ increases proportionally with s_c. Thus, an increase of the cutoff managerial skill puts pressure on managerial payments which leads to more corporate governance investments in the economy since more managers need to be further incentivized

For the subsequent comparative static exercises, I analyze the effects on the share of firms in the economy that do not invest in corporate governance ($g = 0$) in equilibrium. This share is characterized by the following Proposition.

Proposition 3. *The share of firms θ that do not invest in corporate governance is equal to*

$$\theta \equiv \frac{L\widetilde{s}^{-1}}{Ls_c^{-1}} = \left(1 + \frac{(\kappa+\mu)\left(B - \underline{w}\right)}{\lambda \mu \underline{w}}\right)^{\frac{1}{\psi-1}}. \tag{19}$$

θ is large if the costs of corporate governance λ are relatively high or the shirking benefits of managers B

are relatively small.

The following two sections of the paper present comparative statics results of either skill-biased technological change or economic integration in an open economy version of the model on the share of weak governance firms θ.

3 Skill-Biased Technological Change

This section provides comparative static results to illustrate the effects of skill-biased technological change on managerial payments and firm investments in corporate governance. There has been a debate in the economics literature that technological change is to a large extent skill-biased in the sense that it increases the effectiveness of technologies that disproportionally benefit the productivity of firms that employ relatively high-skilled agents. For instance, the availability of computers and related information technologies is particularly relevant for workers that frequently use these technologies.[14] This skill-bias in technological change can be modeled as an exogenous increase in the parameter κ which measures the influence of the production technology on the overall firm productivity.[15] A higher value for κ immediately translates into a more dispersed productivity distribution since the productivity of firms with higher skilled agents improves disproportionally.[16] First, I consider the effects of skill-biased technological change on the zero cutoff earnings condition. Then, I analyze how the effects on X and s_c affect corporate governance choices of firms and how the share of weak governance organizations θ in the economy changes.

An increase in κ leaves the labor market equilibrium clearing condition (14) unaffected since changes in the effectiveness of technologies neither affect the aggregate production labor expenditure nor the earnings on production labor. However, a larger κ affects the zero cutoff earnings condition (12). A skill-biased increase in the effectiveness of technologies has two opposing effects on the surplus of the marginal firm. First, there is a positive productivity effect since the marginal costs $\frac{t^{\kappa}s_c^{\kappa+\mu}}{\underline{w}}$ decrease. Second, there is a negative market size effect that is due to a lower price index because all other firms also become more productive. Since an increase in

[14]See Autor et al. (1998) for empirical evidence.

[15]see Monte (2011)

[16]The elasticity of the firm productivity with respect to changes in κ is increasing in the employed skill level s since $e(\kappa) = \kappa \ln(ts)$.

κ disproportionally benefits firms that employ relatively high skilled agents, the negative effect on the price index dominates the positive productivity effect for the marginal firm. To restore zero earnings for a given cutoff skill s_c, the marginal firm now requires a larger expenditure level X to cover the corporate governance costs to enter the market. This mechanism turns the zero cutoff earnings curve outward which unambiguously increases X and the cutoff skill s_c in the new equilibrium.

Consider next the effects of skill-biased technological change on the critical skill level $\widetilde{s}$ from equation (18). Skill-biased technological change has three effects on managerial wages and the choice of governance within firms and the skill level $\widetilde{s}$.

First, an increase of κ strengthens the contribution of the production technology to firm productivity and therefore weakens the bargaining position of the manager and decreases managerial wages (the bargaining effect). The decrease of managerial wages translates to a lower share of weak governance firms in the economy since lower bonus payments require additional incentives from stricter monitoring.

Second, an increase of κ increases the marginal productivity of managers and thus has a positive effect on managerial wages which reduces the critical skill $\widetilde{s}$ and increases the share of weak governance firms θ (the productivity effect).

Third, skill-biased technological change leads to a tougher selection (s_c rises) such that managerial wages fall and $\widetilde{s}$ increases (the selection effect).

Note, that the selection effect only affects the cutoff skill level $\widetilde{s}$ but leaves the share of organizations with zero corporate governance θ unaffected since $\widetilde{s}$ rises proportionally with s_c. Consequently, tougher selection from technological change affects the number of firms but leaves the share of firms with weak governance unaffected. Nevertheless, the bargaining effect and the productivity effect have an influence on θ. I restate equation (19) as follows:

$$\theta = \left(\frac{\lambda \mu \underline{w}}{\lambda \mu \underline{w} + (\kappa + \mu) (B - \underline{w})} \right)^{\frac{1}{(\kappa+\mu)(\sigma-1)}}.$$

The bargaining effect is captured by an increase of the denominator $\lambda \mu \underline{w} + (\kappa + \mu) (B - \underline{w})$ such that θ decreases. The positive productivity effect is captured by a decrease of the exponent $\frac{1}{(\kappa+\mu)(\sigma-1)}$ such that θ rises. I show in the appendix that the productivity effect outweighs the bargaining effect such that $\frac{\partial \theta}{\partial \kappa} > 0$. Proposition 4 states how skill-biased technological change affects the share of firms that do not invest into corporate governance.

Proposition 4. *Skill-biased technological change ($\kappa \uparrow$) increases competition for the most productive managers and thereby raises the share of firms that do not invest in corporate governance ($\theta \uparrow$).*

Proof. See Appendix. □

4 The Open Economy

The current section establishes an open economy version of the model. I consider two identical countries that participate in intra-industry trade. Economic activities on the domestic market are denoted with a subscript d and exporting activities with a subscript x. An exporting firm needs to produce $\tau > 1$ units of a good for 1 unit to reach the foreign destination. Additionally, a firm needs a fixed amount of production labor f to sell to the export market. Formally, a firm that employs a manager with skill s in the open economy faces the following objective function:

$$\max \varepsilon \left(Y_d(s) + I_x Y_x(s) - w(s)\right) - I_x f \underline{w} - \left(1 - g\left(s\right)\right)\left(C - \left(1 - \varepsilon\right) R\right) \underline{w}, \tag{20}$$

where I_x is an endogenous export participation indicator. Again, firms choose the bonus payment $w\left(s\right)$ and level of corporate governance $g\left(s\right)$ according to Proposition 1. Since exporting firms face identical demand elasticities on both markets, the exporting price is a constant multiplier of the domestic price adjusted by the variable trade cost: $p_x(s) = \tau p_d(s)$. Therefore, the operating profits from exporting are

$$Y_x\left(s\right) = \tau^{1-\sigma} Y_d\left(s\right) = \tau^{1-\sigma} M \left(\frac{t^{\kappa} s^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1}.$$

Denote s_d the managerial skill of the marginal local firm and s_x the managerial skill of the marginal exporting firm. Firms will choose to export whenever their productivity is large enough to cover the fix costs of exporting. Thus, the marginal exporter obtains operating profits from exporting $Y_x(s_x)$ that are just sufficiently large to cover the fixed costs of entering the export markets such that $\varepsilon M \left(\frac{t^{\kappa} s_x^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1} = \tau^{\sigma-1} f \underline{w}$. The managerial skill level of the marginal exporter s_x can be written as a function of the marginal skill level of a domestic firm manager

s_d

$$s_x = \left(\frac{\tau^{\sigma-1} f}{\lambda} \right)^{\frac{1}{1-\psi}} s_d, \tag{21}$$

where I assume that $\left[\tau^{\sigma-1} f\right]^{\frac{1}{1-\psi}} > \lambda$ in order to assure a meaningful exporting behavior of firms with $s_x > s_d$. The open economy price index can now be written as

$$P = \frac{\sigma}{\sigma - 1} \underline{w} t^{-\kappa} \left(\frac{\psi}{\varepsilon L} \right)^{\frac{1}{\sigma-1}} s_d^{\frac{\psi}{\sigma-1}} \left[1 + \lambda^{\frac{\psi}{1-\psi}} \Delta^{-1} \right]^{1/(1-\sigma)}, \tag{22}$$

where $\Delta \equiv \tau^{\frac{1}{\kappa+\mu}} f^{\frac{\psi}{1-\psi}}$ is an index that captures the distance between both countries. The additional term $\left[1 + \lambda^{\frac{\psi}{1-\psi}} \Delta^{-1}\right]^{1/(1-\sigma)}$ captures the effect of foreign competition on the price index. If the economic distance between the two countries is small (low values for Δ occur whenever f and τ are small), competition from foreign exporters lowers the domestic price index. In the limit, when both economies are very remote and Δ approaches infinity, the price index converges to its closed economy version (11).

An equilibrium in the open economy again requires that labor markets clear. The aggregate expenditure on production labor now consists of three components: expenditure on labor to produce for the domestic market, expenditure on labor to produce for the export market and additionally, the expenditure on production labor that is required to cover the fixed investments f. The aggregate expenditure on production labor can again be found by integrating the labor demand of an individual firm over all active firms and now includes the additional labor expenditure to cover the fix costs of exporting f:

$$\int_{s_d}^{\infty} \frac{\varepsilon q_d(s)}{t^{\kappa} s^{\kappa+\mu}} L s^{-2} ds + \int_{s_x}^{\infty} \frac{\varepsilon q_x(s)}{t^{\kappa} s^{\kappa+\mu}} L s^{-2} ds + f \underline{w} L s_x^{-1} = L \underline{w} (1 - s_d^{-1}).$$

Similar to the closed economy case, expenditure on production labor can be simplified to $\varepsilon X (\sigma - 1) \sigma^{-1} + f \underline{w} L s_x^{-1}$ such that labor markets clear in the open economy if

$$\varepsilon \frac{\sigma - 1}{\sigma} X + f \underline{w} L s_x^{-1} = L \underline{w} \left(1 - s_d^{-1} \right).$$

Replacing s_x with (21) leads to

$$X = \frac{\sigma}{\sigma - 1} \frac{L}{\varepsilon} \left[1 - \left(1 + \lambda^{\frac{1}{1-\psi}} \Delta^{-1} \right) s_d^{-1} \right]. \tag{23}$$

Equation (23) is the open economy version of the labor market clearing condition in the closed economy (14). Here, the additional factor Δ^{-1} captures the labor demand for exporting activities.

Consider the zero cutoff earnings condition in the open economy. The zero cutoff earnings firm is only active on the domestic market and faces competition from foreign exporters through a smaller price index (22). Plugging (22) into (10) yields the open economy version of the zero cutoff earnings condition:

$$X = \frac{\sigma L \lambda \underline{w}}{\psi} \left[1 + \lambda^{\frac{\psi}{1-\psi}} \Delta^{-1} \right] s_d^{-1}. \tag{24}$$

Equations (23) and (24) determine the equilibrium solution for X and s_d in the open economy which is summarized in Proposition 5.

Proposition 5. *The zero cutoff condition and the labor market clearing condition uniquely determine the equilibrium solution of the domestic cutoff skill s_d and the aggregate expenditure X in the open economy:*

$$\begin{aligned} X &= \frac{\sigma L \lambda \underline{w} \left(1 + \lambda^{\frac{\psi}{1-\psi}} \Delta^{-1} \right)}{\psi + \varepsilon \lambda \left(\sigma - 1 \right) + \left(\psi + \varepsilon \left(\sigma - 1 \right) \right) \lambda^{\frac{1}{1-\psi}} \Delta^{-1}} \\ s_d &= 1 + \frac{\varepsilon \lambda \left(\sigma - 1 \right)}{\psi} + \left(1 + \frac{\varepsilon \left(\sigma - 1 \right)}{\psi} \right) \lambda^{\frac{1}{1-\psi}} \Delta^{-1}. \end{aligned}$$

Proof. See Appendix. □

Plugging the equilibrium values for X and s_d into the term for the market size M leads to

$$M = \frac{\lambda}{\varepsilon} \underline{w}^{\sigma} t^{-\kappa(\sigma-1)} s_d^{\psi-1}. \tag{25}$$

The equilibrium function of managerial payments in the open economy now requires a case distinction. Managers that are employed by exporting firms obtain an additional wage premium $\varepsilon M \left(\frac{t^{\kappa}}{\underline{w}} \right)^{\sigma-1} \frac{\mu}{\kappa+\mu} \tau^{1-\sigma} \left(s^{1-\psi} - s_x^{1-\psi} \right)$ that arises from serving a larger market. Since globalization allows them to additionally serve the foreign market, these CEOs have a higher marginal productivity and thus obtain a higher income:

$$\overline{W}(s) = \begin{cases} \varepsilon M \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu}\left(s^{1-\psi} - s_d^{1-\psi}\right) + \underline{w} & \text{if } s \in [s_d, s_x) \\ \varepsilon M \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu}\left(\left(s^{1-\psi} - s_d^{1-\psi}\right) + \tau^{1-\sigma}\left(s^{1-\psi} - s_x^{1-\psi}\right)\right) + \underline{w} & \text{if } s \geq s_x. \end{cases} \tag{26}$$

With the open economy equilibrium from Proposition 5 and the open economy managerial payment function (26) it is straightforward to analyze the effects of globalization on θ.

4.1 Trade Integration

Figure 4 illustrates the effects of a trade integration on the domestic managerial cutoff skill level s_d. A reduction of economic distance Δ between both countries, either stemming from a decrease of the variable or the fix trade costs $d\tau < 0$ or $df < 0$, has an effect on both, the labor market clearing and the zero cutoff firm condition.

If the two economies become more integrated, the labor market curve shifts downwards. Intuitively, better exporting opportunities allow the labor market to clear at a lower expenditure level. Simultaneously, more integration shifts the zero cutoff earning curve upwards. A trade integration fosters import competition such that the marginal domestic producer requires a larger expenditure level to break even. These two effects lead to an unambiguous increase of the domestic managerial cutoff skill s_d. Furthermore, the cutoff skill of the marginal exporting firm s_x falls since a lower productivity level is sufficient to cover the fix trade costs and a larger share of firms become exporters since $\partial\left[s_d/s_x\right]/\partial\Delta < 0$.

Figure 4 about here

In the interest of a statement on the comparative statics of firm governance in an open economy, I distinguish two cases: first the case with low trade openness (large Δ), then the case with high trade openness (small Δ). The effect of a trade liberalization on managerial payments are substantially different in these two cases which has different effects on the choice of corporate governance in equilibrium.

Low Trade Openness

Suppose that both countries are very remote such that the selection of firms into exporting is only efficient for a small share of firms. In this scenario, the export cutoff managerial skill level s_x is very high such that the sorting of skill levels is as follows:

$$s_d < \widetilde{s} < s_x.$$

Since only very few firms export, most managers cannot benefit from trade liberalization since these managers do not obtain an exporter wage premium. If the organizational cutoff skill level $\widetilde{s}$ is smaller than the export cutoff managerial skill level s_x, all exporters (and additionally some non-exporters) are weak governance firms. The organizational cutoff $\widetilde{s}$ can again be evaluated as the skill level of the manager that has an outside option with value B such that this manager is the least productive manager that is hired by a firm that chooses not to invest in corporate governance:

$$\varepsilon M \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu} \left(\widetilde{s}^{(\kappa+\mu)(\sigma-1)} - s_d^{(\kappa+\mu)(\sigma-1)}\right) + \underline{w} \quad = \quad B. \tag{27}$$

This leads to an equilibrium share of firms with zero corporate governance of

$$\theta \equiv \frac{L\widetilde{s}^{-1}}{Ls_d^{-1}} = \left(1 + \frac{(\kappa+\mu)\,(B-\underline{w})}{\lambda\mu\underline{w}}\right)^{\frac{1}{\psi-1}} \tag{28}$$

which is identical as in closed economy version of the model. Obviously, θ is not affected by changes in the openness of the economies.

In this scenario, economic integration only increases the market wages of the managers that manage the most productive exporting firms. Only these managers obtain an exporter wage premium that allows them to compensate the downward pressure on managerial wages arising from tougher import competition. The remaining managers suffer from tougher selection via an increase in s_d and since $\widetilde{s}$ increases proportionally, the share of weak governance firms remains constant.

High Trade Openness

Next, suppose that both countries are relatively integrated such that many firms serve the export market. In this scenario, the export cutoff skill level is very low such that the sorting of skill levels is

$$s_d < s_x < \widetilde{s}.$$

This sorting implies that the firm that employs the manager with the organizational cutoff skill $\widetilde{s}$ is an exporting firm. Consequently, the organizational cutoff $\widetilde{s}$ is defined as

$$\varepsilon M \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu} \left(\left(\widetilde{s}^{1-\psi} - s_d^{1-\psi}\right) + \tau^{1-\sigma}\left(\widetilde{s}^{1-\psi} - s_x^{1-\psi}\right)\right) + \underline{w} \quad = \quad B$$

which leads to the following term for the share of organizations with weak governance θ:

$$\theta \quad = \quad \left(\left(\frac{(\kappa+\mu)\,(B-\underline{w}) + \lambda\mu\underline{w}}{\lambda\mu\underline{w}} - \frac{\lambda}{\tau^{2(\sigma-1)} f}\right)\left(\frac{1}{1+\tau^{1-\sigma}}\right)\right)^{-\frac{1}{1-\psi}}. \tag{29}$$

Now, the share of firms that do not invest in corporate governance depends on the trade costs. A reduction in either the variable trade costs τ or the fix trade costs f unambiguously increase θ. Intuitively, a reduction of trade costs increases the market wages for a large share of the managers in the economy since these become more productive and firms that compete for managerial talent are willing to pay them more. This rise in wages is then used to incentivize their manager. Consequently, firms substitute away from incentive provision via better corporate governance towards performance payments.

The following Proposition summarizes the previous discussion and explains how trade integrations affect the share of weak governance firms θ.

Proposition 6. *A reduction of fix and/or variable trade costs unambiguously increases the domestic cutoff skill level s_d since the selection into market entry becomes tougher.*
Relatively large firms in the market reduce their quality of corporate governance and incentivize managers with pay-for-performance to compete for managerial skills.
The effect of a trade integration on the share of firms that do not invest in corporate governance at all (θ) depends on the level of sectoral openness:
(i) If there is low trade openness such that $s_d < \widetilde{s} < s_x$, the share of organizations with weak governance θ remains unaffected by a reduction of the trade costs.

(ii) If there is high trade openness such that $s_d < s_x < \tilde{s}$, the share of organizations with weak governance θ increases when trade costs are reduced.

Proof. See Appendix. □

5 Empirical Analysis

In this section, I test the comparative static predictions of the model using data on entrenchment opportunities and equity compensation in large U.S. stock companies. The empirical section continues with a brief description of the data sources and the variable construction, followed by a description of the estimation strategy and concludes with the discussion of the evidence. I leave a more detailed discussion about the construction of the dataset for the Data Appendix B.

5.1 Data Sources

In order to test how changes in trade openness and skill-biased technological change over time affect the quality of corporate governance within firms, I make use of firm level data and match it with information at the industry level.

5.1.1 Firm Level Data

At the firm level, I make use of three different data sources. In order to measure the quality of corporate governance, I make use of the entrenchment index (E-index) from Bebchuk et al. (2009) which measures the quality of corporate governance at the firm level across time. The index combines information on six governance provisions that capture managerial entrenchment opportunities: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers as well as for charter amendments. Bebchuk et al. (2009) argue that these six provisions are the most relevant ones since they play a key role in the relation between corporate governance and firm value. These provisions are also a subset of the provisions used in the GIM-index by Gompers et al. (2003). Four of the six provisions limit the voting power of shareholders (staggered boards, limits to shareholder bylaw amendments, supermajority requirements for mergers, supermajority requirements for charter amendments), while the two remaining provisions (poison pills, golden parachutes) are salient measures taken in preparation for hostile offers. The E-index is a score between 0 to 6, based on the number of these provisions that a firm provides in a given year. The captured entrenchment opportunities from weak corporate governance are associated with adverse effects on the behavior of managers and managerial incentives. Information on the six different governance attributes is provided by the Investor Responsibility Research Center (IRRC) and includes S&P 500 firms and a set of additional firms. Observations span the time period between 1990 and 2006, with information on the E-index for the years 1990, 1993, 1995, 1998, 2000, 2002, 2004 and 2006.[17]

As a second data source, I use information about CEO equity compensation in quoted U.S. corporations that is provided by BoardEx. BoardEx is a business intelligence service provider that collects remuneration details on business leaders across the world. I consider the equity-linked compensation of CEOs in U.S. firms. The BoardEx panel spans the period between 1998 and 2006.[18]

I match the entrenchment and the equity compensation panels with the Thomson Worldscope database, the third data source at the firm level. Thomson Worldscope provides balance sheet information and the main 4-digit SIC industry of the companies in the two samples. In particular, Worldscope contains annual information on employment, assets, and total investment returns.

5.1.2 Industry Level Data

The sectoral information that is used in the empirical analysis is obtained from three different sources. I use the NBER CES manufacturing industry database to obtain information on total factor productivity, value added and the consumption of intermediate inputs at the 4-digit SIC industry level.

Additionally, I use the UN Comtrade database to obtain U.S. exports and imports at the 4-

[17] The E-index panel data are publicly available on Lucian Bebchuk's website http://www.law.harvard.edu/faculty/bebchuk/data.shtml.

[18] Since BoardEx data are mostly formatted for business client applications, a preparation of the data for academic purposes was needed before the data could be used for empirical work. Please see the Data Appendix B for more details on the necessary preparation steps and underlying assumptions.

digit SIC level. My sectoral measures of trade openness build on those two data sources. The main measure *ln(openness)* is the natural logarithm of the sectoral exports in % of the "effective market size" at the 4-digit SIC level, where "effective market size" is the gross industry output less imports. Since the measure of trade openness is only relevant and available for firms in the manufacturing sector, the estimation sample in the trade related regressions is reduced to all manufacturing firms.

In order to capture skill-biased technological change, I use information on the contribution of information and communication technology (ICT) to the growth of industry value added that is available from the EUKLEMS database. The variable "contribution of ICT" has also been used by Michaels et al. (2014) to estimate whether ICT has polarized the skill demand of labor. This variable is based on a growth accounting exercise and is provided for 36 industries at the 2-digit ISIC Rev. 3 level.

Table 1 provides summary statistics of all variables in the corporate governance and the equity compensation sample.

5.2 Estimation Strategy

The theoretical model predicts that large firms respond to increases in trade openness and skill-biased technological change with weaker corporate governance. In order to test if the strength of corporate governance becomes weaker when firms face a larger degree of sectoral openness or technological change, the econometric model takes the following form:

$$e_{fjt} = \beta s_{jt} + x'_{fjt}\delta + u_{fjt}. \tag{30}$$

The outcome of interest e_{fjt} is firm f's entrenchment index in industry j at year t. Larger values for e_{fjt} translate to more provisions for executives, i.e. more entrenchment opportunities (worse corporate governance). s_{jt} measures trade openness and the usage of skill-biased technologies at the sectoral level. According to the theory, entrenchment should be a function of the sectoral trade openness o_{jt} and skill-bias in technologies t_{jt}. I measure o_{jt} as the natural logarithm of industry j's exports in percent of (gross output - imports) of industry j: $o_{jt} = \ln\left(\frac{EX_{jt}}{GO_{jt}-IM_{jt}} \cdot 100\%\right)$. In order to proxy for technological change that is skill-biased, I directly obtain t_{jt} from EUKLEMS as the contribution of ICT to value added growth in % at the sectoral level.[19]

One potential concern with openness and the contribution of ICT is that they could be correlated such that the individual impact of each variable cannot be estimated consistently. Moreover, including both variables could lead to bad control problems if one variable explains the other: for instance, ICT investments make industries more productive and lead to comparative advantages. I address these concerns by showing specifications, where I include either both variables, o_{jt} and t_{jt} or only one of them. Furthermore, I instrument sectoral openness with a basket of weighted real effective exchange rates, where the weights are industry-specific. Note that the theoretical model considered intra-industry trade while the instrument is based on a comparative advantage argument. However, as Bernard et al. (2007) have shown, heterogeneous firm models with intra-industry trade can be extended to models with both, comparative advantages and intra-industry trade, where trade flows are determined by factor endowments and preferences for variety. The idea of the instrumental variable is to use the weighted real effective exchange rates of Canada, Mexico, the UK, China and Japan vis-à-vis the rest of the world, where the country weights are the industry specific shares of exports that go to each of these countries (their average for the years 1991-1995).[20] This instrument is relevant for sectoral trade openness since it measures the international competitiveness of each U.S. industry vis-à-vis its main trade partners. Furthermore, the instrument satisfies the exclusion restriction to the extent that exchange rates are formed at financial markets. In light of Propositions 6 and 4, I expect negative effects of openness and ICT on corporate governance quality, thus $\beta > 0$.[21] The vector x_{fjt} contains control variables and u_{fjt} is the error term.

In all variants of the model (30), the vector x_{fjt} includes firm and year fix effects. Thus, although a large share of the variation in the entrenchment index is across firms, the model links variation of entrenchment *within* firms as a response to changes in the industry environment over time. This allows to directly test the implications of Propositions 4 and 6: large firms respond to trade liberalizations and technological change with more opportunities for managerial entrenchment. Additionally, the firm fix effect model controls for endogeneity arising from unobservable time-invariant firm and industry characteristics that are correlated with the observables. The inclusion of year fix effects controls for another potential source of en-

[19] See for instance Autor et al. (1998) and Michaels et al. (2014) on the skill-bias of computerization.

[20] See the subsection B.2 in the Data Appendix for more details on the construction of the instrument.

[21] Remember that larger values of e_{fjt} correspond to weaker corporate governance.

dogeneity: unobservable economy-wide corporate governance shocks that are correlated with the development of trade openness and ICT.

To provide further evidence that sector variables are relevant for the managerial labor market and drive managerial incentive compensation, I then estimate the same specifications in light of the model (30) with CEO equity compensation w_{fjt} as the dependent variable. Equity compensation w_{fjt} is the natural logarithm of equity linked compensation in 1000 USD.

5.3 Results

Trade Openness, ICT, and Corporate Governance

Table 2 reports estimates of model (30): within firm level adjustments of corporate governance as a response to within industry changes in trade openness and technological change. All standard errors are corrected for heteroscedasticity robustness.

Columns (1) to (4) in Table 2 show the instrumental variable estimation results that consider the effect of trade openness and ICT contribution on corporate governance according to specification (30). The regressors of interest are *ln(openness)* which is instrumented by the *REER basket* and the *ICT contribution in %*. Not surprisingly, the real effective exchange rate variable is positive and significant in the first stage estimations: larger exchange rates of the trading partners are associated with larger comparative disadvantages and consequently more imports from the U.S. The first stage Cragg-Donald F-statistics are above 21.00 in all specifications which means that the null hypothesis of weak instrumentation can be rejected for a 10% instrumental variable bias.[22] Column (1) includes openness as the main explanatory variable. Additional controls are the total factor productivity at the sector level (4-digit SIC) and firm employment. The inclusion of the total factor productivity variable controls for omitted variable biases since openness and ICT could be correlated with factor productivity which itself might drive firm governance. Employment is included as a measure of firm size since the theoretical model suggests that larger firms are governed more weakly.[23] The openness regressor is positive and significant at the 5% level. Column (2) additionally includes the ICT contribution as an explanatory variable. The ICT contribution regressor enters the model with a positive sign at the

[22] The Stock-Yogo critical value for a 10% IV size bias from weak instrumentation is 16.38.

[23] I include employment to control for changes in firm size over time, although the negative correlation between firm size and corporate governance quality in the theoretical model is *across* firms.

10% significance level. Column (3) then again excludes ICT but uses total assets and the total investment return as additional controls for firm size and performance. The reason to include investment returns as additional control variable is twofold: first, it controls for managerial or total firm performance and second, the corporate governance literature argues that there is a correlation between corporate governance and stock returns. However, the coefficient of investment returns remains insignificant in all specifications. Taking into account the evidence on this correlation and the time period this result is not surprising: while Gompers et al. (2003) find that an investment strategy that was based on buying firms with strong shareholder rights and selling firms with weak shareholder rights earned abnormal returns during 1991 and 1999, Bebchuk et al. (2013) find that this correlation did not persist for the subsequent period. They explain their findings with the gradual learning of investors. The preferred model specification is then presented in column (4): openness and ICT enter the model with significantly positive signs after instrumenting openness and controlling for firm size in terms of employment and assets, investment returns and industry factor productivity. Note that the size and significance of the coefficients for openness and ICT remain at a similar level throughout all IV specifications (1) to (4): the coefficient for openness varies between 1.022 and 1.185 and is significant at the 10% level; the coefficient for the contribution of ICT is 0.123 and significant at the 5% level in column (2), respectively 0.112 and significant at the 10% level in column (4). The estimated coefficients for openness suggest that an increase of the sectoral openness from its mean (2.47) by the within firms standard deviation (0.38) increases the entrenchment index in a firm within this sector by between 0.15 and 0.17 points which is about one third of the within firms standard deviation of the entrenchment index (0.50). The coefficients for the contribution of ICT suggest that an increase of the ICT variable by one within firm standard deviation (0.69) from its sample mean (0.98) increases the entrenchment index by between 0.06 and 0.07 points.

Columns (5) to (8) present the evidence based on ordinary least squares estimations of the specifications from columns (1) to (4). Trade openness enters all specifications with a significantly positive sign at the 10% significance level although the size of the coefficients are much smaller (between 0.0967 and 0.0976). One reason for the smaller ordinary least squares coefficients might be due to measurement errors in fix effects models. If the openness variable is a combination of the true signal which is highly correlated over time and an error component that is serially uncorrelated, the inclusion of firm fix effects increases the variance of the error component while it decreases the variance of the signal.[24] Also the coefficients of the ICT contribution are much smaller and remain insignificant in the least squares estimates.

Trade Openness, ICT, and Equity Compensation

Table 3 provides additional evidence on the effects of trade openness and ICT on the managerial labor market. The table reports estimates of within firm level adjustments of CEO equity compensation as a response to within industry changes in trade openness and technological change. All standard errors are again corrected for heteroscedasticity robustness. The specifications are identical to those presented in Table 2 but now the dependent variable is the natural logarithm of the CEO's equity-linked compensation as a measure of incentive compensation.[25] The coefficient for openness in the IV models (1) to (4) varies between 1.821 and 2.050 and is at the 1% level significantly different from zero. The estimated coefficient of the ICT contribution is equal to 0.481 in column (2) and 0.494 in column (4) and also significant at the 1% level in both specifications. The first stage coefficients of the real effective exchange rate basket are a bit larger in the equity compensation models compared to the corporate governance models (0.0094-0.0098 versus 0.0073-0.0082). The estimated coefficients for openness suggest that an increase of the sectoral openness from its mean (1.55)[26] by the within firms standard deviation (0.28) raises the CEO equity compensation from its mean by between 36 and 41 percent. The estimates for the ICT contribution variable in the IV models suggest that an increase of the ICT contribution by one within firm standard deviation (0.68) from its sample mean (0.75) increases the CEO equity compensation from its mean by between 36 and 37 percent.

The evidence based on ordinary least squares estimations is again presented in columns (5) to (8). In the OLS estimations the coefficients for openness are again much smaller and not significantly different from zero. The coefficients for the ICT contribution are only a bit smaller compared to the IV coefficients (0.237-0.252 versus 0.481-0.494) and significant at the 1% level.

[24] See Angrist and Pischke (2008) for a more detailed discussion on measurement errors and fix effects.

[25] An advantage of equity linked compensation as measure of performance payments is its direct link to the firm value. However, using equity linked compensation underestimates pay-for-performance since it excludes direct bonus remuneration.

[26] Since the equity panel includes a similar but yet different set of firms and the years 1998-2006 instead of 1990-2006, the sample means and standard deviations differ compared to the corporate governance panel. See Table 1 for summary statistics.

6 Conclusion

This paper analyzed how corporate governance decisions within firms are affected by real economic outcomes. To study this question, I integrated a stylized model of performance pay and corporate governance investments into a general equilibrium model with heterogeneous skills and technologies. Since technologies and skills are complementary in terms of productivity, a positive assortative assignment of skills to technologies arises in equilibrium. The most productive firms endogenously choose an organization where governance is weak and managers can extract rents because investments into stronger corporate governance become inefficient incentive mechanisms when firm owners are constraint to pay high wages by the managerial labor market.

The model provides an explanation of a puzzle in the development of CEO compensation: while incentive compensation has become more and more prominent over time, incentive provision via better control inside the firm has fallen behind. This pattern can be explained by changes in the macroeconomic environment of firms through globalization or technological change. Trade liberalizations and skill-biased technological change toughen the competition for managerial talent and thereby induce firms to allow for more managerial entrenchment on average.

I test these predictions with data on managerial entrenchment opportunities and equity compensation in a panel of large quoted U.S. companies and find positive effects of sectoral openness and the contribution of ICT to industry growth on managerial entrenchment in firms and equity-linked compensation of managers.

variable	*observations*	*mean*	*min*	*max*	*std. dev.*
		Entrenchment Panel			
E-index	13732	2.32	0	6	1.34
openness	7588	0.18	-51.64	55.89	1.93
ln(openness)	7132	2.52	-4.54	8.63	1.59
ICT contribution %	25272	0.94	-0.51	6.44	0.89
employment	17123	12719.22	0	1900000	40318.54
ln(employment)	17123	8.02	0	14.46	1.76
total assets	17561	7305301	1	1460000000	41200000
ln(total assets)	17561	13.84	0.69	21.10	1.82
total investment return	16730	48.26	-99.99	159400.00	1905.39
TFP index	19540	2.26	0.47	44.24	5.91
REER basket	20332	99.48	72.25	157.90	8.80
		Equity Compensation Panel			
CEO equity compensation	12185	6382.44	0	1322156	18775.78
ln(CEO equity compensation)	12067	7.64	-1.29	14.09	1.68
openness	4726	0.23	-21.23	13.96	1.34
ln(openness)	4401	2.66	-3.31	7.24	1.58
ICT contribution %	13528	0.75	-0.51	6.44	0.89
employment	13206	18763.49	0	1900000	58450.28
ln(employment)	13195	8.33	0.69	14.46	1.82
total assets	13380	17203290	3.815	1884318000	87481700
ln(total assets)	13380	14.48	1.34	21.36	1.85
total investment return	13028	26.63	-97.50	159400.00	1406.45
TFP index	5366	4.28	9.98	0.47	44.24
REER basket	5607	100.03	74.97	151.88	7.56

Table 1: Summary Statistics

Table 2: Corporate Governance, Trade Openness and ICT

dependent variable: E-index	(1) IV	(2) IV	(3) IV	(4) IV	(5) OLS	(6) OLS	(7) OLS	(8) OLS
ln(openness)	1.185**	1.101**	1.090**	1.022**	0.0970**		0.0976**	0.0967**
	[0.476]	[0.428]	[0.439]	[0.401]	[0.0390]		[0.0389]	[0.0390]
ICT contribution %		0.123**		0.112*		0.00699	0.00648	0.00695
		[0.0616]		[0.0581]		[0.0373]	[0.0373]	[0.0373]
TFP index	0.0163***	0.0171***	0.0162***	0.0168***	0.00802*	0.00490	0.00809**	0.00809*
	[0.00478]	[0.00491]	[0.00477]	[0.00488]	[0.00413]	[0.00447]	[0.00410]	[0.00413]
ln(employment)	0.0922***	0.0883**	0.167***	0.156***	0.0794**	0.107***	0.0792**	0.0963*
	[0.0356]	[0.0348]	[0.0636]	[0.0600]	[0.0402]	[0.0388]	[0.0402]	[0.0547]
ln(total assets)			-0.0918	-0.0838				-0.0177
			[0.0663]	[0.0629]				[0.0525]
total investment return			-1.77e-05	-9.13e-05				-0.000110
			[0.000277]	[0.000268]				[0.000227]
firm f.e.	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
year f.e.	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared (within)	-	-	-	-	0.0952	0.0963	0.0952	0.0953
1st stage Cragg-Donald F-stat	21.00	24.89	22.95	26.63				
REER basket (1st stage)	0.0073***	0.0079***	0.0077***	0.0082***				
	[0.0020]	[0.0020]	[0.0020]	[0.0020]				
observations	3,676	3,676	3,643	3,643	3,839	4,811	3,839	3,807
number of firms	831	831	825	825	994	1,107	994	989

All columns report results from firm fixed effects models. Columns (1) - (4) report results for IV estimates after instrumenting openness with the real effective exchange rate of the sector-specific main trade partners while columns (5) - (8) report results for ordinary least squares estimates. The dependent variable *E-index* is the entrenchment index from Bebchuk et al. (2009) that ranges between 0 and 6 and measures the level of managerial entrenchment opportunities within a given firm-year. *Ln(openness)* is the natural logarithm of exports relative to effective market size (gross output - imports) in % at the 4-digit SIC industry level. *TFP index* is a total factor productivity index at the ISIC 4-digit level. *Ln(employment)* is the natural logarithm of firm employment. *Ln(total assets)* is the natural logarithm of assets in 1000 USD. *Total investment return* is the investment return on a yearly basis in % including dividends. All specifications include year fix effects. Standard errors are heteroscedasticity robust. *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dependent variable: ln(CEO equity compensation)								
	IV	IV	IV	IV	OLS	OLS	OLS	OLS
ln(openness)	2.050***	1.886***	1.961***	1.821***	-0.0279		0.000629	0.00810
	[0.620]	[0.573]	[0.625]	[0.583]	[0.0559]		[0.0541]	[0.0541]
ICT contribution %		0.481***		0.494***		0.301***	0.237***	0.252***
		[0.0985]		[0.101]		[0.0661]	[0.0632]	[0.0625]
TFP index	-0.0206*	-0.0189*	-0.0264**	-0.0246**	-0.0516***	-0.0481***	-0.0491***	-0.0524***
	[0.0112]	[0.0111]	[0.0109]	[0.0108]	[0.00847]	[0.00813]	[0.00846]	[0.00878]
ln(employment)	0.120*	0.0981	0.288***	0.253***	0.132*	0.0890	0.121	0.158
	[0.0710]	[0.0696]	[0.101]	[0.0957]	[0.0759]	[0.0724]	[0.0752]	[0.102]
ln(total assets)			-0.184*	-0.171*				-0.0356
			[0.0957]	[0.0917]				[0.0833]
total investment return			6.36e-05	5.95e-05				4.65e-05
			[5.12e-05]	[5.04e-05]				[5.33e-05]
firm f.e.	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
year f.e.	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared (within)	-	-	-	-	0.0789	0.0820	0.0837	0.0914
1st stage Cragg-Donald F-stat	41.07	45.58	40.15	44.07				
REER basket (1st stage)	0.0094***	0.0098***	0.0094***	0.0098***				
	[0.0016]	[0.0016]	[0.0016]	[0.0016]				
observations	4,340	4,340	4,225	4,225	4,353	4,877	4,353	4,237
number of firms	655	655	647	647	668	724	668	659

All columns report results from firm fixed effects models. Columns (1) - (4) report results for IV estimates after instrumenting openness with the real effective exchange rate of the sector-specific main trade partners while columns (5) - (8) report results for ordinary least squares estimates. The dependent variable *ln(CEO equity compensation)* is the natural logarithm of the CEO's equity-linked compensation in 1000USD. *Ln(openness)* is the natural logarithm of exports relative to effective market size (gross output - imports) in % at the 4-digit SIC industry level. *TFP index* is a total factor productivity index at the ISIC 4-digit level. *Ln(employment)* is the natural logarithm of firm employment. *Ln(total assets)* is the natural logarithm of assets in 1000 USD. *Total investment return* is the investment return on a yearly basis in % including dividends. All specifications include year fix effects; Standard errors are heteroscedasticity robust. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Equity Compensation, Trade Openness and ICT

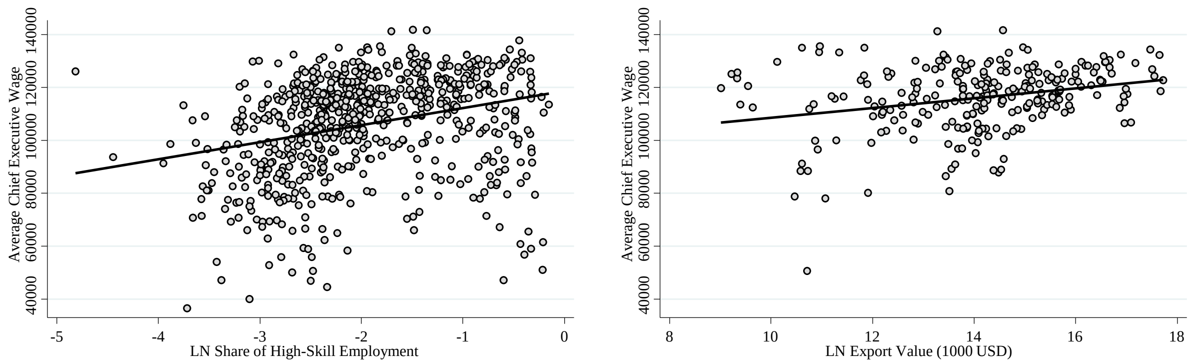

Figure 1: Chief Executive Wages, Skill-Intensity and Export Activity

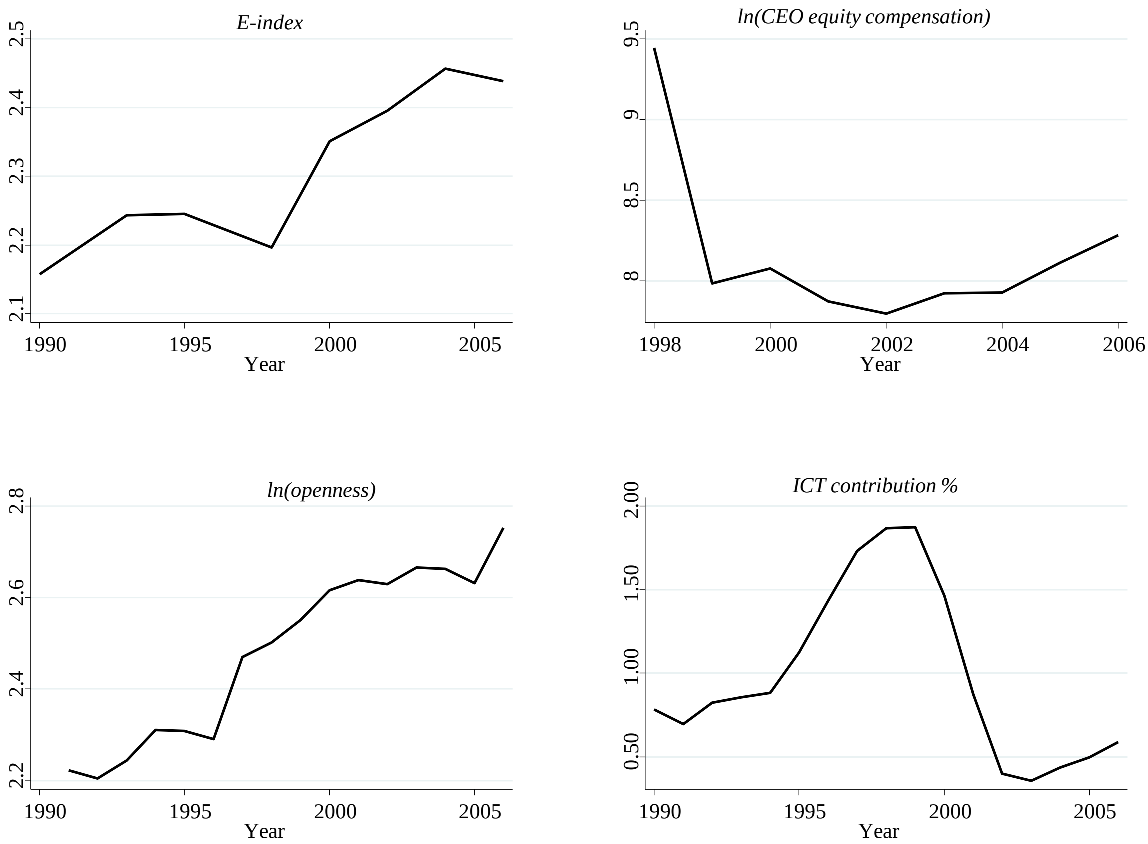

Figure 2: Entrenchment, Equity Pay, Openness, and ICT Contribution over Time

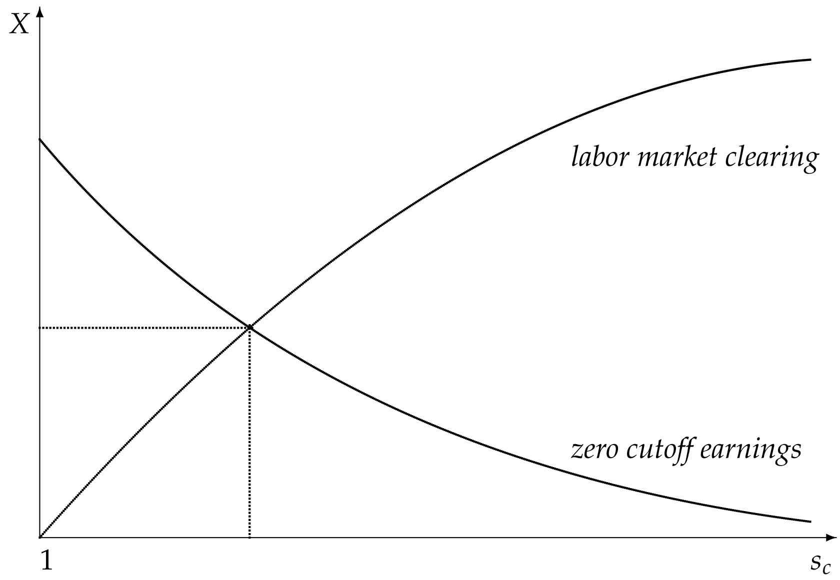

Figure 3: Determination of the closed economy equilibrium in the (X, s_c) locus.

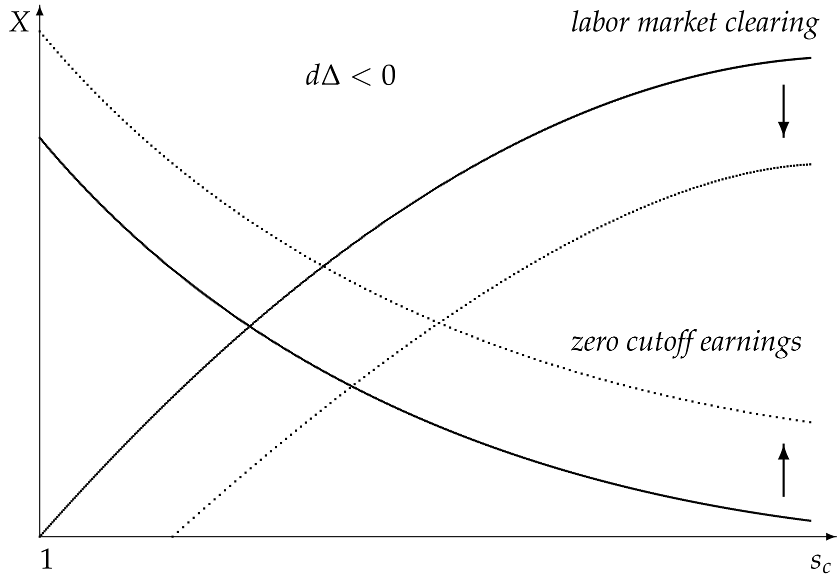

Figure 4: The effects of a trade integration ($d\tau < 0$ and/or $df < 0$) on the managerial cutoff skill level s_d.

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A Appendix - Theory

A.1 The Optimal Choice of Governance and Performance Pay

The owner's problem is

$$\max_{w,g} \varepsilon (Y - w) + (1 - \varepsilon) gR\underline{w} - C\underline{w}g$$

$$\begin{aligned} & s.t. \\ \varepsilon w &\geq (1-g) B \\ \varepsilon w &\geq \overline{W} \end{aligned}$$

with $C\underline{w} \in ((1-\varepsilon) R\underline{w}, (1-\varepsilon) R\underline{w} + B)$. This assumption ensures that the choice of governance is non-trivial. Governance would be always $g^* = 1$ if $C\underline{w} < (1-\varepsilon) R\underline{w}$ and $g^* = 0$ if $C\underline{w} > (1-\varepsilon) R\underline{w} + B$.

A case distinction is necessary to find the optimal contract.

Case *i)* $\overline{W} > B$: In that case the incentive constraint is slack whenever the participation constraint is satisfied. Consequently, the incentive constraint may be neglected and the agent receives a bonus $w = \overline{W}/\varepsilon$. Since incentives do not matter and to save on governance costs, the principal leaves all the power to the CEO and chooses $g^* = 0$ (since $(1-\varepsilon) R\underline{w} - C\underline{w} < 0$).

Case *ii)* $\overline{W} \leq B$: This case is somewhat less trivial since here it depends on the level of governance g which constraint will bind. More governance increases the expected liquidation value ($(1-\varepsilon) gR\underline{w}$) and rises monitoring costs ($C\underline{w}g$). Since $C\underline{w} > (1-\varepsilon) gR\underline{w}$, more governance costs the principal. Nevertheless, there is a positive effect of governance: stricter governance creates incentives for the agent to behave (exert effort). Suppose that the principal sets governance so weak such that $g < 1 - \frac{\overline{W}}{B}$. Then, the incentive constraint would require that $w \geq (1-g) \frac{B}{\varepsilon}$. Thus, it is inefficient to reduce governance because it requires a relatively stronger increase in performance pay w. Next, suppose that $g > 1 - \frac{\overline{W}}{B}$ such that only the participation constraint binds. Since governance bears a cost for the principal, she can improve by reducing g such that both constraints are still satisfied.

A.2 Credibility of CEO Reservation Wages

The following section provides an argument in favor of the credibility of the CEO's outside option to go to the infinitesimally smaller firm. Suppose the infinitesimally smaller firm with production technology z_0 is not willing to offer a bonus payment that equals the current CEO's bonus plus his additional marginal benefit for the firm $\partial (\varepsilon Y(z,s)) / \partial s$. Then, the CEO could choose to go to the next infinitesimally smaller firm $z_{00} \to z_0^-$ and try to get an offer there and if not, proceed to the next smaller firm and so on. The last firm that the CEO could address is the marginal firm with production technology $z_c = ts_c$ which pays an expected CEO wage of $\varepsilon w(s_c) = \underline{w}$. It would be unambiguously beneficial for this marginal firm to employ the CEO with skill s and pay him a little $\epsilon \to 0$ more compared to the bonus of the currently employed marginal CEO. Then again, the firm that is marginally more productive than the marginal firm would benefit from paying the CEO 2ϵ more and so on until we are back at the firm with production technology z_0 that is willing to pay its current CEO's bonus plus the additional marginal benefit of the more skilled CEO $\frac{\partial \varepsilon Y(z,s)}{\partial s}_{|z=z(s)}$ to prevent him from leaving. Hence, the derived outside option is subgame-perfect and therefore credible.

A.3 Closed Economy Equilibrium

The equilibrium in the closed economy is found in two steps. In a first step, the managerial cutoff skill s_c and the aggregate expenditure X are determined. Afterwards, the critical cutoff skill $\widetilde{s}$ can be found.

Firms with managerial skills $s > \widetilde{s}$ choose the weakest level of governance $g = 0$. Firms with managerial skills $s \in [s_c, \widetilde{s}]$ use stricter governance to incentivize their CEOs, instead.

The equilibrium solution (X, s_c) is pinned down by the zero cutoff earnings and the labor market clearing curve: the marginal firm with skill level s_c just breaks even and the aggregate expenditure on production labor must equal the aggregate production labor earnings.

A.3.1 Closed Economy Price Index

The price index can be restated in terms of the model fundamentals and the cutoff talent level s_c. After exchanging variables and integrating over the skill distribution, the price index P may be written as follows:

$$\begin{aligned} P &= \left[\int_{s_c}^{\infty}\left(\frac{\sigma}{\sigma-1}wt^{-\kappa}s^{-(\kappa+\mu)}\right)^{1-\sigma}d\varepsilon L(1-s^{-1})\right]^{1/(1-\sigma)} \\ &= \frac{\sigma}{\sigma-1}t^{-\kappa}w\left(\frac{\psi}{\varepsilon L}\right)^{1/(\sigma-1)}s_c^{\psi/(\sigma-1)}, \end{aligned}$$

where $\psi \equiv 1-(\sigma-1)(\kappa+\mu)$. In order to ensure existence of the improper integral, I need to assume that $(\sigma-1)(\kappa+\mu) < 1$ which intuitively means that there does not exist any firm that is sufficiently efficient to bring the price index down to zero.

A.3.2 Zero Cutoff Earnings Condition

The expected operating profits can be written in terms of X and s_c such that the ZCE curve is a decreasing function $X(s_c)$: The zero cutoff earnings condition requires that the marginal firm is indifferent between entering or leaving the market. Since $W(s_c) = \underline{w} < B$ and thus $g(s_c)* = 1 - \frac{\underline{w}}{\varepsilon B}$ we have

$$\begin{aligned} \varepsilon M\left(\frac{t^{\kappa}s_c^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1} &= \left(1-\frac{\underline{w}}{\varepsilon B}\right)(C-(1-\varepsilon)R)\underline{w}+\underline{w} \\ X &= \frac{\sigma L\left(\left(1-\frac{\underline{w}}{\varepsilon B}\right)(C-(1-\varepsilon)R)+1\right)\underline{w}}{\psi}s_c^{-1}. \\ X &= \frac{\sigma L\lambda\underline{w}}{\psi}s_c^{-1}. \end{aligned}$$

A.3.3 Labor Market Clearing Condition

The labor market clearing condition requires that the aggregate expenditure on production labor is equal to the aggregate earnings of the production workers. The aggregate expenditure on production workers is equal to $L\underline{w}(1-s_c^{-1})$. The aggregate demand for production workers can be obtained by integrating up the demand of an individual firm over all producing firms in the economy. A firm uses $1/\varphi_j$ units of labor per unit of output and produces q_j units of output with probability ε. The demand for production labor of an individual firm can be written in terms of prices since $q_j = x_j/p_j = XP^{\sigma-1}p_j^{-\sigma}$ and $1/\varphi_j = \frac{\sigma-1}{\sigma}p_j$. Demand for production labor is thus given by

$$\varepsilon\frac{q_j}{\varphi_j} = \varepsilon\left[\frac{\sigma-1}{\sigma}XP^{\sigma-1}p_j^{1-\sigma}\right].$$

Integrating the production labor demand for the individual firm over all active firms of the economy yields

$$\begin{aligned}
\int_0^{Ls_c^{-1}} \left[\varepsilon \frac{\sigma-1}{\sigma} X P^{\sigma-1} p_j^{1-\sigma}\right] dj &= \varepsilon \frac{\sigma-1}{\sigma} X P^{\sigma-1} \int_0^{Ls_c^{-1}} p_j^{1-\sigma} dj \\
&= \varepsilon \frac{\sigma-1}{\sigma} X.
\end{aligned}$$

Setting this expression equal to the aggregate supply from above gives the labor market clearing condition

$$X = \frac{L}{\varepsilon} \frac{\sigma}{\sigma-1} \underline{w} (1 - s_c^{-1}).$$

A.3.4 Explicit Equilibrium Solution for $(X, s_c, \widetilde{s})$ in the Closed Economy

Solving for the cutoff skill s_c^{-1} by setting the two conditions equal yields

$$\frac{L}{\varepsilon} \frac{\sigma}{\sigma-1} \underline{w} \left(1 - s_c^{-1}\right) = \frac{\sigma L \lambda \underline{w}}{\psi} s_c^{-1} \quad \Leftrightarrow \quad s_c = 1 + \frac{\varepsilon (\sigma-1) \lambda}{\psi}.$$

Solving for the expenditure share X by plugging the solution for s_c into the labor market clearing condition yields

$$X = \frac{L}{\varepsilon} \frac{\sigma}{\sigma-1} \underline{w} \left[1 - \left(1 + \frac{\varepsilon (\sigma-1) \lambda}{\psi}\right)^{-1}\right] \quad \Leftrightarrow \quad X = \frac{\sigma L \lambda \underline{w}}{\psi + \varepsilon(\sigma-1)\lambda}.$$

The equilibrium market size M of a firm can be stated as follows:

$$\begin{aligned}
M &\equiv \frac{1}{\sigma} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} X P^{\sigma-1} \\
&= \frac{\lambda}{\varepsilon} \underline{w}^{\sigma} t^{-\kappa(\sigma-1)} s_c^{\psi-1}
\end{aligned}$$

Consider next the critikal cutoff skill level $\widetilde{s}$. This cutoff is implicitly defined by

$$\varepsilon M \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu} \left(\widetilde{s}^{(\kappa+\mu)(\sigma-1)} - s_c^{(\kappa+\mu)(\sigma-1)}\right) + \underline{w} = B.$$

Plugging in M and the equilibrium solution for s_c gives

$$\begin{aligned}
\varepsilon \left[\frac{\lambda}{\varepsilon} \underline{w}^{\sigma} t^{-\kappa(\sigma-1)} s_c^{\psi-1}\right] \left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1} \frac{\mu}{\kappa+\mu} \left(\widetilde{s}^{(\kappa+\mu)(\sigma-1)} - s_c^{(\kappa+\mu)(\sigma-1)}\right) + \underline{w} &= B \\
\left(\frac{\widetilde{s}}{s_c}\right)^{1-\psi} &= \left(1 + \frac{(\kappa+\mu)(B - \underline{w})}{\lambda \mu \underline{w}}\right)^{\frac{1}{1-\psi}} s_c.
\end{aligned}$$

There is a mass of Ls_c^{-1} firms in equilibrium and a mass of $L\widetilde{s}^{-1}$ firms choose the weakest corporate governance $g = 0$. Hence, the share of power organizations is given as follows:

$$\theta = \frac{L\widetilde{s}^{-1}}{L\underline{s}^{-1}} = \left(1 + \frac{(\kappa+\mu)(B - \underline{w})}{\lambda \mu \underline{w}}\right)^{\frac{1}{\psi-1}}.$$

A.4 The Effects of Skill-Biased Technological Change

Consider the effects of an increase in κ in the model. While the labor market clearing condition is left unaffected, there are two opposing effects on the zero cutoff earnings conditions: a positive productivity effect and a negative price index effect. Since an increase in κ disproportionally benefits the productivity of the competing firms, skill-biased technological change toughens selection. Consider the selection effect $\partial s_c / \partial \kappa$:

$$\begin{aligned}
\frac{\partial s_c}{\partial \kappa} &= \frac{\partial \psi}{\partial \kappa}\frac{\partial s_c}{\partial \psi} \\
&= \frac{\partial \left[1-(\sigma-1)(\kappa+\mu)\right]}{\partial \kappa}\frac{\partial \left[1+\psi^{-1}\left(\varepsilon\left(\sigma-1\right)\lambda\right)\right]}{\partial \psi} \\
&= \left[-(\sigma-1)\right]\left[-\psi^{-2}\left(\varepsilon\left(\sigma-1\right)\lambda\right)\right] \\
&= \varepsilon\lambda\left(\frac{\sigma-1}{\psi}\right)^2 > 0.
\end{aligned}$$

Next consider the effect of skill-biased technological change on the expenditure level:

$$\begin{aligned}
\frac{\partial X}{\partial \kappa} &= \frac{\partial \psi}{\partial \kappa}\frac{\partial X}{\partial \psi} \\
&= \frac{\partial \left[1-(\sigma-1)(\kappa+\mu)\right]}{\partial \kappa}\frac{\partial \left[\sigma\lambda L\left(\psi+\varepsilon\lambda(\sigma-1)\right)^{-1}\right]}{\partial \psi} \\
&= \left[-(\sigma-1)\right]\left[-\sigma\lambda L\left(\psi+\varepsilon\lambda(\sigma-1)\right)^{-2}\right] \\
&= \frac{\sigma\lambda L(\sigma-1)}{\left(\psi+\varepsilon\lambda(\sigma-1)\right)^2} > 0.
\end{aligned}$$

In order to evaluate how skill-biased technological change affects the share of organizations with weakest governance, the effects on θ needs to be analyzed.

Consider how a change in κ affects θ. The share θ can be restated in the following way

$$\theta = \left(\frac{\lambda\mu\underline{w}}{\lambda\mu\underline{w}+(\kappa+\mu)\left(B-\underline{w}\right)}\right)^{\frac{1}{(\kappa+\mu)(\sigma-1)}}.$$

A rise in κ has two effects on θ: a negative bargaining effect and a positive productivity effect. The negative bargaining effect is captured by an increase of the denominator such that θ decreases. The positive productivity effect is captured by the decrease of the exponent such that θ rises.

In order to evaluate the sign of the overall effect, I take the logarithm of θ and consider its derivative $\nabla(\kappa)$:

$$\begin{aligned}
\nabla(\kappa) &= \frac{\partial \ln(\theta)}{\partial \kappa} \\
&= \frac{\partial\left(\ln\left(\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right)^{-\frac{1}{(\kappa+\mu)(\sigma-1)}}\right)\right)}{\partial \kappa} \\
&= \frac{\partial\left(\frac{1}{-(\kappa+\mu)(\sigma-1)}\ln\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right)\right)}{\partial \kappa}.
\end{aligned}$$

Using the product and chain rule gives

$$
\begin{aligned}
\frac{\partial\left(\frac{1}{-(\kappa+\mu)(\sigma-1)}\ln\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right)\right)}{\partial\kappa} &= (\kappa+\mu)^{-2}(\sigma-1)^{-1}\ln\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right) \\
&\quad -\frac{1}{(\kappa+\mu)(\sigma-1)}\frac{(B-\underline{w})}{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})} \\
&= \frac{1}{(\kappa+\mu)(\sigma-1)}\left(\frac{1}{(\kappa+\mu)}\ln\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right)-\frac{B-\underline{w}}{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}\right),
\end{aligned}
$$

where the term $(\kappa+\mu)^{-2}(\sigma-1)^{-1}\ln\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right)$ captures the positive productivity effect while the term $-\frac{1}{(\kappa+\mu)(\sigma-1)}\frac{B-\underline{w}}{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}$ corresponds to the negative bargaining effect. The positive productivity effect outweighs the negative bargaining effect if and only if

$$
\begin{aligned}
\frac{1}{(\kappa+\mu)}\ln\left(\frac{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right) &> \frac{B-\underline{w}}{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})} \\
\ln\left(\frac{\lambda\mu+(\kappa+\mu)(B-\underline{w})}{\lambda\mu\underline{w}}\right) &> \frac{(B-\underline{w})(\kappa+\mu)}{\lambda\mu\underline{w}+(\kappa+\mu)(B-\underline{w})},
\end{aligned}
$$

which is always true since the left hand side is strictly larger than one while the right hand side is always strictly smaller than one. Consequently, skill-biased technological change unambiguously increases the share of organizations with $g=0$ in equilibrium.

A.5 Open Economy Equilibrium

A.5.1 Marginal Exporters and Marginal Local Firms

Since firms face identical demand elasticities in both markets, the operating profit ratio of a marginal exporter and a marginal local firm can be stated as

$$
\frac{\varepsilon Y_x(s_x)}{\varepsilon Y_d(s_d)} = \frac{\varepsilon\tau^{1-\sigma}M\left(\frac{t^\kappa s_x^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1}}{\varepsilon M\left(\frac{t^\kappa s_d^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1}} = \frac{f\underline{w}}{\left(\left(1-\frac{\underline{w}}{\varepsilon B}\right)(C-(1-\varepsilon)R)+1\right)\underline{w}}
$$

which yields

$$
s_x = \left(\frac{\tau^{\sigma-1}f}{\lambda}\right)^{\frac{1}{1-\psi}} s_d.
$$

A.5.2 Open Economy Price Index

After exchanging variables and integrating over the skill distribution, the price index P in the open economy with two identical countries can be written as

$$
\begin{aligned}
P &= \left[\int_{s_d}^{\infty}\left(\frac{\sigma}{\sigma-1}\underline{w}t^{-\kappa}s^{-(\kappa+\mu)}\right)^{1-\sigma}d\varepsilon L(1-s^{-1})+\int_{s_x}^{\infty}\left(\tau\frac{\sigma}{\sigma-1}\underline{w}t^{-\kappa}s^{-(\kappa+\mu)}\right)^{1-\sigma}d\varepsilon L(1-s^{-1})\right]^{1/(1-\sigma)}. \\
&= \underline{w}t^{-\kappa}\frac{\sigma}{\sigma-1}\left(\frac{\psi}{\varepsilon L}\right)^{\frac{1}{\sigma-1}} s_d^{\frac{\psi}{\sigma-1}}\left[1+\tau^{-\frac{1}{\kappa+\mu}}f^{\frac{-\psi}{1-\psi}}\lambda^{\frac{\psi}{1-\psi}}\right]^{1/(1-\sigma)}.
\end{aligned}
$$

Next, use the index of bilateral distance $\Delta \equiv \tau^{\frac{1}{\kappa+\mu}} f^{\frac{\psi}{1-\psi}}$ to restate the open economy version of P as follows:

$$P = \frac{\sigma}{\sigma-1}\underline{w}t^{-\kappa}\left(\frac{\psi}{\varepsilon L}\right)^{\frac{1}{\sigma-1}} s_d^{\frac{\psi}{\sigma-1}}\left[1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right]^{1/(1-\sigma)}.$$

A.5.3 Labor Market Clearing Condition in the Open Economy

The aggregate earnings of production workers remains unchanged compared to the closed economy case at $L\underline{w}(1-s_d^{-1})$. The expenditure on production labor now is comprised of three components: *(i)* labor expenditure required to produce for the domestic market, *(ii)* labor expenditure required to produce for the foreign market, and *(iii)* labor expenditure to cover the fixed export investment:

$$\int_0^{Ls_d^{-1}}\left[\varepsilon\frac{\sigma-1}{\sigma}XP^{\sigma-1}p_j^{1-\sigma}\right]dj + \int_0^{Ls_x^{-1}}\left[\varepsilon\frac{\sigma-1}{\sigma}XP^{\sigma-1}\tau^{1-\sigma}p_j^{1-\sigma}\right]dj + f\underline{w}Ls_x^{-1}.$$

This term for the aggregate production labor expenditure may be simplified as follows:

$$\begin{aligned}
&= \varepsilon\frac{\sigma-1}{\sigma}XP^{\sigma-1}\left[\int_0^{Ls_d^{-1}} p_j^{1-\sigma}dj + \tau^{1-\sigma}\int_0^{Ls_x^{-1}} p_j^{1-\sigma}dj\right] + f\underline{w}Ls_x^{-1} \\
&= \varepsilon\frac{\sigma-1}{\sigma}XP^{\sigma-1}\left[\left(\frac{\sigma}{\sigma-1}\underline{w}t^{-\kappa}\right)^{1-\sigma}\left(\frac{\psi}{\varepsilon L}\right)^{-1} s_d^{-\psi}\left(1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right)\right] + f\underline{w}Ls_x^{-1} \\
&= \varepsilon\frac{\sigma-1}{\sigma}X + f\underline{w}Ls_x^{-1}
\end{aligned}$$

Setting supply and demand equal leads to

$$\varepsilon\frac{\sigma-1}{\sigma}X + f\underline{w}Ls_x^{-1} = L\underline{w}(1-s_d^{-1});$$

and after replacing s_x one obtains

$$\begin{aligned}
\varepsilon\frac{\sigma-1}{\sigma}X + f\underline{w}L\left(\frac{\tau^{\sigma-1}f}{\lambda}\right)^{\frac{1}{\psi-1}} s_d^{-1} &= L\underline{w}(1-\underline{s}_d^{-1}) \\
X &= \frac{\sigma}{\sigma-1}\frac{L}{\varepsilon}\underline{w}\left(1-\underline{s}_d^{-1}\left(1+\lambda^{\frac{1}{1-\psi}}\Delta^{-1}\right)\right).
\end{aligned}$$

A.5.4 Zero Cutoff Earnings Condition in the Open Economy

Again, the marginal firm is an incentive organization and just breaks even such that

$$\varepsilon Y(s_d) = \left(1-\frac{w}{\varepsilon B}\right)(C-(1-\varepsilon)R)\,\underline{w} + \underline{w}.$$

The expected operating profits can be written in terms of X and s_d such that the zero cutoff curve is a decreasing function in the $X(s_d)$ locus:

$$\begin{aligned}\varepsilon Y(s_d) &= \varepsilon M\left(\frac{t^{\kappa}s_d^{\kappa+\mu}}{\underline{w}}\right)^{\sigma-1}\\ &= X\frac{\psi}{\sigma L}\left[1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right]^{-1}s_d.\end{aligned}$$

Setting this equal to $\left(1-\frac{w}{\varepsilon B}\right)\left(C-(1-\varepsilon)R\right)\underline{w}+\underline{w}$ yields the zero cutoff condition for the open economy

$$\begin{aligned}X\frac{\psi}{\sigma L}\left[1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right]^{-1}s_d &= \left(\left(1-\frac{w}{\varepsilon B}\right)\left(C-(1-\varepsilon)R\right)+1\right)\underline{w}\\ X &= \frac{\sigma L\lambda\underline{w}}{\psi}\left[1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right]s_d^{-1}.\end{aligned}$$

A.5.5 Explicit Equilibrium Solution for (X, s_d) in the Open Economy

Solve first for the cutoff s_d:

$$\begin{aligned}\frac{\sigma L\lambda\underline{w}}{\psi}\left[1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right]s_d^{-1} &= \frac{\sigma}{\sigma-1}\frac{L}{\varepsilon}\underline{w}\left(1-\underline{s}_d^{-1}\left(1+\lambda^{\frac{1}{1-\psi}}\Delta^{-1}\right)\right)\\ s_d &= 1+\frac{\varepsilon\lambda(\sigma-1)}{\psi}+\left(1+\frac{\varepsilon(\sigma-1)}{\psi}\right)\lambda^{\frac{1}{1-\psi}}\Delta^{-1}\end{aligned}$$

Note that $\lim_{\Delta\to\infty}s_d = s_c$.

Plug the solution for s_d into the zero cutoff earnings condition:

$$\begin{aligned}X &= \frac{\sigma L\lambda\underline{w}}{\psi}\left(1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right)\left(1+\frac{\varepsilon\lambda(\sigma-1)}{\psi}+\left(1+\frac{\varepsilon(\sigma-1)}{\psi}\right)\lambda^{\frac{1}{1-\psi}}\Delta^{-1}\right)^{-1}\\ X &= \frac{\sigma L\lambda\underline{w}\left(1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right)}{\psi+\varepsilon\lambda(\sigma-1)+(\psi+\varepsilon(\sigma-1))\lambda^{\frac{1}{1-\psi}}\Delta^{-1}}.\end{aligned}$$

Also the aggregate expenditure level equals the expenditure level in the closed economy case when the index of economic distance Δ approaches infinity.

Additionally, note that $\frac{\partial X}{\partial \Delta}>0$ since

$$\frac{\partial X}{\partial \Delta}=\frac{\lambda L\sigma\psi\underline{w}\left(\lambda^{\frac{1}{1-\psi}}-\lambda^{\frac{\psi}{1-\psi}}\right)}{\left(\Delta\left(\varepsilon\lambda(\sigma-1)+\psi\right)+\lambda^{\frac{1}{1-\psi}}\left(\psi+\varepsilon(\sigma-1)\right)\right)^2}.$$

A.5.6 The Size of the Market Share M in the Open Economy Equilibrium

The equilibrium market share M of a firm can again be stated as follows:

$$\begin{aligned} M &\equiv \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} XP^{\sigma-1} \\ &= \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left[\frac{\sigma L\lambda \underline{w}\left(1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right)}{\psi+\varepsilon\lambda\left(\sigma-1\right)+\left(\psi+\varepsilon\left(\sigma-1\right)\right)\lambda^{\frac{1}{1-\psi}}\Delta^{-1}}\right]\left[\frac{\sigma}{\sigma-1}\underline{w}t^{-\kappa}\left(\frac{\psi}{\varepsilon L}\right)^{\frac{1}{\sigma-1}} s_d^{\frac{\psi}{\sigma-1}}\left[1+\lambda^{\frac{\psi}{1-\psi}}\Delta^{-1}\right]^{\frac{1}{1-\sigma}}\right]^{\sigma-1} \\ &= \frac{\lambda}{\varepsilon}\underline{w}^{\sigma} t^{-\kappa(\sigma-1)} s_d^{\psi-1} \end{aligned}$$

A.6 The Effects of a Trade Integration

Consider the effect of a trade integration ($\Delta \downarrow$) on the share of organizations with no investment in corporate governance θ. I distinguish between two different scenarios, here:

1. low trade openness: the fix and/or variable trade costs are large that only the must productive firms choose to serve the export markets such that the sorting of cutoff skill levels is $s_d < \widetilde{s} < s_x$.
2. high trade openness: the fix and/or variable trade costs are sufficiently small that relatively many firms choose to serve the export markets such that the sorting of cutoff skill levels is $s_d < s_x < \widetilde{s}$.

A.6.1 Low Trade Openness

The organizational cutoff $\widetilde{s}$ can be evaluated as in the closed economy case

$$\begin{aligned} \varepsilon M\left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1}\frac{\mu}{\kappa+\mu}\left(\widetilde{s}^{(\kappa+\mu)(\sigma-1)}-s_d^{(\kappa+\mu)(\sigma-1)}\right)+\underline{w} &= B \\ \left(\frac{\widetilde{s}}{s_d}\right)^{1-\psi} &= 1+\frac{(\kappa+\mu)\left(B-\underline{w}\right)}{\lambda\mu\underline{w}} \\ \widetilde{s} &= \left(1+\frac{(\kappa+\mu)\left(B-\underline{w}\right)}{\lambda\mu\underline{w}}\right)^{\frac{1}{1-\psi}} s_d \end{aligned}$$

A.6.2 High Trade Openness

The organizational cutoff $\widetilde{s}$ in the open economy case is

$$\begin{aligned} \varepsilon M\left(\frac{t^{\kappa}}{\underline{w}}\right)^{\sigma-1}\frac{\mu}{\kappa+\mu}\left(\left(\widetilde{s}^{1-\psi}-s_d^{1-\psi}\right)+\tau^{1-\sigma}\left(\widetilde{s}^{1-\psi}-s_x^{1-\psi}\right)\right)+\underline{w} &= B \\ \left(\frac{\widetilde{s}}{s_d}\right)^{1-\psi}\left(1+\tau^{1-\sigma}\right) &= \left(\frac{(\kappa+\mu)\left(B-\underline{w}\right)}{\lambda\mu\underline{w}}-\frac{\lambda}{\tau^{2(\sigma-1)}f}+1\right) \end{aligned}$$

such that $\widetilde{s}$ and the share of organizations that choose $g = 0$ are equal to

$$\widetilde{s} = \left(\left(\frac{(\kappa+\mu)(B-\underline{w}) + \lambda\mu\underline{w}}{\lambda\mu\underline{w}} - \frac{\lambda}{\tau^{2(\sigma-1)} f} \right) \left(\frac{1}{1+\tau^{1-\sigma}} \right) \right)^{\frac{1}{1-\psi}} s_d$$

$$\theta = \left(\left(\frac{(\kappa+\mu)(B-\underline{w}) + \lambda\mu\underline{w}}{\lambda\mu\underline{w}} - \frac{\lambda}{\tau^{2(\sigma-1)} f} \right) \left(\frac{1}{1+\tau^{1-\sigma}} \right) \right)^{-\frac{1}{(\kappa+\mu)(\sigma-1)}} .$$

B Appendix - Data

B.1 Preparation of the BoardEx Data

Before equity compensation from BoardEx could be applied in the empirical models, a number of preparation steps were neccessary. Since BoardEx includes both, executives and supervisory managers, the latter were excluded from the sample throughout. Furthermore, BoardEx reports several distinct incomes for some executives that hold different positions within the board of the same firm. Those incomes have been aggregated at the manager-firm-year level to obtain the aggregate executive compensation. The next step of preparation involved the deletion of double entries: Although most data items stem from annual report data, there is also some reporting from quarterly announcements included. Those data points from quarterly announcements have been excluded. Furthermore, reporting periods have been assimilated by switching from accounting periods which start at different months depending on each firm in the sample to calendar years. Since job titles are not perfectly consistent, CEOs were identified as the highest paid executive in each firm in a given year.

B.2 Construction of the Instrumental Variable

The variable that I use as an instrument for trade openness is the weighted average of real effective exchange rates $r_t(c)$ of the top 5 U.S. export destinations c: Canada, Mexico, Great Britain, China and Japan. Each weight $\alpha_j(c)$ is the average country c's share of exports relative to the total exports of those five countries from the U.S. during 1991 - 1995 at the industry level j (at the SIC 4-digit level):

$$\begin{aligned} \alpha_j(c) &= \frac{\varnothing\, exports_j(c)}{\sum_{c=1}^{5} \varnothing\, exports_j(c)} \\ IV_{jt} &= \sum_{c=1}^{5} \alpha_j(c)\, r_t(c) \end{aligned}$$

variable	*description*
E-index	Entrenchment index from Bebchuk et al. (2009). The index ranges from 0 (good corporate governance - little entrenchment) to 6 (bad corporate governance - large entrenchment) and counts how many of the following attributes are applied in a company in a given year: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers as well as for charter amendments. Information on the six different governance attributes is provided by the IRRC and includes S&P 500 firms and other large U.S. firms. Data source: http://www.law.harvard.edu/faculty/bebchuk/data.shtml
ln(CEO equity compensation)	Natural logarithm of the equity-linked compensation in 1000 USD of the highest-paid officer in the firm during a given year. Data source: BoardEx database
ln(openness)	Natural logarithm of *openness* in %, where *openness* is *exports/(gross output - imports)*. Gross ouput is approximated as the sum of value added, material costs, energy costs and labor compensation. All variables are at the 4-digit SIC industry level for the main industry of each firm in the sample. Data sources: exports and imports are obtained from the COMTRADE WITS database http://wits.worldbank.org/; gross output is calculated with data from the NBER-CES Manufacturing Industry database http://www.nber.org/nberces/
ln(exports/gross output %)	Natural logarithm of *exports/gross output* in %. Gross ouput is approximated as the sum of value added, material costs, energy costs and labor compensation. All variables are at the 4-digit SIC industry level for the main industry of each firm in the sample. Data sources: exports and imports are obtained from the COMTRADE WITS database http://wits.worldbank.org/; gross output is calculated with data from the NBER-CES Manufacturing Industry database http://www.nber.org/nberces/
ICT contribution %	Contribution of information and communication technology (ICT) capital services to value added growth in percentage points for the main industry of the firm at the ISIC Rev. 3 level. Data source: http://www.euklems.net/
ln(employment)	Natural logarithm of the number of both full and part time employees of the company at the firm level. Data source: Thomson Worldscope database
ln(total assets)	Natural logarithm of the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets in 1000 USD. Data source: Thomson Worldscope database
total investment return	Stock return in % corrected for dividend payments. total investment return = 100% x ((market price year end + dividends p. share + special dividends) / last year's market price year end) - 1) Data source: Thomson Worldscope database
TFP index	Total factor productivity index on the SIC 4-digit level based on 4 factors of production (production workers, non-production workers, material inputs, capital) with the base year 1987, where the index takes the value 1. Data source: NBER-CES Mft. Industry database http://www.nber.org/nberces/
REER basket	weighted average of the real effective exchange rates of top 5 U.S. trading partners Canada, Mexico, Great Britain, China and Japan. Weights are the country share of U.S. imports during 1991-1995 at the SIC 4-digit level. REER are domestic prices relative to the world price (larger REER means greater comparative advantage for the U.S.) Data source: weights are obtained from COMTRADE WITS; exchange rate from the BRUEGEL REER database

Table 4: Description of Variables