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FINANCIAL MARKETS, INDUSTRY DYNAMICS AND GROWTH*

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This article introduces corporate governance frictions into a growth model with endogenous market structure. Managers engage in corporate resource diversion and empire building. Shareholders discipline managers with incentive compensation contracts. A reform that mitigates corporate governance frictions boosts firms' entry and, for a given market structure, has an ambiguous impact on incumbents' return to product improvement. However, as the market structure adjusts, becoming more diffuse, incumbents invest less in product improvement. Calibrating the model to U.S. data, we find that a reform of the kind recently enacted in several advanced economies can lead to a welfare loss.

A broad consensus exists that corporate governance can be relevant for growth in both advanced and emerging economies (La Porta *et al.*, 2000; De Nicolò *et al.*, 2008; Bloom and Van Reenen, 2010). There is little agreement, however, about the channels through which it operates. The 'rule of law' view maintains that economies with better shareholder protection and managerial discipline enjoy stronger entrepreneurship and innovative activity (OECD, 2012). On the other hand, the policies of several emerging countries and some advanced ones often accommodate firms' informational opacity—for example, allowing government-protected business group affiliates to disclose limited information to financial markets (OECD, 2010). A consequence is that managers are able to engage in resource diversion at the expense of shareholders. In addition, governments often favour the appointment of managers with empire building attitudes. Advocates of these policies stress that large incumbent businesses have engaged in aggressive investment and boosted growth in several countries such as Korea, Indonesia, Thailand, Brazil, Chile and Japan (see, e.g., Jwa, 2002; Chang, 2007, for reviews). Opponents maintain that these policies have inhibited competition and entrepreneurship.

It is tempting to conclude that this debate and the evidence on which it hinges are inconclusive (Khanna, 2000; Morck *et al.*, 2005). Nevertheless, from the debate it emerges that to understand the effects of corporate governance on growth one needs to investigate how corporate governance affects both the process of firm entry into product markets (entrepreneurship) and the process of growth of incumbent firms, and the interaction between the two. To date, studies that examine the influence of corporate governance on firm investment have treated market structure as given. Yet, scholars document the profound effects that corporate governance reforms have had on market

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structure in various countries in recent decades via the induced changes in the ease with which firms enter product markets (see, e.g., Fulghieri and Suominen, 2012, and references therein).

The goal of this article is to help fill this gap by studying the effects of corporate governance frictions on the investment and growth patterns of an economy in which corporate governance shapes the evolution of the market structure (firm entry and size). We draw from the literature that has extended endogenous growth theory to include endogenous market structure (see, e.g., Peretto, 1996, 1999, and, for a recent survey, Etro, 2009) and build a model where growth is driven both by the foundation of new firms that offer new intermediate products (entry/extensive margin) and by the investment of incumbent firms in the improvement of intermediate products (investment/intensive margin). To apply the framework to the study of corporate governance, we do two things. First, we posit separation of ownership and control: households can act as founding shareholders and managers of firms; managers are in charge of production and investment decisions concerning existing products. Second, we allow for moral hazard to generate frictions: managers can divert resources from firms (profit stealing) and pursue private benefits tied to investment volumes (empire building); shareholders can only partially discipline managers through incentive compensation (equity) contracts. This way of modelling corporate governance builds on prior corporate finance studies (e.g., Nikolov and Whited, 2014) and on the mentioned evidence on the corporate governance problems of several countries.

We find that both managerial resource diversion and empire building discourage firm entry and, hence, the expansion of product variety. Intuitively, the corporate governance frictions act as a barrier to entry, directly eroding the profits that founding shareholders expect to receive and forcing shareholders to surrender a fraction of expected profits to managers to mitigate moral hazard via incentive contracts. As for incumbents' investment in product improvement, the joint effect of the two frictions would be ambiguous for given market structure: on the one hand, managers' resource diversion depresses the return to investment from shareholders' viewpoint; on the other hand, empire building boosts managers' investment incentives. However, in our economy with endogenous market structure, the net effect of the frictions is to induce more aggressive investment of incumbents in free-entry equilibrium because of the market consolidation and the larger firm size due to the weaker entry. In fact, exactly because of the market consolidation and the larger firm size sustainable in equilibrium, incumbents can reap larger benefits from investing in product improvement.

Our analysis thus shows that, allowing for the endogeneity of market structure, captured by firm size in our model, a nuanced perspective emerges on the growth effects of governance frictions. For example, following a reform that mitigates the frictions, a non-trivial trade-off arises between the acceleration of firm entry and the impact of the growing mass of firms on incumbents' incentive to invest in product improvement. We assess this trade-off analytically and quantitatively. Calibrating the model to U.S. data, we find that a reform of the kind implemented in several advanced economies in 2006–12 on impact boosts firms' entry rate by 0.12%, from the steady-state value 1.61% to 1.73%, and depresses incumbents' investment in product improvement by 0.05%, from 1.60% to 1.55%. These responses are larger in economies with weaker corporate governance than the United States. Further, we find that, relative to a reform targeting empire building, a reform curbing resource diversion can boost entry with a smaller fall in incumbents' investment.

Because of its tractability, the model allows us to trace the full dynamic response to a governance reform through the evolution of the market structure and characterise analytically the welfare effects. Following a reform, household utility is initially driven by the acceleration of firm entry, which responds immediately to the reform as firm founders expect to appropriate a larger share of firms' value. As the market structure adjusts and firms' size falls, however, incumbents' investment declines. Consequently, the negative comovement between number of firms and incumbent firms' growth, which is at the heart of the model, produces a dynamic product variety/quality trade-off that manifests itself as a trade-off between the short- and long-run welfare effects of the reform. The relative importance of the short and long-run welfare effects depends on technological and market structure features: for example, in economies with lower investment externalities the welfare benefit of faster entry gains relevance relative to the drop in incumbents' investment driven by the market structure adjustment. However, for the baseline parameterisation we obtain that the welfare benefit due to faster entry is dominated by the welfare cost due to reduced investment rates. Thus, an improvement in corporate governance leads to a net welfare reduction.

Theoretical work on the growth effects of corporate governance has lagged behind the policy debate. In a related work, Akcigit *et al.* (2014) study an effort model in which firm entry rate is given. By holding up firms ex post, managers can discourage the increase in the scope of firms' product lines. More in general, a strand of literature stresses that corporate governance frictions can hinder growth by inhibiting investment and product improvement (Morck *et al.*, 2005; Driver and Coelho Guedes, 2012). We contribute to the debate by showing that in an economy with endogenous market structure, corporate governance frictions can inhibit entry (the extensive margin of growth) but promote a more aggressive investment of incumbents, which benefit from the market consolidation and the larger firm size induced by imperfect governance. We also investigate this trade-off quantitatively. Our article is also related to the literature on imperfect financial markets and growth (e.g., Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; Cooley and Quadrini, 2001; Aghion *et al.*, 2005). In this strand, Caselli and Gennaioli (2013) model an economy in which credit frictions can inhibit the reallocation of ownership to the most productive agents, slowing down growth.[1] Finally, the article relates to a strand of studies on managerial misbehaviour (e.g., Eisfeldt and Rampini, 2008; Immordino and Pagano, 2012). For example, Cooley *et al.* (2014) investigate the long-run implications of managers' risk taking in financial firms.

The structure of the article is as follows. Section 1 provides suggestive evidence from country- and firm-level data motivating our focus. Sections 2 and 3 present and solve for agents' decisions. Section 4 characterises the general equilibrium and solves for the steady state. Sections 5 and 6 investigate analytically and numerically the dynamics of the economy and its response to corporate governance reforms. Section 7 concludes. Proofs and details on the data and additional robustness analysis are in the Online Appendix.

1. Some Motivational Evidence

This section asks whether the trade-off between the effects of corporate governance frictions on firm entry and on incumbents' investment finds preliminary support in the data (details on the tests are in the Online Appendix).

In Panel A of Table 1, column (1), we use data from 87 advanced and emerging economies and regress firms' entry rate (in percentage) in 2012 on the World Bank 10-point index of corporate governance quality and on several macroeconomic and institutional factors that are generally

[1] For studies on the misallocation of inputs, see Restuccia and Rogerson (2008) and Guner *et al.* (2008).

Table 1. *Empirical Background. Corporate Governance, Firm Entry and Incumbents' Investments.*

Panel A: Corporate governance and entry rate (percent)			Panel B: Corporate governance and incumbents' investment rate in intangibles (percent)							Panel C: Other outcomes	
										Cross-section, firms	
	Cross-section, countries	Panel, countries		Cross-section, countries		Cross-section, firms		Panel, firms		Fixed inv. (percent)	Size (sales)
	(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Corporate governance index	0.78**	0.22**	Corporate governance index	−0.85***	−0.84***	−0.13***	−0.12***	−0.14***	−0.08***	−0.01***	−2.46e+07***
	(0.33)	(0.09)		(0.23)	(0.28)	(0.009)	(0.010)	(0.01)	(0.01)	(0.0001)	(4.78e+06)
Macroeconomic controls			*Macroeconomic controls*								
GDP per capita	0.0001**	–	GDP per capita	−0.00004**	−0.00005*	−8.16e-07	1.49e-07	–	−3.13e-06***	−7.38e-07***	919.13***
	(0.00004)			(0.00002)	(0.00002)	(5.41e-07)	(5.89e-07)		(7.00e-07)	(3.86e-08)	(187.01)
Dependency ratio	−0.04	–	Dependency ratio	−0.51**	−0.59**	−0.006	−0.03***	–	0.005 (0.006)	−0.007***	2,988,841
	(0.14)			(0.22)	(0.24)	(0.006)	(0.007)			(0.0004)	(2,261,559)
Population growth rate	−0.79	–	Population growth rate	−2.86e-08	6.43e-10	−0.013	−0.04**	–	−0.068***	−0.0096***	−3.01e+07***
	(0.58)			(1.76e-08)	(2.08e-08)	(0.015)	(0.016)		(0.013)	(0.001)	(6,621,510)
GDP growth rate	–	0.06***	Public expenditure/GDP	−0.13 (0.16)	−0.15 (0.17)	−0.039***	−0.05***	–	−0.013***	0.0001	1.86e+07***
		(0.02)				(0.004)	(0.005)		(0.004)	(0.0003)	(3,160,760)
Credit market depth			*Credit market depth*								
Credit bureau coverage	−0.01	–	Credit bureau coverage	–	−0.007	–	0.0001	–	0.0003	−0.0001***	731,420***
	(0.02)				(0.02)		(0.0003)		(0.0003)	(0.00002)	(142,033)
Credit registry coverage	−0.03	–	Credit registry coverage	–	0.03 (0.03)	–	0.002***	–	0.002	−0.0002***	546,218***
	(0.03)						(0.0005)		(0.0004)	(0.00003)	(112,444)
Entry costs			*Firm-level controls*								
Time (days) to start a business	−0.001	–	Firm age (years)	–	–	−0.00002	−0.0006	−0.001**	−0.001*	−0.0001	1,137,420***
	(0.003)					(0.0004)	(0.0005)	(0.0003)	(0.0003)	(0.00002)	(278,643)
Procedures to build warehouse	−0.09	–	Firm no. of employees	–	–	5.53e-06*	2.11e-06	6.88e-06***	6.98e-06***	1.04e-07	203,353***
	(0.09)					(3.22e-06)	(2.01e-06)	(1.47e-06)	(1.85e-06)	(7.99e-08)	(34,200)
Time (year) and country dummies	No	Yes	–	–	–	–	–	–	–	–	–
Observations	87	583	Observations	40	38	158,496	148,647	460,461	434,727	215,149	171,527

Notes: This table reports coefficient estimates and standard errors for the effect of corporate governance quality on firm entry (Panel A), incumbents' investment in intangibles (Panel B), incumbents' fixed asset investment and size (Panel C). The WB governance index is on a 1–10 scale. The dependent variable is: cols. (1)–(2) firms' entry rate in the country in 2012, in %; cols. (3)–(4) average incumbents' investment in intangibles in the country in 2013, in %; cols. (5)–(6) incumbent firm investment in intangibles in 2013, in %; cols. (7)–(8) incumbent firm investment in intangibles in the year, in % (the panel is over 2010–4); col. (9) incumbent firm fixed investment in 2013, in %; col. (10) incumbent firm sales in 2013, in U.S. dollars. See also the Online Appendix. *, **, *** denote significant at the 10, 5, and 1%, respectively.

used to explain entry. To mitigate possible endogeneity problems, we include the controls lagged by one year. The results suggest a positive correlation between corporate governance quality and firm entry. In column 2, we perform a panel data analysis over the 2006–12 period. We regress firms' percentage entry rate on the index of corporate governance quality, on an indicator of the cycle (GDP growth in the country), and saturate the regression with year and country fixed effects. Between 2006 and 2012, several countries enacted corporate governance reforms, so that the governance index exhibits substantial intertemporal, within-country variation. The estimated coefficient on the index of corporate governance quality suggests that an increase of the index by 1 is associated with a higher entry rate by 0.2 percentage points (on average the reforms in OECD economies increased the governance quality index by approximately 0.3). This impact is roughly one order of magnitude smaller than the entry rates that various countries in the sample experience in a typical year.

In Panel B of Table 1, we turn to explore the link between corporate governance and incumbents' investment in product improvement. In the literature, the more comprehensive investment in intangible assets (R&D capital, software, brands) is frequently used as a proxy for investment in product improvement rather than R&D expenses (see, e.g., OECD, 2013).[2] In columns (3)–(4), using data from 40 advanced and emerging countries, we regress incumbents' average rate of investment in intangibles in 2013 on the governance quality index and on control variables that could drive investment (data source: Orbis, Bureau van Dijk).[3] The results suggest a negative correlation between the index of governance quality and incumbents' investment in intangibles. Regressing the firm-level percentage investment in intangibles in 2013 on the governance index and on aggregate and firm controls (columns (5)–(6)) or performing a firm-level panel analysis for the years 2010–4 (columns (7)–(8)) yields results that are consistent with the country-level regressions in columns (3)–(4).[4]

In Panel C, we experiment with alternative dependent variables. Column (9) shows a negative correlation between governance quality and incumbents' investment in fixed assets. Finally, the model predicts that governance frictions can make incumbents invest aggressively by inducing market structure consolidation and allowing to sustain a larger firm size in equilibrium. In column (10), we indeed find a negative association between governance quality and incumbents' size (sales).

2. The Model: Preferences and Technology

The growth model takes its key elements from a large literature.[5] Time is continuous and infinite. All variables are functions of time, but to simplify the notation we omit the time argument unless necessary to avoid confusion. The economy is closed. The production side consists of a final sector producing a homogeneous good and an intermediate sector producing a continuum of differentiated non-durable goods. To keep things simple, there is no physical capital. The

[2] Countries may differ in the relative importance of formal R&D activities, investment in brands or in training.

[3] A number of studies estimate a positive effect of corporate governance quality on R&D and innovation (see, e.g., Wurgler, 2000; Xiao, 2013). Other studies, however, find a negative effect (see, e.g., Bargeron *et al.*, 2010; Driver and Coelho Guedes, 2012; and, for a discussion, Kose *et al.*, 2008).

[4] The magnitude of the estimated coefficient on the governance index is lower than in the country-level regressions. In firm-level regressions countries with a larger business sector (e.g., advanced economies) weigh more. In advanced countries, the impact of governance frictions may be less strong, as we will see in the model. Moreover, firm controls may capture some channels through which corporate governance influences investments (partially absorbing its effect).

[5] For growth models with endogenous market structure, see, e.g., Peretto (1996, 1999) and, for a survey, Etro (2009).

intermediate sector is the core of our economy: new firms enter the sector by developing new intermediate goods while incumbent firms invest in the improvement of existing intermediate goods.

2.1. *Households*

The economy is populated by a representative household with $L(t) = L_0 e^{\lambda t}$, $L_0 \equiv 1$, members, each endowed with one unit of labour. The household has preferences

$$U(t) = \int_t^{\infty} e^{-(\rho-\lambda)(\tau-t)} \log\left(\frac{C(\tau)}{L(\tau)}\right) d\tau, \quad \rho > \lambda \geq 0, \tag{1}$$

where t is the point in time when the household makes decisions, ρ is the discount rate, $\lambda$is the population growth rate, and C is consumption. The household supplies labour inelastically. It thus faces the flow budget constraint

$$\dot{A} = rA + wL - C, \tag{2}$$

where A is assets holding, r is the rate of return on assets and w is the wage. The intertemporal consumption plan that maximises (1) subject to (2) consists of the Euler equation

$$r = \rho - \lambda + \dot{C}/C,$$

the budget constraint (2) and the usual boundary conditions.

2.2. *Final Producers*

A competitive representative firm produces a final good that can be consumed, used to produce intermediate goods, invested in the improvement of the quality of existing intermediate goods, or invested in the creation of new intermediate goods. The final good is our numeraire. The technology for its production is

$$Y = \int_0^N X_i^{\theta} \left[Z_i^{\alpha} Z^{1-\alpha} \frac{L}{N^{1-\sigma}} \right]^{1-\theta} di, \quad 0 < \theta, \alpha < 1,\ 0 \leq \sigma < 1, \tag{3}$$

where Y is output, N is the mass of intermediate goods and X_i is the quantity of intermediate good i used in production. Given the inelastic labour supply of the household and the one-sector structure of the economy, labour market clearing yields that employment in the final sector equals population size L. Quality is the ability of an intermediate good to raise the productivity of the other factors: the contribution of intermediate good i depends on its own quality, Z_i, and on the average quality, $Z = \int_0^N (Z_j/N)\, dj$, of intermediate goods. We show below that the parameters α and σ regulate the private returns to quality and the social returns to variety, respectively. The first-order conditions for the profit maximisation problem of the final producer yield that each intermediate firm i faces the demand curve

$$X_i = \left(\frac{\theta}{P_i}\right)^{\frac{1}{1-\theta}} Z_i^{\alpha} Z^{1-\alpha} \frac{L}{N^{1-\sigma}}, \tag{4}$$

where P_i is the price of intermediate good i. The first-order conditions then imply that the final producer pays total compensation

$$\int_0^N P_i X_i di = \theta Y \quad \text{and} \quad wL = (1-\theta)Y$$

to intermediate goods and labour suppliers, respectively.

2.3. *Intermediate Producers*

The typical intermediate firm i operates a technology that requires one unit of final good per unit of intermediate good produced and a fixed operating cost, $\phi Z_i^\alpha Z^{1-\alpha}$, also in units of the final good.[6] The firm can increase the quality of its intermediate good according to the technology

$$\dot{Z}_i = I_i,$$

where I_i is the firm's investment in units of final good. Using (4), the firm's net profit is

$$\Pi_i = \left[(P_i - 1)\left(\frac{\theta}{P_i}\right)^{\frac{1}{1-\theta}} \frac{L}{N^{1-\sigma}} - \phi\right] Z_i^\alpha Z^{1-\alpha} - I_i. \tag{5}$$

According to this expression, α is the elasticity of the firm's gross profit with respect to its own quality so that throughout the analysis we can think of it as the private return to quality. (We show below that the social return to quality is 1.) The value of the firm is defined as

$$V_i(t) = \int_t^\infty e^{-\int_t^\tau r(v)dv} \Pi_i(\tau) d\tau. \tag{6}$$

The typical intermediate firm i comes into existence when βX units of final good are invested to set up operations, where $X = \left(\int_0^N X_i di\right)/N$ denotes the average sales of the intermediate firms. Because of this sunk entry cost, the firm cannot supply an already existing good in Bertrand competition with the incumbent monopolist but must introduce a new intermediate good that expands product variety. The firm enters at the average quality level and, hence, at average size. This simplifying assumption preserves symmetry of equilibrium at all times.

3. Corporate Governance

Our goal is to study how corporate governance frictions stemming from the separation of ownership and control affect economic growth and market structure by influencing entry, investment and production decisions. In this section we concentrate on the micro (firm-level) components of the analysis. We study their general equilibrium implications in the following sections.

3.1. *Conceptual Set-up: Frictions and Control Mechanisms*

Households provide the resources to pay the entry cost in exchange for equity. We thus identify them as the firm's principal and refer to them as the *founding shareholders* (or simply as the *founders* or *financiers*). Next, we postulate that the principal hires a *manager*, the agent, to set up the firm and then run everyday operations. The manager's objective function is not aligned with

[6] Writing the fixed operating cost as $\phi Z_i^{\varkappa} Z^{1-\varkappa}$, $\varkappa \in [0, 1]$, produces the same qualitative results.

that of the founder due to a 'resource diversion' friction, whereby the manager siphons resources off the firm, and an 'empire-building' friction, whereby the manager derives private benefits from investing beyond what shareholders' value maximisation calls for. To address this problem, the manager's compensation consists of an equity share.

At the foundation of a new firm, the founder makes two decisions. First, taking into account the conflict of interest with the manager, he chooses the path of the manager's equity share that maximises the value of his own stake in the firm. We develop the analysis for a generic path but for analytical tractability then focus on the case in which the equity allocation chosen at foundation is held constant (see below for interpretation and robustness). Second, the founder decides whether to finance the start-up of the firm in the first place. This decision is represented by the participation constraint that the (maximised) value of his stake in the firm be weakly larger than the funds he provides. Assuming that any household can fund the start-up of a firm, no-arbitrage requires that the founder's participation constraint hold with equality.

3.2. *Managers*

The compensation package of the manager consists of an equity share $e_{m,i}$. The manager can steal a fraction S_i of net profit, Π_i. The effort cost of stealing is $c^S(S_i) \cdot \Pi_i$, where the function $c^S(S_i)$ is increasing and convex.[7] Moreover, as in Stulz (1990) and Jensen (1986), the manager derives private benefits from the firm's volume of investment I_i. Formally, we write the manager's utility flow as

$$u_i^{\text{manager}} = \left[e_{m,i}\,(1 - S_i) + S_i - c^S(S_i)\right] \cdot (\Pi_i + \Omega I_i). \tag{7}$$

The parameter $\Omega \geq 0$ governs the intensity of the empire building friction.[8]

At time t, the manager chooses for $\tau \in [t, \infty)$ the paths of price, $P_i(\tau)$, investment, $I_i(\tau)$, and stealing effort, $S_i(\tau)$, given the path of his shareholding, $e_{m,i}(\tau)$, that maximise

$$V_i^{\text{manager}}(t) = \int_t^{+\infty} e^{-\int_t^{\tau} r(v)dv} u_i^{\text{manager}}(\tau)\, d\tau. \tag{8}$$

Expressions (7)–(8) make clear that, due to stealing and empire building, the manager's objective is not the maximisation of the value $V_i(t)$ in (6). Instead, he forms the Hamiltonian

$$H_i = \left[e_{m,i}\,(1 - S_i) + S_i - c^S(S_i)\right] \cdot (\Pi_i + \Omega I_i) + q_i I_i,$$

where q_i is the shadow value of the marginal increase in product quality. The first-order conditions with respect to P_i, I_i, Z_i and S_i are (dropping the τ index of calendar time for simplicity):

$$\left[e_{m,i}\,(1 - S_i) + S_i - c^S(S_i)\right] \cdot \frac{\partial \Pi_i}{\partial P_i} = 0; \tag{9}$$

$$\left[e_{m,i}\,(1 - S_i) + S_i - c^S(S_i)\right] \cdot \left[\frac{\partial \Pi_i}{\partial I_i} + \Omega\right] + q_i = 0; \tag{10}$$

$$\left[e_{m,i}\,(1 - S_i) + S_i - c^S(S_i)\right] \cdot \frac{\partial \Pi_i}{\partial Z_i} = -\dot{q}_i + r q_i; \tag{11}$$

[7] Specifically, the function is of class C^∞ with $c^S(0) = 0$, $\partial c^S(S_i)/\partial S_i > 0$, $lim_{S_i \to 0} \partial c^S(S_i)/\partial S_i = 0$, $lim_{S_i \to 1} \partial c^S(S_i)/\partial S_i = \infty$.

[8] We obtain the same qualitative results if the empire building friction is ΩZ_i (details available on request).

$$\frac{\partial\left[e_{m,i}\left(1-S_i\right)+S_i-c^S(S_i)\right]}{\partial S_i}\cdot\left(\Pi_i+\Omega I_i\right)=0. \tag{12}$$

Equation (9) yields $P_i = 1/\theta$. Combining this result with (10) and (11) yields the manager's rate of return to investment:

$$r_Z=\frac{\alpha}{1-\Omega}\left[\left(\frac{1}{\theta}-1\right)\frac{X_i}{Z_i}-\phi\left(\frac{Z}{Z_i}\right)^{1-\alpha}\right]+\frac{\dot{q}_i}{q_i}, \tag{13}$$

where

$$q_i=\left[e_{m,i}\left(1-S_i\right)+S_i-c^S(S_i)\right]\cdot\left(1-\Omega\right). \tag{14}$$

These expressions make clear the distortions of the return to investment. First, the manager's return is higher than the purely value-maximising one because he obtains the additional marginal benefit $[e_{m,i}(1-S_i)+S_i-c^S(S_i)]\cdot\Omega$ from the volume of investment I_i. Second, the manager's return can be distorted by the potential temporal variation of his shadow value of investing due to the possible temporal variation in $e_{m,i}$ and S_i. For example, a manager with a profit share that declines over time is induced to invest less today as he expects to reap a smaller share of profits in the future. Formally, in (16) a decline in $e_{m,i}$ or S_i implies $\dot{q}_i/q_i<0$. In an economy in which the manager's objective is perfectly aligned with the founder's one unit of investment is worth one unit of consumption so that the shadow value of investment satisfies $q_i=1$ and $\dot{q}_i/q_i=0$.[9]

The first-order condition for the stealing effort S_i, (12), says that the manager sets the marginal benefit of his stealing effort equal to its marginal cost,

$$1-e_{m,i}=\frac{\partial c^S(S_i)}{\partial S_i}. \tag{15}$$

The marginal benefit is the net profit that the manager diverts from the share $1-e_{m,i}$ that the ownership structure allocates to the founder. Accordingly, the equity share $e_{m,i}$ discourages stealing because it raises the extent to which the manager makes costly effort to steal from himself. Given the properties of the function $c^S(S_i)$, straightforward application of the implicit function theorem to equation (15) yields a function $S_i(e_{m,i})$ characterising the manager's stealing decision that has the following properties: $S_i(0)=S_i^{\max}$; $S_i'\left(e_{m,i}\right)<0$; $S_i(1)=0$.

3.3. *Founding Shareholders*

The founder makes two decisions: the first is whether to fund the start-up project in the first place; the second is to set the path $e_{m,i}(\tau)$ for $\tau\in[t,\infty)$ of the manager's equity share. The first decision is represented by the participation constraint,

$$\beta X(t)\le V_i^{\text{founder}}(t), \tag{16}$$

which we argued holds with equality because any household can finance entry of a new firm. This constraint, therefore, yields the economy's free-entry condition. The value that must equal the entry cost is not the value defined in (6) but the value of the founder's stake in the firm. The

[9] The Supplement presents the case of an economy without corporate governance frictions. We can think of this as an economy in which managers' cost of stealing is infinite and their investment decision is fully contractible, so that managers can commit ex ante to undertaking a specified investment path vis à vis firms' founders.

two differ because of the need to delegate the firm's management to an agent that pursues his own objectives. To study the second decision, we use the function $S_i(e_{m,i})$ constructed above and write

$$V_i^{\text{founder}}(t) = \int_t^{+\infty} e^{-\int_t^\tau r(v)dv} \left[1 - e_{m,i}(\tau)\right]\left[1 - S_i\left(e_{m,i}(\tau)\right)\right] \Pi_i(\tau)d\tau. \tag{17}$$

Our first result is then the following.

PROPOSITION 1. *(Equity Shares) Assume that the share $e_{m,i}$ is chosen at the time of foundation of the firm, t, and then held constant for $\tau > t$. Then the founder's problem reduces to*

$$\max_{e_{m,i}(t)} [1 - e_{m,i}(t)]\left[1 - S_i\left(e_{m,i}(t)\right)\right]. \tag{18}$$

The solution yields a value $e_{m,i}$, constant over calendar time, that allows us to define

$$\Theta \equiv \left(1 - e_{m,i}\right)\left[1 - S_i\left(e_{m,i}\right)\right]. \tag{19}$$

At any date the founder receives as dividends only a constant fraction Θ of the net profits.

Proof. See the Online Appendix.

To understand this result, recall expressions (13) and (14) for the manager's return to investment. Temporal variation of the manager's equity share would influence the investment path $I(\tau)$ and hence the path of profits $\Pi(\tau)$. Our assumption that the ownership shares are set at time t shuts down this dependence and, therefore, yields that the founder knows that for $\tau > t$ the path $\Pi_i(\tau)$ does not depend on the shares. More precisely: (*i*) his problem does not have a dynamic constraint, and thus reduces to a sequence of identical problems; (*ii*) it features $\partial \Pi_i(\tau)/\partial e_{m,i}(t) = 0$. A useful way to think about the latter property is to write the dividend flow inside (17) as

$$\underbrace{\left[1 - e_{m,i}(\tau)\right]\left[1 - S_i\left(e_{m,i}(\tau)\right)\right]}_{\text{share of the pie}} \cdot \underbrace{\Pi_i(\tau)}_{\text{size of the pie}}.$$

Our structure isolates the 'size of the pie' part from the equity shares decision. Accordingly, the founder solves the static (i.e., intratemporal) problem (18), equalising the marginal cost of incentivising the manager through ownership shares to the marginal benefit due to the reduction of the manager's stealing. The next step in the argument is to note that the decision rule $S_i(e_{m,i})$ obtained from the manager's first-order condition does not contain time-varying factors or other endogenous variables of the model. Therefore, the solution of the founder's problem yields a value $e_{m,i}$ that does not depend on the foundation date, t, and thus is constant with respect to the model's index of calendar time. Accordingly, the founder's 'share of the pie' is also constant.

The founder's *appropriation factor* Θ, defined in (19), fully captures the consequences of the manager's stealing for the founder. To see the implications of resource diversion for the entry decision, now recall that the participation constraint of the founder (16) gives us the free-entry condition $\beta X(t) = V_i^{\text{founder}}(t)$. Taking logs and time derivatives yields the return to entry

$$r_N = \frac{\Theta \Pi_i}{V_i^{\text{founder}}} + \frac{\dot{V}_i^{\text{founder}}}{V_i^{\text{founder}}} = \frac{\Theta}{\beta}\frac{\Pi_i}{X} + \frac{\dot{X}}{X}, \tag{20}$$

which equals the dividend price ratio plus capital gains/losses. The dividend features the appropriation factor Θ that captures the two channels through which the resource diversion distortion manifests itself. The first channel is direct: the founder surrenders a fraction $e_{m,i}$ of the dividend flow to the manager to mitigate the manager's resource diversion. The second channel is indirect: given the shares $(1 - e_{m,i}, e_{m,i})$, the manager makes his stealing decision that results in a share S_i of the net profits being diverted from dividend distribution to the manager's pockets.

3.4. *Discussion*

It is useful to take stock of what we have so far. The key simplification in our structure is that the appropriation factor Θ is time-invariant because the equity shares $(e_{m,i}, 1 - e_{m,i})$ are constant. Firms' ownership structures exhibit strong inertia for several reasons, including sunk costs, externalities, and stakeholders' vested interests (Bebchuk and Roe, 1999). For example, managers could oppose a change in the equity allocation that would reduce their appropriation of profits. Moreover, because of free rider problems, dispersed shareholders could be reluctant to sell shares. One advantage of this approach is that Θ summarises all the effects of resource diversion that are relevant for the macroeconomic analysis. Consequently, our aggregate analytical results do not require specific functional forms but hold under very general conditions. It is only when we want to know how Θ depends on features of the environment represented by specific properties of the function $c^S(S_i)$ that we need to specify it. We will do so in our numerical work in Section 6, since in that context we want to perform comparative statics and dynamics exercises on the role of micro parameters that govern the costs and benefits of the decisions of our principal and agent.

As stressed above, on the other hand, separability of the 'share of the pie' and 'size of the pie' components is important. More precisely, the following simplifications were instrumental in guaranteeing this separability: we scale costs and benefits of stealing by the net profit Π_i; we scale the empire building friction Ω by the factor $[e_{m,i}(1 - S_i) + S_i - c^S(S_i)]$; and we impose that the equity shares are chosen at foundation and then held constant throughout the life of the firm. The benefit of these restrictions is that we are able to solve in closed form the general equilibrium dynamics of the model and thus gain substantial analytical insight on the mechanism that we study. The cost is that they suppress the potential dynamic interdependence of the manager's investment decision with the stealing and the equity shares decisions. The robustness analysis in the Supplement shows that the insights carry through if we relax these restrictions.

4. General Equilibrium

We now turn to the general equilibrium of our economy. In this section we concentrate on the steady state. We study dynamics in Sections 5–6.

4.1. *Structure of the Equilibrium*

Models of this class have symmetric equilibria in which all intermediate firms charge the same price and have the same quality level at all times.[10] Specifically, they charge price $P = 1/\theta$ and receive $N \cdot PX = \theta Y$ from the final producer. We can then write $X = \theta^2 Y/N$. Next, we impose

[10] See Peretto (1996, 1999) for the formal arguments. The conditions for symmetry in this article are (*i*) that the firm-specific return to quality innovation is decreasing in Z_i (in this article's set-up this follows from $\alpha < 1$) and (*ii*) that entrants enter at the average level of quality Z. The first condition implies that if one holds constant the mass of firms and starts the model from an asymmetric distribution of firm sizes, then the model converges to a symmetric distribution. The second requirement simply ensures that entrants do not perturb such symmetric distribution.

symmetry in the production function (3) and use the previous result to eliminate X, obtaining

$$Y = \theta^{\frac{2\theta}{1-\theta}} N^{\sigma} Z L. \tag{21}$$

The reduced-form representation of the production function shows that both firm entry and incumbents' investment in product quality influence total factor productivity. In particular, the social return to variety equals σ and the social return to quality equals 1.

The definition of profit (5), symmetry and Proposition 1 allow us to rewrite (13) and (20) as:

$$r_Z = \frac{\alpha}{1-\Omega}\left[\left(\frac{1}{\theta}-1\right)\frac{X}{Z}-\phi\right];$$

$$r_N = \frac{\Theta}{\beta}\left[\left(\frac{1}{\theta}-1\right)-\frac{\phi - I/Z}{X/Z}\right]+\frac{\dot{X}}{X}.$$

These expressions show that the returns to investment and to entry depend on quality-adjusted *firm size*, measured by the quality-adjusted volume of production, X/Z. They thus suggest that we use $x \equiv X/Z$ as our stationary state variable in the analysis of dynamics since in this model steady-state growth is driven by exponential growth in intermediate product quality. Using (21),

$$x \equiv \frac{X}{Z} = \frac{1}{P}\cdot \underbrace{\frac{\theta Y}{Z}}_{\text{market size}} \cdot \underbrace{\frac{1}{N}}_{\text{market share}} = \left(\frac{\theta}{P}\right)^{\frac{1}{1-\theta}} \frac{L}{N^{1-\sigma}}. \tag{22}$$

This expression shows the equilibrium determinants of quality-adjusted firm size and rationalises our assumption that the social return to variety satisfies $\sigma < 1$: it ensures that the market share effect in the intermediate goods market—N at the denominator of $\theta Y/NZ$—dominates over the love-of-variety effect N^{σ} in final production so that the mass of firms ends up at the denominator of the expression for quality-adjusted gross firm size. Henceforth, we call x 'firm size' for short.

With our choice of state variable, we obtain the following expressions for the returns to incumbents' investment and to firms' entry:

$$r_Z = \frac{\alpha}{1-\Omega}\left[\left(\frac{1}{\theta}-1\right)x-\phi\right]; \tag{23}$$

$$r_N = \frac{\Theta}{\beta}\left[\left(\frac{1}{\theta}-1\right)-\frac{\phi+z}{x}\right]+\frac{\dot{x}}{x}+z, \tag{24}$$

where $z \equiv \dot{Z}/Z = I/Z$ is the investment rate. These two equations show how the returns to investment and to entry depend on corporate governance frictions. Specifically, the empire building problem, Ω, increases the return to investment (23) because managers derive utility from unprofitably expanding investment. The return to entry is decreasing in the severity of the resource diversion problem $(1-\Theta)$: with no profit stealing $\Theta = 1$, with profit stealing $\Theta < 1$.

To complete this characterisation we subtract the cost of intermediate production from final output and use (22) to obtain GDP per capita as

$$\frac{G}{L} = \underbrace{\left(\frac{\theta}{P}\right)^{\frac{\theta}{1-\theta}}}_{\text{final demand (static)}} \cdot \underbrace{\left[1 - \frac{\theta}{P}\left(1 + \frac{\phi}{x}\right)\right]}_{\text{intermediate efficiency (static IRS)}} \cdot \underbrace{N^{\sigma} Z}_{\text{intermediate technology (dynamic IRS)}},$$

where G denotes GDP and $P = 1/\theta$. The first term in this expression captures the role of the pricing decision in locating firms on their demand curve, thus determining their scale of activity. The second captures the existence of static economies of scale, which imply that larger firms produce at lower average cost. The third captures the role of product variety and product quality, which evolve over time according to the behaviour dictated by the returns discussed above.

4.2. *The Steady State*

We now turn to the characterisation of the steady state. Households' saving behaviour yields

$$r = \rho + \frac{\sigma\lambda}{1-\sigma} + z.$$

Substituting this expression in the returns to investment (23) and to entry (24) we obtain:

$$z = \frac{\alpha}{1-\Omega}\left(\frac{1}{\theta} - 1\right)x - \frac{\alpha}{1-\Omega}\phi - \left(\rho + \frac{\sigma\lambda}{1-\sigma}\right); \tag{CI}$$

$$z = \left[\frac{1}{\theta} - 1 - \frac{\beta}{\Theta}\left(\rho + \frac{\sigma\lambda}{1-\sigma}\right)\right]x - \phi. \tag{EI}$$

The first curve, which we call the corporate investment (CI) locus, describes the steady-state investment rate that incumbent firms generate given the firm size that they expect to achieve in equilibrium. In an economy with a higher α, for instance, the typical firm invests, for a given level of x, at a greater rate, as it appropriates a larger fraction of the investment return. Similarly, with a fatter mark-up $1/\theta$ it pays more to invest in product improvement. Stronger managerial empire building, Ω, also causes the CI to become steeper. The second curve, which we call the entrepreneurial investment (EI) locus, describes the steady-state investment rate that equalises the return to entry and the return to investment, given the value of firm size that both entrants and incumbents expect to achieve in equilibrium. Observe that in an economy where the mark-up $1/\theta$ is higher or the return to variety σ is lower, arbitrage in the rate of returns to investment and to entry is achieved with a higher investment in product improvement. A less intense managerial resource diversion (higher Θ) also causes the EI to become steeper.

The steady state is the intersection of the CI and EI curves in the (x, z) space.[11] The formal result is as follows.

[11] Existence and stability of this steady state require the intercept condition that the EI curve starts out below the CI curve and the slope condition that the EI curve is steeper than the CI curve. Together they say that intersection exists with the EI line cutting the CI line from below. The restrictions on the parameters that guarantee this configuration are those that yield the global stability of the economy's dynamics (see the Online Appendix for more).

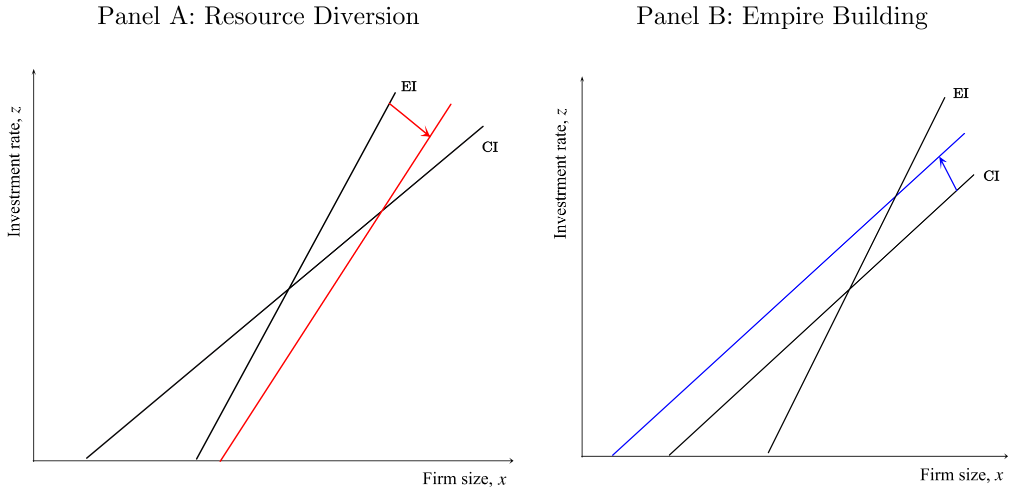

Figure 1. *Steady-State Effect of an Increase in Resource Diversion and Empire Building.*
Notes: The CI and EI loci represent the knowledge investment and entry steady-state arbitrage conditions (subsection 6.3). The EI's downward rotation in plot A indicates a worsening of the diversion issue: for a given size of the firm, x, the shareholders' returns, r, and the investment rate, z, drop. The upward shift of the CI loci in Panel B is caused by a rise in the empire-building preference Ω.

PROPOSITION 2. *(Steady State) In steady state (quality-adjusted) firm size is*

$$x^* = \frac{\left(1-\frac{\alpha}{1-\Omega}\right)\phi - \left(\rho + \frac{\sigma\lambda}{1-\sigma}\right)}{\left(1-\frac{\alpha}{1-\Omega}\right)\left(\frac{1}{\theta}-1\right) - \frac{\beta}{\Theta}\left(\rho+\frac{\sigma\lambda}{1-\sigma}\right)}.$$

The associated rates of growth of quality, variety and income (GDP) per capita are, respectively:

$$z^* = \frac{\left[\frac{\alpha}{1-\Omega}\phi + \left(\rho+\frac{\sigma\lambda}{1-\sigma}\right)\right]\frac{\beta}{\Theta} - \frac{\alpha}{1-\Omega}\left(\frac{1}{\theta}-1\right)}{\left(1-\frac{\alpha}{1-\Omega}\right)\left(\frac{1}{\theta}-1\right) - \frac{\beta}{\Theta}\left(\rho+\frac{\sigma\lambda}{1-\sigma}\right)}\left(\rho+\frac{\sigma\lambda}{1-\sigma}\right);$$

$$n^* \equiv \left(\frac{\dot{N}}{N}\right)^* = \frac{\lambda}{1-\sigma}; \tag{25}$$

$$\left(\frac{\dot{Y}}{Y}\right)^* - \lambda = \left(\frac{\dot{G}}{G}\right)^* - \lambda = \frac{\sigma\lambda}{1-\sigma} + z^*. \tag{26}$$

Proof. See the Online Appendix.

Figure 1 plots the CI locus and the EI locus and performs comparative statics exercises. For example, imagine a business environment that accommodates informational opacity in financial markets or that (perhaps unintentionally) facilitates resource diversion via lax accounting rules. These features yield a low stealing cost $c^S(S)$ and lead to intense profit stealing—that is, a low Θ. Figure 1, Panel A, shows that a drop in Θ rotates the EI locus clockwise: for given firm size, x, firms can meet the reservation rate of return of households only through a drop in the investment rate, z, that compensates the lower Θ. The intensification of stealing does not affect the CI locus, in contrast, because it equally erodes benefit and cost of investment.[12] As Panel A shows, the overall effect of the shock is greater steady-state firm size and higher investment. Put differently, the increase in the severity of stealing makes the intermediate sector more concentrated, via the fall in product variety, and prompts incumbents to invest more aggressively. Several studies that take market structure as given conclude that worse corporate governance frictions tend to depress investment.[13] This mechanism is also present in our economy and is captured by the investment drop for given firm size x. However, our general equilibrium analysis shows that conclusions become nuanced when the endogeneity of the market structure is taken into account. In equilibrium, the slowdown of firm entry and the resulting consolidation of the market structure is both the consequence of and the condition for incumbents that invest more aggressively in product improvement.

Figure 1, Panel B, considers an increase in the intensity of empire building (Ω). This pushes the CI locus up because empire building raises the manager's return to investment. Accordingly, it yields higher investment z and larger firm size x. The latter occurs because in equilibrium a more concentrated market structure is required to support firms that invest more aggressively.

Finally, it is useful to examine under what conditions corporate governance frictions have larger effects. The slope of the loci affects the magnitude of the effects. For example, it is immediate that incumbents respond with more aggressive investment to a lower Θ especially when the private return to investment in quality (α) and the markup ($1/\theta$) are higher (these imply a steeper CI locus, as noted). Intuitively, larger private investment returns and markups strengthen the impact of this corporate governance friction through the market structure consolidation.

5. Dynamics and Welfare: Analytical Results

This section briefly describes the dynamics of the model. The objective is twofold: to have an analytical guide for assessing the quantitative effects of changes in corporate governance and to articulate the channels through which such changes affect welfare. The model is so tractable that we obtain an explicit solution for the equilibrium path of the state variable x and analytical expressions for all other variables as functions of x (see the Online Appendix for the details.)

The economy evolves through three stages of development. In the most advanced stage, there is both entry and incumbents' investment in product improvement. In earlier stages, either the entry rate or the investment rate, or both, are zero. To focus the discussion on the role of corporate governance, we consider only the most advanced stage.[14] Our main result is as follows.

PROPOSITION 3. *(Dynamics and Welfare) Consider the transition path of an economy that starts at time* 0 *with initial condition* x_0 *and converges to* x^*. *Under the approximation* $\sigma\Theta/\beta x \cong 0$ *(i.e., x sufficiently large), xevolves according to the linear differential equation*

$$\dot{x} = \nu \cdot \left(x^* - x\right),$$

where

$$\nu \equiv (1-\sigma)\left[\left(1 - \frac{\alpha}{1-\Omega}\right)\left(\frac{1}{\theta} - 1\right)\frac{\Theta}{\beta} - \left(\rho + \frac{\sigma\lambda}{1-\sigma}\right)\right]. \tag{27}$$

[12] The cost of stealing does not affect the slope or position of the CI locus because managers steal net profits. Thus, a change in their stealing cost c_s changes the cost and the return from investment equally.

[13] See Stein (2003) and Driver and Coelho Guedes (2012) for reviews and, e.g., Xiao (2013) for evidence.

[14] The qualitative properties of the global dynamics are as in Peretto (2015). We refer the reader interested in the details of the global dynamics to that article.

Therefore, the explicit solution for the economy's path is

$$x(t) = x_0 e^{-\nu t} + x^* \left(1 - e^{-\nu t}\right). \tag{28}$$

Using this result, the utility flow is

$$\log\left(\frac{C}{L}\right) = \log \Lambda + \left(\frac{\sigma}{1-\sigma}\lambda + z^*\right) t + \left[\frac{\alpha}{1-\Omega}\frac{x_0}{\nu}\left(\frac{1}{\theta} - 1\right) + \frac{\sigma}{1-\sigma}\right]\left(1 - \frac{x^*}{x_0}\right)\left(1 - e^{-\nu t}\right), \tag{29}$$

where

$$\Lambda \equiv \left[1 - \theta + \frac{(\rho - \lambda)\beta\theta^2}{\Theta}\right] \theta^{\frac{2\theta}{1-\theta}}. \tag{30}$$

Upon integration, welfare is

$$U_0 = \underbrace{\frac{\log \Lambda}{\rho - \lambda}}_{\text{initial consumption}} + \underbrace{\frac{\frac{\sigma\lambda}{1-\sigma} + z^*}{(\rho - \lambda)^2}}_{\text{steady-state growth}} + \underbrace{\frac{\frac{\alpha}{1-\Omega}x_0\left(\frac{1}{\theta} - 1\right) + \frac{\sigma\nu}{1-\sigma}}{(\rho - \lambda)(\rho - \lambda + \nu)}\left(1 - \frac{x^*}{x_0}\right)}_{\text{transition}}. \tag{31}$$

Proof. See the Online Appendix.

According to Proposition 3, the welfare associated to the transition to the steady state x^* from initial condition x_0 has three components: the intercept component (or level effect) due to initial consumption, the steady-state growth component (or growth effect), and the transitional component. The expression for U_0 assigns to each of the three components its own weight reflecting discounting and the duration of the transition. The transitional component captures a key channel at work in this economy. Consider an increase in the intensity of stealing or of empire building that triggers a consolidation of the industry, so that over time it converges to larger firms that grow faster, i.e., a transition with $x^* > x_0$. While such consolidation entails an acceleration of incumbents' investment (quality growth), it also entails a slowdown of entry and thus a loss of product variety relative to the baseline path. To see it, recall the definition of firm size x, which gives us:

$$x = \frac{X}{Z} = \theta^{\frac{2}{1-\theta}} \frac{L}{N^{1-\sigma}} \Rightarrow n = \frac{\lambda}{1-\sigma} - \frac{\dot{x}}{x}.$$

Throughout the transition to the higher x^*, the rate of entry falls below its steady-state value $\lambda/(1 - \sigma)$. In other words, the model exhibits a dynamic quality/variety trade-off that manifests itself as a trade-off between firm size and firm growth on one side and the mass of firms on the other.

We can also compute analytically how a shock to a parameter that governs the intensity of profit stealing or empire building affects households' welfare, from any initial condition. Denoting the pre-shock and post-shock steady states as 0 and 1, respectively, we obtain

$$U_1 - U_0 = \frac{1}{\rho - \lambda}\left[\log\left(\frac{\Lambda_1}{\Lambda_0}\right) + \frac{z_1 - z_0}{\rho - \lambda} + \frac{\frac{\alpha}{1-\Omega}x_0\left(\frac{1}{\theta} - 1\right) + \frac{\sigma\nu_1}{1-\sigma}}{\rho - \lambda + \nu_1}\left(1 - \frac{x_1}{x_0}\right)\right], \tag{32}$$

where ν_1 is the eigenvalue in (27) associated with the new value of the parameter. The first term in square brackets captures the effect on initial consumption, the second reflects the steady-state growth change, and the third reflects the change in entry (variety growth) along the transition. In line with the discussion above, consider an increase in the intensity of profit stealing, causing a

Table 2. *Baseline Economy, Steady State.*

Panel A: Parameters								
Production and entry				*Households*		*Corporate governance*		
α	σ	θ	ϕ	β	γ	a	b	Ω
0.167	0.25	0.769	0.715	2.2	0.0121	0.9001	0.8999	0.01

Notes: α: private return to product quality; σ: social return to product variety; θ: markup parameter; φ: fixed operating cost parameter; β: fixed entry cost parameter; γ: population growth rate; a and b: stealing cost function parameters; Ω: empire building parameter.

drop in Θ. The first term is positive because initial consumption increases, i.e., $\Lambda_1 > \Lambda_0$. The second term is also positive, reflecting the acceleration of incumbents' investment. The third term is negative because firms become larger (industry consolidation), implying a slowdown of entry (product variety growth) along the transition. Consequently, the increase of profit stealing leads to a welfare loss if the transitional effect of slower firm entry is larger than the sum of the positive effect on incumbents' investment in product quality and the initial effect due to the higher consumption–output ratio. This occurs when the weight on the third term in square brackets is large relative to the weights on the first two terms. In particular, expression (32) shows that, while the first two terms have weights 1 and $1/(\rho - \lambda)$, respectively, the weight on the third term depends on several things, most prominently the private investment return, α, the mark-up $1/\theta$, x_0, and the love of variety parameter σ. The expression suggests that, following an increase in the intensity of profit stealing (resulting in a drop in Θ), economies with high α, which have large firms that invest aggressively, and with strong love-of-variety in production, high σ, are more likely to suffer. In the next section we use expression (32) to assess the welfare effects of changes in fundamentals that drive corporate governance.

6. Dynamics: Quantitative Analysis

In recent decades, reforms in both advanced and emerging countries have modified the rules governing the activity of auditors, the prerogatives of boards of directors, the allocation of power among corporate stakeholders, the punishment of corporate frauds and the disclosure requirements in capital markets (OECD, 2012). In this section we study, through the lens of the model, the adjustment process of an economy hit by a corporate governance shock. The purpose of the exercise is to illustrate the main mechanisms of the model and relate them to the evidence of Section 1. Specifically, the growth effects of a corporate reform will be shown first for a United States-like economy, for which there is consensus on the set of technological and market structure parameters, and then for economies that differ from this on the quality of governance dimension. While the model gives prediction on several industry and macroeconomic variables, such as the average firm size, the saving rate, the interest rate and the growth rate of the gross domestic product, the illustration will focus on the response of firms' entry rate, n, and on the pace of the quality improvement, z, that captures the reaction of incumbents. The Online Appendix contains a wider range of results.

6.1. *A United States-Like Economy*

The baseline parameterisation of the United States-like economy is summarised in Table 2.A. We set $\lambda = 1.21\%$, equal to the long-run average population growth rate in the United States.

Panel B: Steady state							
Ratio	*Percentages*						
x^*	z	n	y	h	e_m	Θ	S
3.37	1.60	1.61	2	9.24	0.1	89.99	0.016

Notes: x: firm size; z: investment rate; n: entry rate; y: per capita output growth rate; h: saving rate; e_m: manager's equity share; Θ: founders' appropriation factor; S: share of profits stolen.

The social return to variety is determined through (25): $\sigma = 1 - \lambda/n$. The U.S. Census Bureau database indicates that, from 1982 to the 2008 crisis, firms' net entry rate was 2.5%, implying $\sigma = 0.5$. Over a similar period, Lee and Mukoyama (2015, p. 24) and Hathaway and Litan (2014, p. 2) report lower entry rates for the U.S. manufacturing sector, close to the rate of population growth, implying $\sigma = 0$. Hence we choose a baseline $\sigma = 0.25$, with associated $n = 1.61\%$, but also study an economy with $\sigma = 0.5$. The private return to quality, α, is 1/6. We infer this by comparing the private and social return on investments. The investment return that internalises spillover effects would be $1/\alpha$ times the private return (see (23)). In Jones and Williams (1998) the social rate of return on R&D, a proxy for investment in product quality, is in the 30–100% range. Taking the lower bound, and a 5% private rate, $\alpha = 0.05/0.3 = 1/6$ with investment spillovers, $1 - \alpha$, of 83%. While the implied spillovers magnitude might seem surprisingly large, Baumol (2002, pp.133–4) reaches a similar conclusion through two different methods for estimating uncompensated external benefits. Nevertheless, as with σ, given the elusive nature of externalities, we study also an economy with different levels of investment spillovers. The monopolistic price P is 1.3 (and hence $\theta = 0.769$)—within the range of mark-up ratios for the manufacturing sector (Christopoulou and Vermeulen, 2012). We target a growth rate of per capita output y of 2%, an interest rate of 5%, and $\rho = 3\%$. The parameters ϕ and β are set to match $y = 2\%$ and a long-run saving rate ($h = 1 - C/G$) of about 10%.[15] The resulting investment rate $z = y - \sigma n = 1.60\%$ (see (25) and (26))—coincidentally close to the net entry rate. To choose a value for the empire building parameter Ω we employ the estimates of Nikolov and Whited (2014). For a sample of 1,438 U.S. firms over the period 1992–2008 they find an empire building distortion of 0.7% gross profits ($\Pi + I$ in our model) and an average investment rate of 12% (see their Tables VI.b and II, respectively).[16] Since in our model the steady state firm's value is Π/r, with $r = 5\%$, the distortion ΩI corresponds to $0.7\% \cdot (5I/12 + I)$, and $\Omega \simeq 1\%$. For the effort cost of resource diversion we employ a simple quadratic function:

$$c(S) = \frac{1}{2}aS^2 + bS. \tag{33}$$

Following Equation (15), the manager's reaction function satisfies

$$1 - e_m = aS + b. \tag{34}$$

The founder's marginal benefit and cost of giving away a higher share of profits to the manager (see (18)) is

$$\frac{1}{a}(1 - e_m) = 1 - S. \tag{35}$$

[15] According to data from the Bureau of Economic Analysis the gross national saving rate in the post-war period fluctuated between 15% and 20%. Allowing for a depreciation rate of 510%, we obtain a net saving rate, as a ratio of GDP, in the interval of 515%. Our calibration delivers a saving rate in the middle of this interval.

[16] A similar investment rate is reported by OECD (2013).

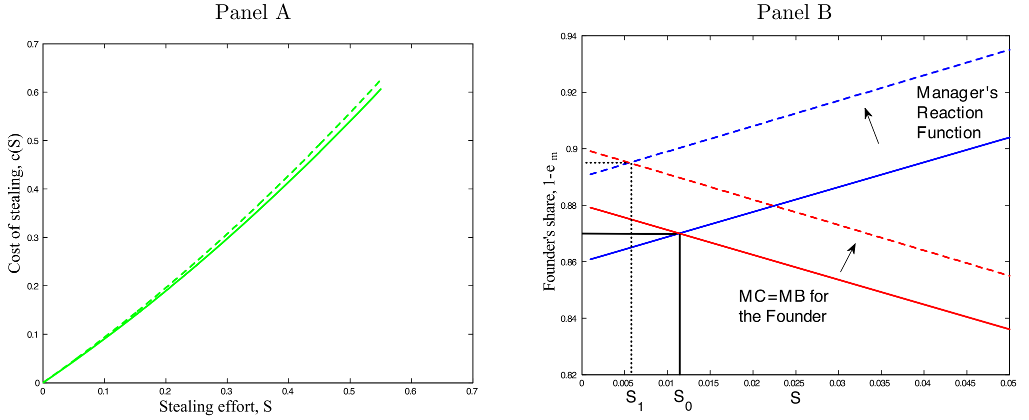

Figure 2. *Governance Reform.*
Notes: Authors' elaboration based on Equations (30)–(31).

An improvement in corporate governance, captured by an increase in the parameters a and b, causes a rotation of the $c(S)$ (see Figure 2.A), an upward shift of the manager's reaction function (34) and of the founder's decision rule (35)—see Figure 2.B. As a result the share of profits retained by the founder $(1 - e_m)$ increases, and the stealing effort declines, as long as the parameter b is sufficiently large to induce a significant shift of the manager's reaction function. (subsection 6.3 elaborates on the ramifications of such a governance shock on investments and on firms' entry).

The values of a and b are determined by targeting S and e_m. Nikolov and Whited (2014) estimate a 0.01% diversion of profits and cash holdings. Adjusting for 10% of cash and taking a profit rate of 17% (see their Tables II and III), $S = 0.016\%$. While this appears to be a low value, Figure 2.B suggests that to achieve it founders may need to give up a significant share of profits. Leslie and Oyer (2009) and Muscarella and Vetsuypens (1990) estimate equity stakes of managers of 3.6% and 12.7%, respectively. Kaplan (1989) and Morck *et al.* (1988) show estimates closer to the higher value. We set $e_m = 10\%$.

6.2. *Steady-State Interpretation of the Cross-Country Data*

The empirical evidence of Section 1 suggests that in countries with a higher governance index there is stronger entry dynamics, but their incumbent firms appear to be more reluctant to make investments in intangibles. Figure 3 provides a first quantitative link between this evidence and the predictions of the model. The figure shows the steady-state investment rate and firm size against the range of governance quality—the variation is generated through alterations of a and b in (33) in the [0, 1] interval, moved in lock-step to preserve the same gap of the U.S. specification. When the cost of diverting resources rises, shareholders can retain a larger share of firms' value because they surrender a smaller share to managers, and possibly because of the diminished stealing effort (Figure 2.B). A diversion-free economy emerges with $a = b = 1$, as these values imply $S = e_m = 0$ and $\Theta = 1$. The range of equilibria can be read as being generated through downward shifts of the EI curve in Figure 1.A: when diversion is easier, the return on entry declines, incumbents become larger and invest more aggressively. Figure 3 gives a quantitative

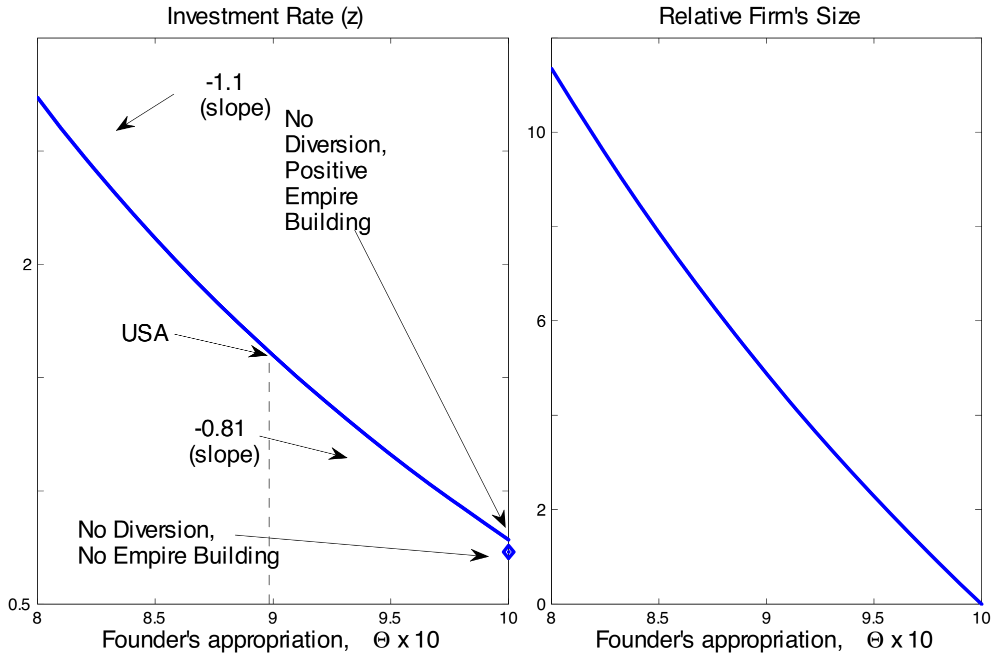

Figure 3. *Quality of Corporate Governance and Rate of Investment.*
Notes: Θ is the founder's appropriation factor. The relative firm's size is a percentage deviation from the smallest one (when $\Theta = 1$). Rates are in percentages.

steady-state assessment of these associations. A country with a one point higher governance index comes with about 1% lower investment rate for economies similar to the United States; the effect is slightly stronger for economies with higher diversion (lower Θ)—observe that, to ease the comparison with the 10-point World Bank governance index, the running variable is $\Theta \times 10$. Such a correlation is somewhat high compared with the coefficient on the governance index in the intangible investment regressions of Table 1 (e.g., -0.85 in the cross-country one). However, the prediction assumes that economies are in steady state where the investment response to diversion is the strongest. Along the transition the investment rate is more modest (see the Online Appendix). Therefore, economies further away from the stationary state have investment rates lower than those shown in Figure 3.

6.3. *Response to Reforms*

This section explores the consequences of a corporate governance reform through a permanent shock to managers' ability to divert resources or to managers' private benefits of empire building. Agents do not anticipate the arrival of the shock, and they perceive it as permanent. Section 5 noted that any governance shock affects the two sources of growth, entry and incumbents' investment, in opposite directions: it boosts one and depresses the other. This section clarifies the relative importance of the two effects for a United States-like economy and for economies with different levels of variety and investment spillovers.

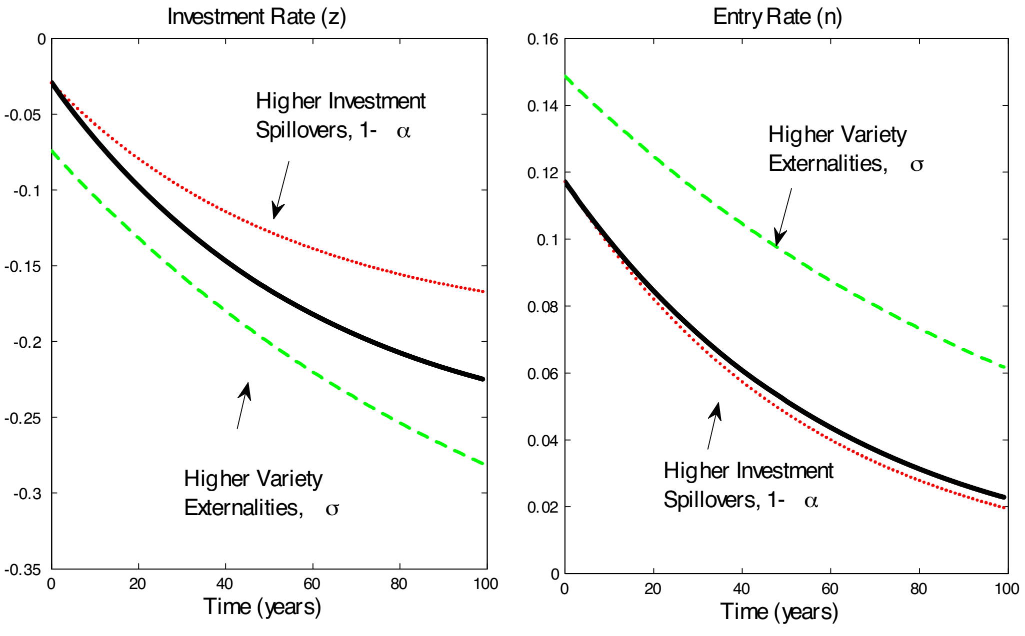

Figure 4. *Impulse Responses to Stealing Cost Shock.*
Notes: Rates are in percentages. A shock to $c(s)$ in Equation (29) leads to a decline of Θ and e_m by 3 percentage points (for the initial state of the economy see Table 2.B). In the baseline case (bold lines) the entry rate jumps up by about 0.12% after the reform. The dashed and dotted lines refer, respectively, to economies with a higher σ (0.5) and lower α (0.13).

Section 1 suggested that governance reforms enacted in OECD countries in 2006–12 increased the World Bank corporate governance 10-point index by approximately 0.3, on average. The reform is then represented by an alteration of the diversion cost function $c^S(S)$ so as to cause a rise of the equilibrium level of Θ by 0.03 (see Figure 2). Managers' equity stake e_m goes from 10% to 7%; the equilibrium level of stealing S is only marginally affected. The reform lifts the entry rate upward. The increased number of firms, however, means smaller market size and a reduced profitability of quality improvement. As a result, the investment rate, z, drops (see Figure 4). The 0.12% jump of the entry rate right after the shock is about twice as much that suggested by the panel regression in column 2 of Table 1 (0.06%) and about half that of the cross-sectional regression in column 1 (0.2%).

Because the estimation of investment spillovers, $1 - \alpha$, and of the social return to variety, σ, is notoriously an elusive exercise, we replicated the numerical experiment with stronger externalities. With a higher $1 - \alpha$ the firm's appropriation of its own investment is smaller. Therefore, the amplitude of the impulse responses is more modest (see Figure 4)—in Figure 2 a shift of the EI curve has a smaller impact than in the baseline case. Conversely, the investment and entry responses to the shock are amplified in an economy with stronger variety externalities—the expected profitability of entry is relatively higher, for a given number of firms. Table 3 summarises the long-run effects of the three experiments on the key industry and macro variables. It also reports the welfare effects divided according to the three components in Equation (29): a long-run component, which is negative due to the drop in investment, a transition component, which

Table 3. *Corporate Governance Reform (Higher Stealing Costs).*

Panel A								
	Ratio				*Percentages*			
	x	z	n	r	h	e_m	Θ	S
Before the reform	3.37	1.60	1.61	5	9.24	0.1	89.99	0.016
After the reform	3.32	1.33	1.61	4.73	8.89	0.07	92.99	0.016

Notes: For the meaning of the symbols, see note to Table 2. r: interest rate.

Panel B					
	Δ *Steady state* (*percentages*)			Δ *Welfare* (*percentages*)	
	x	z	Level	Trans.	Long Run
Baseline	−1.6	0.27	−0.18	2.34	−8.46
$\alpha = 0.13$	−4.93	−0.19	−0.18	1.66	−6.06
$\sigma = 0.5$	−5.92	−0.30	−0.18	5.56	−13.20

Notes: The reform causes em to decline by 3 percentage points. Panel A reports the steady-state values before and after the reform. Panel B reports steady-state differences relative to the pre-shock values. The changes of z are expressed in percentage points. The remaining figures are proportional percentage deviations. Welfare calculations are based on equation (28). The last two rows of Panel B refer to economies with stronger externalities.

is positive because greater entry leads to a larger variety of intermediate goods, and a level component, which is negative, because running firms absorbs resources that otherwise could have been consumed.[17] Interestingly, Table 3 shows that in the baseline parameterisation the welfare benefit is clearly dominated by the welfare costs so that overall the governance reform leads to a net welfare reduction.

If a permanent increase in the stealing cost causes an upward shift of the EI curve, a permanent decline of the empire building parameter Ω induces a downward shift of the CI curve (see Figure 1). The implications of the two shocks are qualitatively similar (to conserve space, the impulse response for the empire building shock are not shown). In the long run, the economy ends up with smaller firms that invest less aggressively. In the short run, the effects are also comparable: the reduction in Ω leads to a jump in the entry rate and a drop in the investment rate. The main difference with respect to the diversion experiment is that investment responds more—the shock has a direct effect on the manager's incentive to invest. Thus if the policy objective of a corporate governance reform is to stimulate firm entry, the intervention should target first managerial resource diversion, as this has a lower negative impact on incumbents' investment in product improvement.

7. Conclusion

This article has investigated the impact of corporate governance frictions on growth in an economy with endogenous market structure. The analysis reveals that managers' empire building and resource diversion tend to depress firm entry and increase the concentration of the market structure. At the same time, these frictions make incumbents invest more aggressively in product

[17] Any change in real resource losses directly due to the change in stealing costs shows up in the level component. Such direct welfare effects play a minor role.

improvement, despite having an ambiguous impact on the investment return for a given degree of consolidation of the market structure. The welfare impact of a corporate governance reform is not obvious a priori. Following a reduction of corporate resource diversion or of empire building, the acceleration in firm entry can boost welfare. Yet, the less aggressive investment of incumbents induced by the acceleration of entry and by the resulting adjustment of the market structure can lead to a welfare reduction. We have studied how the quality of corporate governance before the reform and technological features of the economy affect the magnitude and relative importance of the entry and investment effects. Interestingly, our quantitative analysis reveals that, for the baseline parameterisation, an improvement in corporate governance leads to a net welfare reduction.

The article leaves interesting questions for future research. Since in the model firms enter at the average size, the analysis downplays differences between start-ups and mature firms. This not only preserves tractability but is also consistent with our goals. The governance frictions we consider are a more typical feature of relatively established firms, where management is often separated from ownership. Moreover, as noted, the analysis can help capture the experience of established businesses that have frequently been protected by policies accommodating empire building and informational opacity. Nonetheless, an integrated approach that differentiates between start-ups and more mature firms, allowing for different start-up and post-entry governance frictions, would probably give a more accurate quantitative assessment of the importance of such frictions. This could also change the welfare predictions about corporate governance reforms. We leave this and other issues to future research.

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Additional Supporting Information may be found in the online version of this article:
Online Appendix.

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