

Should Business Groups be Dismantled? The Equilibrium Costs of Efficient Internal Capital Markets*

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Abstract

We analyze the relationship between conglomerates' internal capital markets and the efficiency of economy-wide capital allocation, and identify a novel cost of conglomeration that arises from an equilibrium framework. Because of financial market imperfections engendered by imperfect investor protection, conglomerates that engage in "winner-picking" (Stein, 1997) find it optimal to allocate scarce capital internally to mediocre projects, even when other firms in the economy have higher productivity projects that are in need of additional capital. This bias for internal capital allocation can decrease allocative efficiency even when conglomerates have efficient internal capital markets, because a substantial presence of conglomerates might make it harder for other firms in the economy to raise capital. We also argue that the negative externality associated with conglomeration is particularly costly for countries that are at intermediary levels of financial development. In such countries, a high degree of conglomeration, generated for example by the control of the corporate sector by family business groups, may decrease the efficiency of the capital market. Our theory generates novel empirical predictions that cannot be derived in models that ignore the equilibrium effects of conglomerates. These predictions are consistent with anecdotal evidence that the presence of business groups in developing countries inhibits the growth of new independent firms due to lack of finance.

Key words: capital allocation, conglomerates, investor protection, internal capital markets.

JEL classification: G15, G31, D92.

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1 Introduction

During the 1990s business groups in developing countries, and specially in East Asia, have been under pressure to restructure. Although widely regarded as the engine of economic growth in earlier decades, business groups are now blamed by politicians and commentators for the economic problems (slow growth, financial crises, etc.) affecting some regions of the world. Those against the busting up of business groups contend that these organizations substitute for missing markets (Khanna and Palepu, 1997, 1999). For example, the presence of business groups may improve economic efficiency because their internal capital markets allocate capital among member firms more efficiently than the underdeveloped external capital market does (Hoshi, Kashyap, and Scharfstein, 1991; Khanna and Palepu, 1997; Stein, 1997; Perotti and Gelfer, 2001). In contrast, those in favor of dismantling business groups argue, among other things, that business groups inhibit the growth of small independent firms by depriving these firms of finance.¹

Existing models of internal capital markets consider conglomerates in isolation, abstracting from the effects that conglomeration might have on other firms in the economy (see Stein, 2003, for a survey of the literature on internal capital markets).² However, the argument that conglomeration makes it harder for small independent firms to raise financing is directly suggestive of such externalities. Is it reasonable to expect that a high level of conglomeration hampers the allocative efficiency of external capital market? If this conjecture were true, it would give rise to important welfare and policy implications. For instance, even if conglomerates' internal capital markets were efficient (in the sense that conglomerates allocate capital to divisions with the highest growth opportunities), one could not infer that the presence of conglomerates should be encouraged because the benefits of efficient internal capital markets could be outweighed by the negative externalities that conglomerates impose on other firms in the economy. To address these questions, an equilibrium model that considers both internal and external capital markets, and the interactions between them is needed. We present such a framework in this paper.

¹See, for example, the article "Small business living with the crumbs" in the *The Financial Times* of April 23, 1998, for an account of the difficulties that independent firms faced in obtaining finance before the reform of the Korean chaebols.

²We use the term conglomerate and business group interchangeably. Although these organizations are different in many respects (for instance a business group is formed by legally independent firms while a conglomerate is typically a single firm with multiple divisions) they both have internal markets that allocate capital among the member firms in the case of business groups (Samphantharak, 2003) and among divisions in the case of conglomerates (Lamont, 1997).

In our model, capital allocation is constrained by the extent of legal protection of outside investors against expropriation by the manager or ‘insiders’ (La Porta et al. 1997, 1998). When investor protection is low, there is a limit to the fraction of cash flows that entrepreneurs can credibly commit to outside investors (*limited pledgeability* of cash flows). Because of this friction, the economy has a limited ability to direct capital to its best users: high productivity projects might not be able to pledge a sufficiently high return to attract capital from lower productivity projects.

In this set up, a conglomerate that reallocates capital efficiently (Stein, 1997) allocates the capital of a worthless project to its best unit, even if this unit is of mediocre productivity. A conglomerate prefers this internal reallocation even when there are higher productivity projects in the economy in need of capital, because, due to limited pledgeability, the high productivity projects cannot properly compensate the conglomerate for its capital. In contrast, a stand-alone firm with a worthless project has no internal reallocation options, and thus finds it optimal to supply the project’s capital to the external market. This difference in the reallocation decisions of conglomerates and stand-alones means that a high degree of conglomeration in a country’s corporate sector is associated with a smaller supply of capital to the external market and might, under some conditions, decrease the efficiency of aggregate investment.

The model also suggests specific conditions under which conglomerate’s internal capital markets increase allocative distortions. For very low levels of investor protection conglomerates actually improve allocative efficiency because the external market works so poorly that high productivity firms cannot raise additional capital irrespective of the amount of capital supplied. Because released capital cannot find its way to high productivity projects, the reallocation of conglomerates to mediocre units is better than no reallocation at all. For very high levels of investor protection, the conglomerates’ internal reallocation bias disappears because high productivity projects can offer a sufficiently high return to attract capital from the conglomerate. In this case, the external market works so well that the allocation of capital becomes independent of the degree of conglomeration. The negative effect of conglomeration on the external capital market is most pronounced for intermediate levels of investor protection. In such circumstances, the legal and contracting environment is good enough to make it *possible* for the external capital market to work well. However, the external market’s residual underdevelopment makes it fragile to the negative externality engendered

by conglomeration. In other words, for intermediary levels of investor protection the probability that high productivity firms can raise additional capital is very sensitive to capital supply, and thus to the degree of conglomeration. In these cases, the efficiency of capital allocation decreases with conglomeration.

Our theory thus predicts that, in some circumstances, an exogenous decrease in conglomeration can improve the efficiency of capital allocation by increasing the availability of finance to high productivity projects. This prediction is consistent with anecdotal evidence from South Korea. The financing constraints that new independent firms faced in the 1990's were partly attributed to the presence of the chaebols.³ It also appears that following the reform of the chaebols, more funds have become available to independent firms.⁴ Korea is probably at the intermediate stage of institutional development in which the equilibrium effects of internal capital markets are high. It is possible that while chaebols played an important role in earlier stages of development of the Korean capital market, more recently they have become a burden as market institutions evolved over time.

Clearly, the degree of conglomeration is not completely exogenous since individual entrepreneurs have the choice whether to set up conglomerates or stand-alone firms. Nevertheless, there is evidence that, in many countries, corporate grouping affiliation is determined to a large extent by history and political pressure (see references in section 4). Thus, we believe that it is meaningful to model exogenous variations in conglomeration.

Nevertheless, we extend the model to allow entrepreneurs to choose whether to set up conglomerates or stand-alone firms. As we explained above, when conglomeration is high, the external market works poorly (due to the negative effect of conglomerates on the supply of capital). A poorly developed capital market raises the entrepreneur's incentive to conglomerate because conglomerates need to rely less on the external capital market than stand-alone firms. Thus, when an entrepreneur expects others to conglomerate, he is more likely do to so as well. This positive feedback effect generates multiple equilibrium levels of conglomeration. Finally, we show that social welfare can be higher in the low conglomeration equilibrium. Thus, countries might get stuck in an equilibrium with excessive conglomeration, and yet individual conglomerates will have no incentives

³See reference in footnote 1.

⁴See for example The Economist, April 17 2003, "Unfinished business".

to break up.

Our results contribute to the literature on whether internal capital markets are efficient (Gertner, Scharfstein and Stein, 1994; Stein, 1997) or not (Shin and Stulz, 1998; Rajan, Servaes and Zingales, 2000; Scharfstein and Stein 2000). We are not the first to point out that conglomerates may have a negative effect on the allocation of capital. Other models also have the implication that, as the financing-related benefits of conglomeration decrease, costs of conglomeration such as less effective monitoring (Stein, 1997), coordination costs (Fluck and Lynch, 1999), free cash-flow (Matsusaka and Nanda, 2002 and Inderst and Mueller, 2003) and incentive problems (Gautier and Heider, 2003) make conglomerates less desirable. However, the literature has focused on conglomerates in isolation and thus has not generated equilibrium implications.⁵ Our paper, by focusing on the interactions between conglomerates' internal capital markets and the efficiency of the external capital market, generates a new theoretical insight as well as novel empirical implications and policy recommendations.

In terms of the theoretical insight, we add to the literature by identifying a novel, equilibrium cost of conglomeration that stems from the negative externality that conglomerates impose on a country's external capital market. This cost implies that conglomerates can be *simultaneously* detrimental to equilibrium capital allocation, and efficient at allocating capital internally.

In addition, our model generates new testable hypotheses and policy recommendations. For example, we predict that a high degree of conglomeration in a country's corporate sector might increase financing constraints for independent firms that lie outside the conglomerate. We also provide reasons for why the dismantling of conglomerates might need to involve government intervention (see section 7 for a complete list and a discussion of empirical implications and policy recommendations). These implications cannot be generated by models that consider conglomerates in isolation.

Our paper is also related to a recent literature that examines the equilibrium implications of private capital allocation decisions in economies characterized by limited investor protection (Shleifer and Wolfenzon, 2002; Almeida and Wolfenzon 2005; Castro, Clementi, and MacDonald, 2004) and to an earlier literature that analyzes the relationship between general financing frictions

⁵ Maksimovic and Phillips (2001, 2002) are an exception: they analyze allocation decisions by conglomerates in an equilibrium context, but with no role for financial imperfections.

and capital allocation (Levine, 1991; Bencivenga, Smith, and Starr, 1995). However, this literature has not considered the equilibrium effects of conglomerates' internal capital markets, which is the main focus of this paper.⁶

We start in the next section by presenting a very simple example that illustrates the main effect that drives the novel results of our paper. In section 3 we describe our full model, and in section 4 we analyze the effect of an exogenous change in conglomeration on the efficiency of capital allocation. The main result of the paper is stated and explained in section 4.4. This result is derived under the assumption that conglomerates and stand-alones are initially formed with no external finance, but section 5 relaxes this assumption and shows that the result is robust to the introduction of external finance at the formation date. In section 6, we extend the model to analyze the implications of endogenizing conglomeration. We discuss the empirical and policy implications of the model in section 7, and present our final remarks in section 8. All proofs are in the Appendix.

2 A simple example

In this section we present a simple example that illustrates the intuition behind the main results of the full fledged model. To make this example as transparent as possible, we make a number of assumptions that we then relax in the model of section 3.

Consider an economy with three investment projects, each with a different productivity. An investment of one unit of capital produces a payoff of 5 units if invested in project H (high productivity project), 3 units if invested in project M (medium productivity) and 1 unit if invested in project L (low productivity). There is only one unit of capital to be allocated and this unit happens to be invested in project L .

The main friction in this economy is that cash flows cannot be fully pledgeable to outside investors (we discuss this assumption in Section 3.4). We denote by λ the maximum fraction of the profits that can be credibly pledged to outsiders and by $1 - \lambda$ the fraction that the entrepreneur seeking finance gets to keep (we can think of the fraction $1 - \lambda$ of the profits as the private benefits of control).⁷ This limited pledgeability assumption might limit capital reallocation across

⁶This is also the main contribution of our paper to a recent literature that analyzes efficiency and business-cycle properties of capital reallocation (Eisfeldt and Rampini, 2003, 2004).

⁷This interpretation suggests an empirical proxy for λ , namely the degree of investor protection in a country. There is a large empirical literature providing evidence that private benefits of control are larger in poor investor protection countries (Nenova, 1999, and Dyck and Zingales, 2004).

firms because a firm supplying capital cannot be promised the full return generated by the firm seeking finance. As a result, even when the firm seeking capital generates a higher return than the (potential) supplier of the capital, the maximum return that can be pledged might be lower than the return the supplier can generate itself. In this case, some socially efficient reallocations do not take place.

This problem is not present for reallocation of capital among the projects inside a conglomerate because the owner-manager keeps the private benefits generated by all of them (this is the same assumption as in Stein, 1997). For this reason, the conglomerate reallocates capital to the highest productivity projects. In a sense, we can say that pledgeability inside a conglomerate is perfect, or that $\lambda = 1$ for capital reallocations inside the conglomerate.

To illustrate the impact of these pledgeability assumptions on allocative efficiency, we characterize the equilibrium allocation of the unit of capital for two different economies. In the first economy, the three projects are stand-alone firms. In the second economy, projects L and M are part of a two-project conglomerate, while project H is a stand-alone firm. As a benchmark, note that the efficient reallocation of capital in both situations is from project L to H , generating a total payoff of 5.

When there are no conglomerates, all capital reallocations must occur through the external capital market. Firm L can keep the unit of capital and produce an output of 1. Alternatively, it can supply this unit to any of the other two firms. Due to limited pledgeability, the maximum firm M can pay is 3λ , and the maximum firm H can pay is 5λ . Therefore, conditional on the decision to provide the capital to the market, the stand-alone firm L allocates this capital to project H for a total economy payoff of 5. However, when pledgeability is low (in particular when $\lambda < \frac{1}{5}$) firm L prefers to keep the capital rather than to supply it to the market.

In the second economy, project L (with its unit of capital) is in the conglomerate. The conglomerate can leave the capital in project L and generate 1 or it can choose to reallocate this unit of capital. By allocating internally to project M , the conglomerate achieves a payoff of 3, whereas by allocating to project H through the external capital market, it can achieve a payoff of 5λ . Thus the conglomerate always reallocates (since $\max\{3, 5\lambda\} > 1$) but, when $\lambda < \frac{3}{5}$, it reallocates internally to project M instead of externally to project H .

It is now easy to see how conglomerates' (efficient) internal capital markets can distort the

equilibrium allocation of capital. If $\frac{1}{5} \leq \lambda < \frac{3}{5}$, the economy achieves a total payoff of 5 if there are no conglomerates, but it achieves a payoff of 3 when there is a conglomerate present. Notice that the inefficiency comes about *precisely* because the conglomerate is performing a privately efficient reallocation of capital. This inefficiency is the novel (equilibrium) cost of internal capital markets that we identify in the paper.

This simple example also shows that the effect of internal capital markets on the equilibrium allocation depends non-monotonically on the pledgeability parameter λ . If pledgeability is very low ($\lambda < \frac{1}{5}$), the conglomerate's internal capital reallocation is socially useful because it increases the total payoff from 1 to 3. This is a situation in which the external capital market is very poorly developed. The social cost of conglomeration appears at intermediate levels of pledgeability ($\frac{1}{5} \leq \lambda < \frac{3}{5}$). For these intermediate levels the external capital market has the potential to work well, but it is sensitive to the presence of conglomerates. The economy would benefit if the conglomerate were dismantled. Finally, for higher levels of pledgeability ($\lambda \geq \frac{3}{5}$), the conglomerates' internal reallocation bias disappears since the high productivity project can offer a high return for the unit of capital. In this case, the economy can achieve the efficient allocation of capital irrespective of the level of conglomeration.

A useful way of understanding this result is as follows. A stand-alone firm faces the same pledgeability problem for all firms in the economy. As a result, conditional on liquidating a project, the stand-alone firm ranks all projects in the socially optimal way (recall the stand-alone firm compares 3λ to 5λ). However, the conglomerate faces pledgeability problems only for firms outside the conglomerate (recall the conglomerate compares 3 to 5λ). Thus, a conglomerate has a bias towards internal reallocation. This capital allocation distortion is the cost of conglomeration. The benefit of conglomeration is that, because of capital market imperfections, conglomerates reallocate capital more frequently than stand-alone firms. In sum, conglomerates reallocate capital more frequently but these allocations are not always the socially optimal ones.

As we show in the next few sections, this simple example delivers the same result as our full model. However, this example is artificial in several important dimensions. First, it assumes an extreme scarcity of capital (only one unit needs to be allocated to three competing investment projects). Second, it assumes a particular location for the unit of capital (in the low productivity project) and a particular distribution of productivities in the conglomerate and stand-alone firm

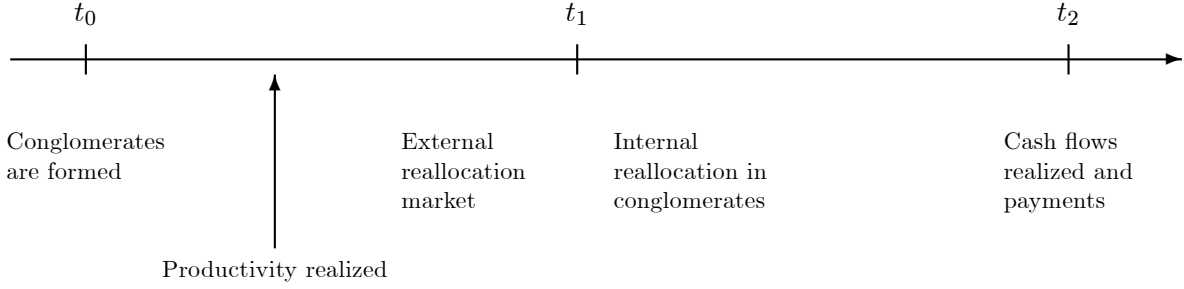


Figure 1: Timing of events

(the high productivity project lies outside the conglomerate). Third, the (re)allocation of capital in the external market is not explicitly modeled. Fourth, the initial formation of the conglomerates is ignored, and the variation in the level of conglomeration is assumed to be exogenous. We tackle these issues in the general model that starts in the next section.

3 The model

In this section we develop our full theoretical framework to analyze the effect of conglomeration on the equilibrium allocation of capital.

The timing of events in the model is shown in Figure 1. There are three dates. At date t_0 , there is a set J (with measure one) of projects that can be undertaken. There is also a set of entrepreneurs who can set up projects as stand-alone firms or as conglomerates. The productivity of projects is not known at date t_0 when conglomerates and stand-alones are formed, however, it becomes public knowledge before date t_1 . In light of the new information, capital can be reallocated among projects at date t_1 . Reallocation can occur in the external capital market or, when projects are in a conglomerate, it can occur in the inter capital market. We assume that, in addition to the entrepreneurs, there is a group of investors with an aggregate amount of capital $K > 1$.⁸ We also assume that $K < \infty$, that is, there is an aggregate capital constraint.⁹ Finally, cash flows are realized at date t_2 .

⁸This capital is in excess of what is needed to fund every project in the economy with two units (the maximum that we will allow in the model, as explained below). Thus, unlike in the simple example of Section 2, there is excess capital in this economy.

⁹The necessary condition for our results to hold is that the aggregate capital supply is small enough, such that conglomerates' internal capital markets can have a first order effect on the equilibrium rate of return. See section 7 for a discussion of this condition.

3.1 Conglomerate formation

At date t_0 , some entrepreneurs form conglomerates, while others form stand-alones. We restrict attention to two-project conglomerates, but the results of the model hold for conglomerates of any finite number of projects.¹⁰ If an entrepreneur sets up a conglomerate, he will control and manage two projects simultaneously. We assume for now that the number of entrepreneurs who decide to form conglomerates at date t_0 is exogenously given. The formation of the conglomerates is analyzed in more detail in section 6.

After entrepreneurs make their conglomeration decisions, the boundaries of the firms in the economy can be described by a partition \mathcal{E} of J , where each element $F \in \mathcal{E}$ is a firm (stand-alone or conglomerate). For example, if project $i \in J$ ends up as a stand-alone firm, then $\{i\} \in \mathcal{E}$, and if projects $j, k \in J$ form a conglomerate then $\{j, k\} \in \mathcal{E}$. We let c be the fraction of the projects that end up in conglomerates. Thus, there are $c/2$ conglomerates and $1 - c$ stand-alone firms. We refer to c as the degree of conglomeration in the economy.

3.2 Projects and the general technology

Projects are of infinitesimal size and, at date t_0 , require the investment of one unit of capital. Consequently, a stand-alone firm requires the investment of one unit of capital, while a conglomerate requires two units. In this section we assume that the required initial investment is financed entirely with the entrepreneurs' wealth, that is, firms carry no external finance claims into date t_1 . This assumption is relaxed in section 5.

At date t_1 , a project can be liquidated, in which case the entire unit of capital is recovered. If a project is not liquidated, it can receive additional capital or can be continued with no change until date t_2 . At date t_2 , projects generate cash flows.¹¹

Projects can have one of three different productivity levels denoted by L (low), M (medium), and H (high). The probability that a project is of productivity L , M , and H is p_L , p_M , and p_H (with $p_H + p_M + p_L = 1$), respectively. The probability distribution is independent across projects

¹⁰Consider our simple example in section 2. If all three firms are inside the same conglomerate, capital is always allocated efficiently irrespective of the location of the high productivity project. Notice, however, that for this result to hold it is crucial that all capital is invested in a *single* conglomerate.

¹¹Because liquidation is costless and there is excess capital, all projects (which are identical ex-ante) will "enter" date t_1 with one unit of capital invested. This assumption makes the model more symmetric than the simple example of section 2, in which we assumed that only a particular project had capital invested in it.

so that, at date t_1 , exactly a fraction p_L , p_M and p_H of the projects are of type L , M and H , respectively.¹² After the productivity of the projects is realized, there are three different types of stand-alone firms (the L , M , and H stand-alone firms) and six different types of conglomerates (the LL , LM , LH , MM , MH , and HH conglomerates). We let $t(j) \in \{L, M, H\}$ be the realized productivity of project j .

For simplicity, we assume drastic decreasing returns to scale. Depending on its type, a project generates cash flow Y_H , Y_M or Y_L (with $Y_H > Y_M > Y_L \equiv 0$) *per unit* invested, but only for the *first two units* (i.e., the initial unit with which the project is started at date t_0 and the unit that is potentially invested at date t_1). Additional units invested generate no cash flow.

At date t_1 there is a second technology ('general technology') available to all agents in the economy. We define $x(\omega)$ as the *per-unit* pay off of the general technology with ω being the aggregate amount of capital invested in it.

Assumption 1 *The general technology satisfies:*

- a. $\frac{\partial[\omega x(\omega)]}{\partial \omega} \geq 0$
- b. $x'(\omega) \leq 0$

We assume that total output is increasing in the amount invested in the general technology (assumption 1(a)) but that the per-unit payoff is decreasing (assumption 1(b)). To rank the productivity of the projects and the general technology, we assume that:

Assumption 2 $Y_M > x(0)$

The most productive technologies are good projects, followed by medium projects. By assumption 2, medium projects are more productive than the general technology regardless of the amount invested in the latter (since $x(0) > x(\omega)$ by assumption 1(b)). Finally, the bad projects are the least productive.

3.3 External capital markets

At date t_1 , some firms decide to supply their capital to the market, other firms choose to seek capital in the market and others opt out of the market completely. We let S be the set of *projects* –not firms– that are liquidated and whose capital is supplied to the external market. For example,

¹²Notice that any individual project has the same probability of turning out to be L , M , or H , irrespective of whether it lies in a conglomerate or not (unlike in the simple example of section 2).

if the stand-alone firm $\{i\}$ decides to liquidate and supply its capital to the market then $i \in S$. Similarly, if the conglomerate $\{j, k\}$ decides to supply the capital of unit j to the market then $j \in S$. The total supply of capital to the market is then $K + \int_{\{i \in S\}} di$, where K is the amount of capital in the hands of other investors.

The rest of the projects are continued until date t_2 . Some firms with continuing projects benefit from raising capital in the market at the prevailing market rate. These firms seek external finance. We let C be the set of *projects* that form these firms. For example, if conglomerate $\{j, k\}$ seeks two units of capital (one for each project) then $j, k \in C$. Because all projects start date t_0 with one unit and the maximum investment is two units, firms seek one unit of capital per project.

Finally, some conglomerates with continuing projects prefer to allocate capital internally and neither supply nor demand capital from the external market. We let O be the set of projects that form these conglomerates.

The actions that take place in the external capital market are as follows. First, firms that seek finance announce one contract for each unit of capital they desire to raise. It will be convenient to label the contracts by the project that ultimately receives the capital rather than by the firm that announces it. For example, we refer to the contract that the stand-alone firm $F = \{i\}$ announces as P^i . Similarly, a conglomerate $G = \{j, k\}$ seeking two units of capital announces two contracts P^j and P^k .

After firms and conglomerates announce contracts, date- t_1 investors (investors, and projects in set S) allocate their capital to these contracts and to the general technology so as to maximize the value of their investment. Investors can take any of the contracts offered by any of the firms. An allocation in the capital market can be described by r^i , the probability that an investor takes contract P^i , and ω^* , the amount allocated to the general technology.¹³

3.4 Limited pledgeability

The allocation of capital in external markets will be affected by an imperfection at the firm level: firms and conglomerates cannot pledge to outside investors the entire cash flow generated. In

¹³We characterize the allocation rule by the *probability* that a contract is taken because we allow investors to randomize among projects. Of course, after the uncertainty about this randomization is resolved, projects either get capital or they don't. However, we specify the allocation rule by the ex-ante probability of getting capital (rather than the ex-post actual allocation) because this is what matters to firms offering contracts.

particular, we assume that only a fraction λ of the returns of the *second unit* invested is pledgeable.¹⁴

The limited pledgeability assumption can be justified as being a consequence of poor investor protection, as shown in Shleifer and Wolfenzon (2002). In their model, insiders can expropriate outside investors, but expropriation has costs that limit the optimal amount of expropriation that the insider undertakes. Higher levels of protection of outside investors (i.e., higher costs of expropriation) lead to lower expropriation and consequently higher pledgeability.

Limited pledgeability also arises in other contracting frameworks. For example, it is a consequence of the inalienability of human capital (Hart and Moore, 1994). Entrepreneurs cannot contractually commit never to leave the firm. This leaves open the possibility that an entrepreneur could use the threat of withdrawing his human capital to renegotiate the agreed upon payments. If the entrepreneur's human capital is essential to the project, he will get a fraction of the date- t_2 cash flows. Limited pledgeability is also an implication of the Holmstrom and Tirole (1997) model of moral hazard in project choice. When project choice cannot be specified contractually, investors must leave a high enough fraction of the payoff to entrepreneurs to induce them to choose the project with low private benefits but high potential profitability.

The assumption of limited pledgeability imposes constraints on the amount firms can offer. For example, the offer P^i of a stand-alone firm $F = \{i\}$ is constrained by

$$P^i \leq \lambda Y_{t(i)}. \quad (1)$$

The constraints on the contracts P^j and P^k of a conglomerate $G = \{j, k\}$ with $Y_{t(j)} \leq Y_{t(k)}$ seeking two units of capital depend on the number of units raised. When only one of the two contracts is taken, there are two relevant constraints. The first is a straightforward incentive compatibility constraint, $P^j \leq P^k$. The conglomerate always allocates the unit raised to its higher productivity project k . This condition ensures that the conglomerate's strategy results in capital being allocated to the project for which the contract was intended to. Under this condition, investors prefer contract P^k over P^j , and will thus take contract P^k first.

The second constraint is due to limited pledgeability,

$$P^k \leq \lambda Y_{t(k)}. \quad (2)$$

¹⁴The assumption that the cash flows from the first unit are not pledgeable is made only for simplicity. It will become clear that our results do not hinge on this assumption (see footnote 21).

When the two contracts are taken in equilibrium, the conglomerate allocates one unit to each project and the relevant constraint is

$$P^j + P^k \leq \lambda(Y_{t(j)} + Y_{t(k)}). \quad (3)$$

3.5 Internal capital markets

Once the external capital market closes, the conglomerate allocates its internal capital to maximize its total payoff. The result that conglomerates reallocate capital towards its most productive projects follows from the assumption that the entrepreneur that founded the conglomerate is the residual claimant: he receives the entire marginal unit of cash flow generated at date t_2 by the conglomerate. However, the result would hold even if the entrepreneur has committed the entire pledgeable cash flow to outsiders (as might turn out to be the case when we introduce date t_0 external finance). The reason is that the entrepreneur derives private benefits of control from *both* projects (this assumption is similar to that in Stein, 1997). As explained above, one can think of the non-pledgeable cash flow $(1 - \lambda)Y$ as a measure of the private benefits that the founder derives from each project. If a unit of capital is reallocated from project j to project k inside the conglomerate $\{j, k\}$, the conglomerate's founder loses $(1 - \lambda)Y_{t(j)}$ in private benefits from one project but receives $(1 - \lambda)Y_{t(k)}$ from the other. Thus, as long as the private benefits are positively correlated with total cash flows, the entrepreneur maximizes total payoff, i.e., the internal capital market is *privately* efficient.

Naturally, we recognize that internal capital markets are not always privately efficient (Stein, 2003). Our goal, however, is to highlight the novel cost of internal capital markets that we identify in the paper, which is associated with the effect of internal capital markets on the efficiency of the *external* capital market. Because internal capital markets are privately efficient, in the absence of an externality, conglomeration would clearly increase the efficiency of capital allocation.

Nevertheless, it is important to emphasize that our results do not require internal capital markets to be fully privately efficient. First, as long as conglomerates' internal capital markets mitigate the limited pledgeability problem that exists in external capital markets at least to some extent, our results will continue to hold. In other words, what is required is that λ be higher for capital reallocations that occur inside the conglomerate. Second, and perhaps more importantly, the types of (private) capital allocation distortions that the previous literature has associated with

internal capital markets will most likely reinforce our results. Specifically, if conglomerates engage in “socialistic” capital allocation (as suggested for example by Rajan, Servaes, and Zingales, 2000), their bias for internal allocation will most likely increase, since conglomerates will be even more reluctant to move capital away from low-productivity units. Given that our results are driven by conglomerates’ bias for internal allocation, such considerations would only magnify the externality that we focus on.

4 Conglomerates and the equilibrium capital allocation

In this section we characterize the effect on conglomerates on capital allocation when the degree of conglomeration in the economy, c , is exogenously given. Admittedly, the degree of conglomeration is not completely determined by exogenous factors since individual firms have the choice whether to conglomerate. Still, there are lessons to be learned to the extent that there is some exogenous variation in conglomeration across countries. For example, Khanna and Yafeh (2001, p.9) cite evidence that current corporate grouping affiliation in Japan, South Korea and Eastern Europe is determined to a large extent by history. Hoshi and Kashyap (2001) explain how the pre-war Zaibatsu (family-based business groups) were dissolved by the occupation forces. Moreover, the recent reform of the chaebol in South Korea shows that political pressure is a force that can shape business groups. In any case, we study the implications of endogenizing conglomeration in section 6.

We solve the model backwards. Since at date t_2 no decisions are taken, we start by characterizing the internal allocation of funds in a conglomerate.

4.1 Internal allocation of capital

After the external capital market has cleared, conglomerates allocate the capital they have to their projects, seeking to maximize the conglomerate’s payoff. The allocation rule inside the conglomerate is as follows.

A conglomerate with two continuing projects and two additional units of capital (i.e., two units in addition to the two units the projects started off with) allocates one unit to each project. A conglomerate with two continuing projects and one additional unit of capital allocates this additional unit to its higher productivity project. Finally, a conglomerate with two continuing

projects and no additional units of capital transfers the unit of capital from its existing lower productivity project to its higher productivity one. The decision of a conglomerate with a single continuing project is simple since all it can do is to allocate any additional capital to its continuing project.

4.2 Equilibrium of the external capital market

We describe the equilibrium in the external capital market after the productivity of the projects has been realized. To characterize the equilibrium, we define, for each project i , a quantity \bar{P}^i in the following way. If project i is in a stand-alone firm then $\bar{P}^i \equiv \lambda Y_{t(i)}$. If project i is in a conglomerate with project j then $\bar{P}^i \equiv \lambda Y_{t(i)}$ if $Y_{t(i)} \geq Y_{t(j)}$ and $\bar{P}^i \equiv \lambda(Y_{t(i)} + Y_{t(j)})/2$ if $Y_{t(i)} < Y_{t(j)}$.

We show in the proof of the next proposition that, with this definition of \bar{P}^i , we can treat each project $i \in C$ as if it were a stand-alone firm announcing P^i , with \bar{P}^i being the maximum amount this project can offer in the external market. The intuition is as follows. When project i is in a stand-alone firm, the maximum it can offer is simply $\lambda Y_{t(i)}$ (see Equation (1)). If project i is in a conglomerate with project j and $Y_{t(i)} \geq Y_{t(j)}$, the first unit of capital the conglomerate raises is allocated to project i . The conglomerate can thus offer up to $\lambda Y_{t(i)}$ for this unit (see Equation (2)). Finally, if project i is in a conglomerate with project j and $Y_{t(i)} < Y_{t(j)}$, it only receives capital when the conglomerate raises two units. The maximum amount per unit that the conglomerate can offer in this case is $\lambda(Y_{t(i)} + \lambda Y_{t(j)})/2$ (see Equation (3)).

Proposition 1 *For any allocation of projects to stand-alone firms or conglomerates, \mathcal{E} , and any participation decision by firms, sets S , O , and C , the equilibrium of the external capital market is as follows. All projects with $\bar{P}^i \geq R^*$ offer R^* to investors and projects with $\bar{P}^i < R^*$ offer any amount strictly less than \bar{P}^i . Project $i \in C$ receives capital in the external market*

- with certainty, if $\bar{P}^i > R^*$,
- with probability r^* , if $\bar{P}^i = R^*$, and
- with probability 0, if $\bar{P}^i < R^*$,

where R^* satisfies

$$x^{-1}(R^*) + \int_{\{i \in C | \bar{P}^i > R^*\}} di \leq K + \int_{\{i \in S\}} di \leq x^{-1}(R^*) + \int_{\{i \in C | \bar{P}^i \geq R^*\}} di \quad (4)$$

and, r^* satisfies

$$x^{-1}(R^*) + \int_{\{i \in C | \bar{P}^i > R^*\}} di + \int_{\{i \in C | \bar{P}^i = R^*\}} r^* di = K + \int_{\{i \in S\}} di. \quad (5)$$

The general technology receives $\omega^* = x^{-1}(R^*)$ units of capital.

The proof of this proposition, as well as a more detailed description of firms' and investors' strategies, is in the Appendix. The idea of the proof is as follows. Investors allocate their capital to projects that offer R^* and to the general technology, which also offers a return of R^* . Because there are no projects offering a higher return, this allocation is consistent with investor maximization. Note that, if a project deviates from the equilibrium strategy and offers more than R^* , it would receive capital with certainty.

The contracts offered by firms in proposition 1 are optimal given investors' allocation rule. In equilibrium, a continuing project that seeks finance (those that form set C) offers to pay R^* .¹⁵ This project cannot profitably offer strictly less because projects that offer less than R^* do not get capital. Neither can this project profitably offer more than R^* . First, if the project has $\bar{P} > R^*$, it gets capital for sure so there is no gain in increasing the offer. And second, if this project has $\bar{P} = R^*$, it receives capital with probability r^* , which is potentially less than 1. This project would benefit by raising its offer but cannot do so due to limited pledgeability constraints.¹⁶ Finally, because a project with $\bar{P} < R^*$ has to offer strictly less than R^* , it never gets capital regardless of its offer.

The above explains that, for a given R and r , the strategies of the projects and of the investors constitute an equilibrium. The exact values of R^* and r^* are determined such that the external

¹⁵We can refer to projects offering contracts (rather than stand-alone firms or conglomerates), because we show in the proof of Proposition 1 that we can treat each project $i \in C$ as a stand-alone firm with the constraint that $P^i \leq \bar{P}^i$.

¹⁶The fact that projects with $\bar{P} > R^*$ receive capital for sure whereas projects with $\bar{P} = R^*$ receive capital with some probability (potentially less than 1) even though these projects offer the same contract is not an assumption, but rather an implication of equilibrium. As we show in detail in the proof of the proposition, if the allocation rule assigned capital with probability strictly less than one to projects with $\bar{P} > R^*$ then an optimal contract would not exist for these projects. Under this rule, projects with $\bar{P} > R^*$ would get capital with probability strictly less than one if they offered R^* , but would get capital for sure if they offered $R^* + \epsilon$. The optimal contract would not exist because ϵ could always be made smaller.

market clears. Recall that the total supply of capital to the market is $K + \int_{\{i \in S\}} di$. According to the equilibrium strategies, the total ‘demand’ for capital by projects and the general technology for a given R and r is $x^{-1}(R) + \int_{\{i \in C | \bar{P}^i > R\}} di + \int_{\{i \in C | \bar{P}^i = R\}} r di$. The first term is the amount of capital allocated to the general technology. The second is the amount of capital allocated to projects with $\bar{P}^i > R$, and the third term is the amount of capital allocated to the projects with $\bar{P}^i = R$. Equating supply and demand leads to Equation (5). Equation (4) follows directly from Equation (5) by imposing the condition that r^* must lie between 0 and 1.

The equilibrium is illustrated in Figure 2, Panels A and B. The downward sloping curve is the graphical representation of the demand for capital. In Figure 2, we assume that the set C contains all the projects in the stand alone firms M and H , and all the projects in conglomerates MM , MH , and HH .¹⁷ At high levels of R (when $R > \lambda Y_H$) no project in C can offer a sufficiently high return to attract capital and thus only the general technology ‘demands’ capital, up to the point where its return $x(\omega) = R$. At a lower level of R , equal to λY_H , projects in C with $\bar{P} = \lambda Y_H$ can attract capital. The demand for capital is then the sum of the amount demanded by the general technology, $x^{-1}(\lambda Y_H)$, and the amount demanded by projects in C with $\bar{P} = \lambda Y_H$. Notice that at $R = \lambda Y_H$ all firms in C with $\bar{P} = \lambda Y_H$ benefit from raising capital. This explains the first flat portion of the demand curve, which is equal to the entire measure of continuing projects with $\bar{P} = \lambda Y_H$, $\int_{\{i \in C | \bar{P}^i = \lambda Y_H\}} di$. At a lower level of R , equal to $\frac{\lambda}{2}(Y_H + Y_M)$, conglomerates of type HM are able to raise two units of capital by pledging exactly $\frac{\lambda}{2}(Y_H + Y_M)$ for the second unit. The second flat portion of the curve is the measure of such conglomerates. At an even lower level of R even projects of type M can raise additional capital, which explains the remaining parts of the demand curve.

The vertical line is the total supply of capital. As we explain below supply is independent of the rate of return in our model.

Finally, the equilibrium return R^* can be read on the vertical axis at the point where the demand for capital intersects the supply. In Panel A, the equilibrium R^* is bigger than the maximum amount that projects can pledge (λY_H), and thus only the general technology receives capital.¹⁸ In panel

¹⁷Also, Figure 2 is constructed under the assumption that $x(0) > \lambda Y_H$, such that some capital must be invested in the general technology before it can flow to projects with $\bar{P} = \lambda Y_H$.

¹⁸Notice that in this case r^* , which is the probability that a project with $\bar{P}^i = R^*$ receives capital, can take any value in $[0, 1]$ since there are no projects with $\bar{P}^i = R^*$. Thus, the equilibrium r^* is not unique in this case.

B, $R^* = \lambda Y_H$, and thus all projects in C with $\bar{P} = \lambda Y_H$ can attract capital. However, given the amount of capital supplied there are not enough available funds for all of them. In this case, the probability that such projects get capital (r^*) is uniquely determined by Equation (5). Graphically, it is the ratio of the total amount of capital that is available to be allocated to high productivity projects in set C , which is equal to $K + \int_{\{i \in S\}} di - x^{-1}(\lambda Y_H)$, to the total measure of such projects.

4.3 Decision to demand, supply or opt out of the market

In this section we analyze the participation decisions of firms, that is, the determination of sets S , C , and O . As we will show, this will allow us to characterize the demand and the supply of capital for any levels of conglomeration, c , and pledgeability, λ , and consequently the equilibrium capital allocation that is associated with each configuration of exogenous parameters.

Proposition 2 *The participation decisions of firms are as follows*

- *Stand-alone firms of type L and conglomerates of type LL supply all their capital to the market (set S).*
- *Conglomerates of types LM and LH do not participate in the external capital market and reallocate internally the capital in the L project to their higher productivity project (set O).*
- *Stand-alone firms of types H and M, and conglomerates of types MM, MH, and HH seek finance in the external market for all their projects (set C).*

The participation decisions of firms in proposition 2 follow from a restriction that the equilibrium return R^* must obey in our model. Notice that because of market clearing, the equilibrium amount of capital allocated to the general technology (ω^*) must satisfy $0 < \omega^* \leq 1 + K$. From this it follows that $x(1 + K) \leq R^* < x(0)$ and, by assumptions 1 and 2:

$$Y_L \equiv 0 < R^* < Y_M < Y_H. \quad (6)$$

With this restriction, we can derive the sets S , C and O . For stand-alone projects the participation decision is straightforward. Low productivity projects supply their capital to the market since they get R^* in the market but get zero if they continue. Similarly, conglomerates of type LL liquidate and supply their capital to the market. The projects of these firms constitute the set S .

The total supply of capital can now be computed as a function of c . There are $(1 - c)p_L$ stand-alone firms with low productivity projects, each supplying one unit of capital, and $\frac{c}{2}(p_L)^2$ conglomerates of type LL , each supplying two units of capital. The supply of capital to the markets is then

$$K + \int_{\{i \in S\}} di = K + (1 - c)p_L + cp_L^2. \quad (7)$$

Equation (7) illustrates a key feature of the model: the higher is the degree of conglomeration, the lower is the supply of capital. The reason is that while a stand-alone firm with a project of type L always supplies its capital to the market, conglomerates ML and HL always opt out of the market because they prefer internal reallocation. As the degree of conglomeration increases, the number of stand alone projects of productivity L decreases and the number of conglomerates that opt out of the market increases.

Stand alone projects of productivities M and H , and conglomerates of types HH , MM and MH generate more cash flow when they continue their projects (either Y_M or Y_H) than when they supply their capital (R^*). Moreover, stand-alone firms with projects M and H benefit from raising one unit of capital and conglomerates of type HH , MM and MH benefit from raising two units since they would pay R^* but can generate either Y_M or Y_H . The projects of these firms constitute the set C .

We can also compute the precise measure of projects in C with a particular \bar{P} , as a function of c and λ . As an example, we compute the measure of projects with $\bar{P} = \lambda Y_H$. There are $(1 - c)p_H$ stand-alone firms with a high productivity project, $\frac{c}{2}p_H^2$ conglomerates of type HH each with two projects with $\bar{P} = \lambda Y_H$, and $cp_H p_M$ conglomerates of type MH with one project with $\bar{P} = \lambda Y_H$.¹⁹ Thus, there are $(1 - c)p_H + cp_H^2 + cp_H p_M$ projects in C with $\bar{P} = \lambda Y_H$. Other measures can be computed similarly.

Finally, conglomerates of type HL and ML do not participate in the external capital market. They are (weakly) better off allocating capital internally than using the external capital market, because the best they can do in the market is to supply the unit of capital in their low productivity project and raise one unit for their higher productivity one. But they do not need the market to accomplish this transaction. Furthermore, if the probability of raising capital in the external market

¹⁹Notice that for a conglomerate $G = \{j, k\}$ with $t(j) = t(k) = H$ we have $P^j = P^k = \lambda Y_H$, and for a conglomerate $G = \{j, k\}$ with $t(j) = M$ and $t(k) = H$, we have $P^k = \lambda Y_H$.

is less than one, they strictly prefer internal reallocation. The projects of these firms constitute the set O .

4.4 Conglomerates and the efficiency of capital allocation

In the following proposition we state and prove the central result of the paper. We show that conglomeration can have a positive or a negative effect on the efficiency of capital allocation, depending on the range of the pledgeability parameter λ .

Proposition 3 *There are two values of λ , $\hat{\lambda}_1 < \hat{\lambda}_2$ such that:*

- a. For $\lambda < \hat{\lambda}_1$, the aggregate payoff is increasing in the degree of conglomeration,*
- b. For $\hat{\lambda}_1 < \lambda < \hat{\lambda}_2$, the aggregate payoff is decreasing in the degree of conglomeration, and*
- c. For $\lambda > \hat{\lambda}_2$, the aggregate payoff is non-decreasing in the degree of conglomeration.*

To understand the proposition, notice that the capital that conglomerates of type ML and HL reallocate internally goes from type L to either type M , or type H projects. If instead the projects of type L were stand-alone firms, their capital would be supplied to the market. Whether conglomeration is good or bad for overall efficiency depends on what would have happened to the capital that these conglomerates reallocate internally, had it been supplied to the external market. If most or all of the released capital would have ended up in type H projects, then conglomerates are bad for efficiency because part of the capital they reallocate internally goes to projects of type M . However, if little or none of the capital would have been reallocated to type H , the aggregate payoff increases with conglomeration.

For low levels of pledgeability ($\lambda < \hat{\lambda}_1$) the external market does a poor job at allocating capital to type H projects, and thus decreasing the number of conglomerates reduces the efficiency of capital allocation. This effect can be seen in Figure 3, Panel A, where the arrow shows the effect of a decrease in the level of conglomeration, corresponding to the hypothetical exercise of busting up conglomerates. A decrease in the degree of conglomeration increases the supply of capital to the market. However, as Panel A shows, all the newly released capital ends up in the general technology. Because the released capital was previously allocated internally by conglomerates to

either their M or H projects, the decrease in conglomeration over this range reduces the allocative efficiency of the economy.

For intermediate values of λ , $\hat{\lambda}_1 < \lambda < \hat{\lambda}_2$, the market does a better job of allocating capital than in the previous case. In this range of λ reducing the number of conglomerates is beneficial for the efficiency of capital allocation. This case is illustrated in Figure 3, Panel B. In this panel, both the initial and final levels of conglomeration are the same than in Panel A, however, the degree of pledgeability is higher. Because of this higher pledgeability, all the capital released to the market finds its way to high productivity projects. Thus, the decrease in conglomeration is beneficial since some of this newly released capital was previously allocated to mediocre projects by the LM conglomerates.

Notice that the bias towards internal investment of these conglomerates is due to limited pledgeability. A conglomerate of type LM does not supply capital to the market but rather allocates it internally (even when there is unsatisfied demand from projects of type H), since projects of type H cannot offer a sufficiently high return.²⁰ In this range, the maximum return a type H project can offer is lower than the cash flows that a project of type M generates (i.e., $\lambda Y_H < Y_M$) and thus it is privately optimal for the conglomerate to allocate internally whereas it is socially optimal to supply its capital to the market.²¹

Finally, for higher levels of pledgeability, increasing conglomeration is never detrimental to the aggregate payoff because all projects of type H receive capital in the external capital market. As a result, transfers that take place inside the LM conglomerates are no longer suboptimal since the best project in need of capital for the economy as a whole is now project M .

²⁰One might wonder whether mergers between firms with H projects and conglomerates of type LM would not eliminate the inefficiency. The answer is that such mergers would be subject to the same imperfection that curb transactions in the external capital market (limited pledgeability). An acquisition at date t_1 of a type H firm by a type LM conglomerate, for example, basically consists of the type H firm exchanging its future date t_2 cash flow for a current payment made by the conglomerate LM . The inefficiency would be completely eliminated only under the assumption that the conglomerate would be willing to pay the full Y_H for the assets of firm H . This is unlikely to be the case if there is any specificity to the assets of H that cannot be captured by the conglomerate, for example, if there is specific human capital invested in H . If the entrepreneur who runs firm H is necessary to generate its full value, then it might be necessary to give him part of the rent generated by this firm ex-post (at date t_2), and thus the conglomerate LM would not be willing to pay the full value of the firm ex-ante (at date t_1).

²¹We are assuming that firms cannot pledge cash flows of the first unit to raise the second unit of capital. However, this simplifying assumption is not necessary for the results. If the first unit was pledgeable all firms would have incentives to cross-pledge cash flows from the first unit in order to raise the second unit. This would complicate the analysis of the external market equilibrium because we would need to keep track of a larger number of potential values for \bar{P} . Nevertheless, there would still be a range for the pledgeability parameter in which conglomerates ML would have a socially inefficient bias towards internal reallocation. The only difference is that because overall pledgeability is higher with this alternative assumption, both $\hat{\lambda}_1(c)$ and $\hat{\lambda}_2(c)$ would be lower.

This proposition is the generalization of the result presented in the simple example of section 2. It shows that most of the simplifying assumptions that we made in that section are not necessary to generate the equilibrium cost of internal capital markets. It also shows that a similar comparative statics exercise holds in the general model - the cost of conglomeration kicks in for intermediate pledgeability levels, for which the external capital market is most sensitive to the presence of conglomerates.

5 External finance at date t_0

So far we have assumed that conglomerates and stand-alone firms do not need external finance at date t_0 . As a result, when firms enter the reallocation market at date t_1 , the decisions that the controlling shareholder takes are privately efficient because they are not influenced by external claims that the firm brings from date t_0 .

The potential problem of introducing external finance at date- t_0 is that it can change the actions of conglomerates and stand-alone firms. For example, in the model with no external finance at date t_0 , a stand-alone firm with productivity L is always liquidated because it is privately efficient to do so (recall that $Y_L < R^*$). However, when we introduce external finance, it is possible that outside investors capture most of the benefits from liquidation. In this case, controlling shareholders will prefer not to liquidate at date t_1 , even when the firm is a low productivity one. This effect might eliminate the mechanism behind our results since conglomeration would no longer be associated with a decrease in the supply of capital to the external markets.

5.1 Interim cash flows and contracts at date t_0

To analyze the robustness of our model to these considerations, we extend our model to consider the effect of external finance at date t_0 . We assume that the stand-alone firms need an amount $Z^{SA} \leq 1$ of external finance and conglomerates need an amount $Z^C \leq 2$.²² Because what concerns us here is the liquidation of low productivity stand-alone firms, we focus on stand-alones firms in the text. We consider conglomerates in the appendix.

²²It could be, for example, that an entrepreneur has wealth of $W \leq 1$ and so when setting up a stand alone firm he needs $Z^{SA} = 1 - W$ of external finance and when setting up a two-project conglomerate, he needs $Z^C = 2 - W$ of external finance. However, in this section we do not specify where the external financing needs come from and rather work with general Z^{SA} and Z^C .

In the model of the previous section we assumed that there were no cash flows at date t_1 , and that the date- t_2 cash flow in state L (Y_L) was equal to zero. We relax these assumptions, and assume instead that $Y_L > 0$, and that the initial unit produces a date- t_1 cash flow y_s just before the reallocation market opens. We assume that these cash flows are not verifiable (i.e., the controlling shareholder pockets them if he decides not to pay them out). Finally, we assume that date- t_1 cash flows are positively correlated with firm productivity:

$$y_H \geq y_M \geq y_L \tag{8}$$

We consider a very simple class of date- t_0 financial contracts characterized by $\{D_1, D_2\}$, where D_1 and D_2 are the promised repayments at dates t_1 and t_2 , respectively. If the payment D_1 is not made, the firm is liquidated at date t_1 , and the proceeds are used to pay date- t_0 outside investor.²³ We assume that the entire liquidation proceed is pledgeable so that, in case of liquidation, the date- t_0 investor receives $\min\{D_1 + \frac{D_2}{R^*}, 1\}$, where $D_1 + \frac{D_2}{R^*}$ is the present value of the the promised payments.

The main technical difficulty with introducing date- t_0 external finance is that there might be dynamic interactions between the contract written at the initial date, and the equilibrium of the capital reallocation market at date t_1 . In particular, the date- t_0 contract optimally depends on the equilibrium outcome that is anticipated for date t_1 . In turn, the equilibrium in the date t_1 reallocation market depends on the contracts offered at date t_0 . In order to simplify the analysis, we assume away such interactions in the present section. We have also worked out an alternative set up in which we model these interactions and we show that this alternative set up generates welfare conclusions that are qualitatively similar to those of the model that we develop here.²⁴

In order to separate the date- t_0 contract from the date- t_1 reallocation market, we assume that the amount D_2 can only be paid out of the pledgeable part of the cash flows generated by the *first* unit of capital invested. We also assume that the date- t_1 investor is paid out of the pledgeable part of the cash flows generated by the *second* unit invested in the project. In particular, we do not allow excess cash flows from the first unit of capital that are not pledged to the initial investors to affect firms' ability to compete for capital at date t_1 . With these simplifying assumptions, we can

²³In particular, we assume that there is renegotiation of the first period payment D_1 . We briefly analyze the effects of renegotiation below.

²⁴This alternative model is available from the authors upon request.

introduce date- t_0 external finance without changing the analysis of the date- t_1 capital reallocation market. To keep the model symmetric, we assume that only a fraction λ of the date- t_2 cash flow generated by each unit is pledgeable.

We assume that all the date- t_0 bargaining power is in the hands of the entrepreneurs. As a result, they offer contracts so that date- t_0 investors just break even, that is, they get an expected payoff equal to R^*Z (date- t_0 investors can always store their capital Z from date t_0 to date t_1 and then invest it in the market at date t_1 to get a return of R^*). We also assume that the date- t_2 cash flow in the low productivity state (Y_L) is lower than R^* , so that it is privately efficient to liquidate the project in state L (as in the model of the previous section).

5.2 Optimal date- t_0 contracts

Because the returns of the project at date t_2 are only partially pledgeable, the controlling shareholder can always get a strictly positive payoff by continuing at date t_1 , irrespective of the promised repayment to date- t_0 investors. This minimum bound on the controlling shareholder's payoff, $(1 - \lambda)Y_s$, can be thought of as the private benefits of continuation. In contrast, because the liquidation proceeds are easily verifiable, the outside investor can seize all the liquidation proceeds (if the promised payment is large enough) and leave nothing to the controlling shareholder. This feature of the model can induce excessive continuation of projects, if external financing claims are large enough.

Nevertheless, this ex-post (after claims are issued) preference for continuation does not necessarily lead to actual continuation of projects. The reason is that, before the external claims are issued, the privately optimal action to take is still to liquidate in state L . Thus, committing ex-ante to liquidate in state L maximizes the value of the firm and hence benefits the entrepreneur. The question is then whether the contracts described above can be designed so that the entrepreneur can commit to the privately efficient liquidation rule, that is, to liquidate in state L and to continue the project on states M and H .

We characterize the solution by splitting the parameter space into two regions depending on the amount of external finance needs. We give a verbal intuition of the results. The precise statement of the results and their proofs are in the appendix.

5.2.1 Low external financing needs

We show in the appendix that when external financing needs are low, it is always possible to implement the privately efficient liquidation rule. The reason is that, in this case, the entrepreneur remains the residual claimant in all states of the world and hence always prefers –even after the claims are issued– to take the optimal action.

5.2.2 High external financing needs and inefficient liquidation

If external financing needs become large enough, the entrepreneur has to promise a substantial fraction of the pledgeable cash flows to investors in order to be able to raise capital at date t_0 . When the promised payments are large, liquidation of the project at date t_1 would leave the entrepreneur with a very small payoff. Because the private benefits of continuation are strictly positive in all states, the entrepreneur prefers to continue rather than to liquidate, regardless of the productivity of the project. In particular, the entrepreneur would like to continue the project even when the realized productivity is low.

As we explained above, however, it is always optimal for the entrepreneur to commit ex-ante to liquidate in state L as this maximizes the value of the firm. The question is whether he can achieve this goal with the standard debt contract.

If the first period cash flows are independent of productivity (i.e., $y_H = y_M = y_L = \bar{y}$), it is impossible to implement the optimal liquidation rule. In this case, the contract cannot force selective liquidation in state L . If the first period payment D_1 is larger than \bar{y} , the entrepreneur would be forced to liquidate in all states.²⁵ Because it is very costly to liquidate the project in states M and H , it is better to give the entrepreneur the choice to liquidate by making the first period payment D_1 lower than \bar{y} . But, given the choice, the entrepreneur chooses to continue in all states. Under this scenario, the equilibrium cost of conglomeration that we identified in section 4.4 would disappear, since dismantling conglomerates would no longer increase liquidation and the supply of capital to the external market.

However, this is an extreme situation because the date- t_1 cash flows are exactly the same.

²⁵This analysis relies on the assumption of no renegotiation. It is possible that creditors agree to renegotiate down a large payment D_1 in states M and H . However, renegotiation might fail because most of the benefits of continuation are private benefits that accrue to the entrepreneur alone, and the entrepreneur is liquidity constrained at date t_1 (as in Aghion and Bolton, 1992). To the extent that efficient renegotiation is possible, it would be an additional reason why insufficient liquidation in state L would not be a robust conclusion of the model (see the analysis below).

When this is not the case and, in particular, when these cash flows are positively correlated with the productivity of the project ($y_H > y_M > y_L$), a standard debt contract can implement the optimal liquidation rule. In the case of the stand-alone firm, the optimal contract specifies a first period payment D_1 that is greater than y_L but lower than y_M .²⁶ This contract restores efficient liquidation decisions.²⁷

The main feature of the date- t_0 contract that induces efficient liquidation is that it is state-contingent. The analysis above shows that state-contingent liquidation can be achieved with a simple debt contract, if short term cash flows are positively correlated with long term productivity. In particular, with privately efficient liquidation decisions the analysis of the date- t_1 reallocation market, and the welfare results of the model are identical to those that we characterized before. Thus, we conclude that our previous results are generally robust to the introduction of date- t_0 external finance.²⁸

6 The equilibrium level of conglomeration

In the previous sections, we analyzed the effect of conglomeration on the efficiency of capital allocation, assuming that the level of conglomeration, c , was exogenously given. In this section we endogenize this variable by allowing the entrepreneurs to choose whether to form a conglomerate or a stand-alone firm.

We assume that at date t_0 there is a measure $k > 1$ of founder-managers who can set up firms. These founders choose at date t_0 whether to own one or two projects, that is, whether to set up a stand-alone or a conglomerate firm. Because $k > 1$, even if all founders decide to set up stand-alones there will be enough managerial talent in the economy to create all possible firms at date t_0 .²⁹ We assume that these founders are homogeneous in all respects, and have wealth $W \leq 1$. Founders

²⁶As we show in the appendix, a similar conclusion holds in the case of the conglomerate, in which it is only optimal to liquidate in state LL .

²⁷There is a maximum amount of external finance that can be raised with this contract. If external financing needs are higher than this maximum amount, we can have *excessive* liquidation in equilibrium. We analyze the consequences of excessive liquidation in the alternative model mentioned above, available upon request.

²⁸Our analysis assumes that standard debt contracts can be enforced, irrespective of the country's level of institutional development. While this assumption might be questionable for countries with very low investor protection, this possibility does not invalidate our results because in such countries the equilibrium cost of conglomeration is unlikely to be important to begin with. The robustness of our welfare results to the introduction of external finance only require standard debt contracts to be enforceable in countries with *intermediary* level of institutional development, those for which the equilibrium cost of conglomeration might be important.

²⁹Khanna and Palepu (1997,1999) suggest that business groups might arise to economize on managerial talent. We rule out this rationale for conglomerates by assuming that $k > 1$.

can raise outside capital at date t_0 if they need to. We use the contractual framework developed in section 5 to model external financing of stand-alone firms and conglomerates. In particular, we assume that it is feasible to write down date- t_0 contracts that induce privately efficient liquidation and continuation decisions, both in stand-alone and conglomerate firms. This assumption rules out any deadweight costs of external finance.³⁰

Finally, we assume that there is a cost d of conglomeration. This can be thought of as the organizational costs incurred by the conglomerate due to its higher complexity. For example, the conglomerate requires the founder-manager to oversee two projects instead of one. In addition, d can capture other benefits and costs of conglomeration. For example, Claessens, Djankov and Lang (2000) conclude from various case studies of business groups in East Asia that their “dominance lies in the privileges they solicit from the government.” Countries where these privileges are high have a smaller d . In order to simplify the analysis we assume that d is a private cost that is born by the founder-manager who heads the conglomerate, without affecting the cash flows that are pledgeable to outside investors.

We write the founders’ date- t_0 conglomeration payoff as $U^C(c)$, and the stand-alone payoff as $U^{SA}(c)$. As we show below, these payoffs will be directly affected by the degree of conglomeration c . Because external finance has no deadweight costs, these payoffs are effectively identical to those which would obtain with no external finance. Founders choose to form a conglomerate whenever $U^C(c) > U^{SA}(c) + d$. Therefore, in an equilibrium with an interior level of conglomeration $0 < c^* < 1$, it must be the case that:

$$U^C(c^*) = U^{SA}(c^*) + d \tag{9}$$

If this condition holds, founders are indifferent between setting up a conglomerate or a stand alone firm. Because $k > 1$, irrespective of c^* there will be a measure of founders who cannot set up firms, and only earn a market return on their capital. For simplicity, we assume that the right to own a firm is randomly allocated to founders, and that the founders who do not set up firms are strictly rationed and must invest their capital in the market.

Given our set up, the number of equilibria and their properties will only depend on the shape of

³⁰In our alternative, complete contracting framework, we consider a more general set up in which external finance might induce excessive liquidation of stand-alones and conglomerates. The welfare properties of this alternative model are very similar to the simpler model developed here.

the founders' payoffs, $U^C(c^*)$ and $U^{SA}(c^*)$. The degree of conglomeration c has an effect on these payoffs because it affects the equilibrium of the external capital market. Since external finance has no effect on liquidation decisions by assumption, the analysis of the external capital market is identical to that of section 4.2. In particular, an increase in c reduces the supply of capital to the market, and decreases the probability that high productivity projects can raise additional capital in the external market (r_H), that is, $\frac{\partial r_H}{\partial c} \leq 0$. Given this result, the following proposition characterizes the equilibria generated by the model.

Proposition 4 *There are two cutoff values for λ , satisfying $\lambda_1 < \lambda < \lambda_2$, such that:*

- a. *If $\lambda \leq \lambda_1$, or if $\lambda \geq \lambda_2$, there exists a unique equilibrium level of conglomeration*
- b. *If $\lambda_1 < \lambda < \lambda_2$, then we can either have a unique equilibrium as in part a), or two equilibrium levels of conglomeration, \underline{c} and \bar{c} . In the latter case, the lower level \underline{c} is always associated with a higher probability that high productivity projects can raise capital, that is, $r_H(\lambda, \underline{c}) > r_H(\lambda, \bar{c})$.*

An intuitive way of understanding the existence of multiple equilibria is as follows. Stand-alone firms supply capital to the market more often than conglomerates do. For this reason, when the degree of conglomeration is low (i.e., there are many stand-alone firms), the supply of capital to the external market is large, and thus it is more likely that a high productivity firm raises capital in the external market. In turn, because the external capital market works well, the benefits of having an internal capital markets are reduced. As a result, when an entrepreneur expects a low degree of conglomeration, it does not pay for him to conglomerate. Thus, there is an equilibrium with a low degree of conglomeration. In the other equilibrium, the degree of conglomeration is high, the supply of capital to the market is low, and high productivity projects have a difficult time raising capital in the external capital market. Because the external market works poorly, there are significant benefits of having an internal capital market, and therefore founders choose to conglomerate. Thus, there is an equilibrium with high conglomeration. The multiple equilibria are depicted in Figure 4, Panel A.

However, the mechanism that generates multiple equilibria does not work if investor protection is too low ($\lambda < \lambda_1$), because in these cases the external market works poorly irrespective of the degree of conglomeration. Similarly, if investor protection is high enough ($\lambda > \lambda_2$) high productiv-

ity projects can raise capital irrespective of the degree of conglomeration. In these cases, the main equilibrium effect of conglomeration is on the interest rate R . Because conglomeration reduces the supply of capital to the market, an increase in conglomeration raises the interest rate R . Furthermore, because stand-alone firms supply their capital to the market more often, an increase in R raises the payoff of the stand-alone relative to the conglomerate. Thus an increase in conglomeration has an unambiguously negative effect on the payoff differential $U_I^C - U_I^{SA}$ that founders consider when deciding whether to conglomerate or not. As shown in Figure 4, Panel B, in this case there is a unique equilibrium level of conglomeration, c^* .

6.1 Welfare analysis

We now describe the welfare properties of the equilibria characterized in proposition 4.

The most interesting welfare comparison is that between the multiple conglomeration equilibria. In this case, the local comparative statics' results in section 4.4 are not enough to understand the welfare implications of the model. Consider what happens as we move from the high conglomeration equilibrium, \bar{c} , towards the low one, \underline{c} , in Figure 4, Panel A. Because at \bar{c} the probability of raising capital in the external market (r_H) is low, a local decrease in conglomeration around \bar{c} will actually *lower* aggregate output. As we move closer to the low conglomeration equilibrium r_H increases, and at some point further increases in conglomeration start increasing aggregate output. Thus, the welfare comparison between the multiple equilibria is in principle unclear.

Nevertheless, we show in the Appendix that under certain conditions the low conglomeration equilibrium is socially superior. Intuitively, the global benefits of improved external capital reallocation to high productivity projects in the low conglomeration equilibrium outweigh potential benefits of conglomeration, such as the fact that conglomerates reallocate capital more frequently. We note that this result holds even when we do not count the cost of conglomeration d in the aggregate payoff, and will only get stronger if we do (since there are fewer conglomerates in the \underline{c} equilibrium).

In addition, if there is a unique equilibrium level of conglomeration the welfare analysis is virtually identical to that in section 4.4.³¹ Essentially, the welfare implications of the model in this case can be gauged from the local effects of changes in conglomeration. Consider for example the

³¹In fact, the analysis is *exactly* identical if the cost of conglomeration d is not included in social welfare.

equilibrium in Figure 4, Panel B. Starting from the equilibrium c^* , an increase in conglomeration is more likely to have a negative effect on welfare if the equilibrium c^* is such that the probability that high productivity projects can raise capital in the market (r_H) is high, but lower than one. In this range an increase in conglomeration (engendered for example by a decrease in d) decreases the total amount of capital that is invested in high-productivity projects, taking into account both the external market and internal reallocation of capital into H projects. This effect can only happen in the intermediate range of λ characterized in proposition 4. In the extreme ranges of λ ($\lambda \leq \lambda_1$ and $\lambda \geq \lambda_2$) an increase in conglomeration has a *positive* effect on the aggregate payoff, because in these ranges the probability that high productivity projects raise capital is not sensitive to the degree of conglomeration.

6.2 Multiple equilibria with endogenous pledgeability

The results above suggest that countries with intermediate investor protection might be stuck in an equilibrium with too much conglomeration. The same institutional environment (λ, d) can support two very different equilibria in terms of the degree of conglomeration and the efficiency of capital allocation. However, even if the low conglomeration equilibrium is socially superior there might be no natural mechanism to allow the economy to move to the more desirable equilibrium. In this section we discuss mechanisms that reinforce the presence of multiple equilibria.

Our model assumes that the institutional environment is exogenously determined. However, it is possible that the degree of external market pledgeability in a country is a function of the degree of conglomeration.³² For example, one might imagine that investor protection can be increased if a country commits resources to improve its legal and accounting systems. However, if the costs of increasing pledgeability are high, it might not be worthwhile to do so in a country characterized by a high degree of conglomeration, because of the minor role that external markets play in overall capital allocation.

In addition, it is possible that conglomeration affects pledgeability even if the costs of increasing pledgeability are relatively low, because of political economy considerations. Recent literature suggests that investor protection and other important institutional variables are partly determined by a country's political processes (Pagano and Volpin, 2001, Rajan and Zingales, 2003). In particular,

³²We thank our referee for suggesting this possibility.

to preserve their privileged position, business groups' controlling shareholders might have incentives to lobby for laws and regulations that restrict capital market access (Morck, Wolfenzon and Yeung, 2005). Furthermore, the concentration of wealth and corporate control that is engendered by a high degree of conglomeration might easily translate into political power, making it more likely that the political economy equilibrium will favor the interests of controlling shareholders. As a consequence, countries with a large prevalence of business groups might end up having lower pledgeability, even when it would be relatively easy to improve investor protection.

These considerations can easily reinforce the tendency towards multiple equilibria that we identified in this paper. In an equilibrium with a high degree of conglomeration and concentrated corporate control, the efficiency of capital allocation will be poor not only because of the prevalence of conglomerates per se (the mechanism identified in this paper), but also because external market pledgeability is lower than what it could be if corporate control was less concentrated. Furthermore, given the concentration of power and the fact that the external capital market works so poorly, high conglomeration is a stable equilibrium, both from an economic and also from a political stand-point. A break up of conglomerates might dramatically improve capital allocation, not only because of the direct effect that we identified in this paper, but also because the incentives to improve investor protection increase. The endogenous improvement in external market pledgeability helps sustain the low conglomeration equilibrium, and improves its welfare properties even beyond the differences that we characterized above.

7 Empirical and policy implications

In this section we discuss our theory's empirical and policy implications. We also discuss some anecdotal evidence that appears to be consistent with these implications.

Because our theory's main implications are based on the effects of conglomerates on the external market, a pre-condition for the model's mechanism to work is that the reduction in external market activity that the presence of conglomerates entails be a first order effect. Although there is no systematic study on this issue, the sheer size of business groups as a fraction of the economy in some countries suggests that this can be the case. Claessens, Fan, and Lang (2002) find that in 8 out of the 9 Asian countries they study, the top 15 family groups control more than 20% of the listed corporate assets. In a sample of 13 Western European countries, Faccio and Lang (2002) find

that in 9 countries the top 15 family groups control more than 20% of the listed corporate assets. Given that business groups consist of such a large fraction of the capital market in some countries, it is highly plausible that their actions could have first-order effects on the behavior of the market as a whole.

Our theory makes the following empirical prediction about the relationship between conglomeration and the efficiency of capital allocation.

1. The level of conglomeration in a country’s corporate sector could be negatively related to the economy-wide efficiency of capital allocation, even if conglomerates’ internal capital markets are privately efficient

This result follows directly from proposition 3. Because of its negative effect on the ability of other firms to raise capital, conglomeration can decrease the efficiency of equilibrium capital allocation even when internal capital markets are efficient.

There are several important aspects related to implication 1 that need to be discussed. First, in order to test implication 1, one would need to measure the economy-wide efficiency of capital allocation. One possibility is suggested by Wurgler (2000), who uses the country-level elasticity of industry investment to industry value added to measure the efficiency of capital allocation.³³ According to Wurgler, this elasticity provides a measure of whether capital is efficiently reallocated from declining industries towards growing ones.³⁴ Second, one would need to build an “aggregate conglomeration” index for a large enough sample of countries. While we do not believe that such a measure is currently available for many countries, it can, in principle, be constructed. For example, for East Asia, Claessens, Djankov and Lang (2000) measure the fraction of firms that are affiliated with business groups. With a large enough sample of countries, future research could examine the empirical relationship between conglomeration and country-level measures of the efficiency of capital allocation such as Wurgler’s.

A perhaps more fundamental concern is whether a negative relationship between conglomeration and the efficiency of capital allocation would allow us to clearly accept our theory against

³³Wurgler’s main finding is that this elasticity is positively related to the level of financial development in cross-country regressions.

³⁴Almeida and Wolfenzon (2005) use Wurgler’s measure to examine the relationship between an index of aggregate external finance dependence and the efficiency of capital allocation. They argue that Wurgler’s *within-year* elasticity of investment to value-added is specially likely to capture the idea of capital reallocation.

alternatives such as the possibility that conglomerates allocate capital inefficiently from a private standpoint (e.g., Scharfstein and Stein, 2000). If conglomerates do not allocate capital to their best available option, the efficiency of capital allocation should decrease with conglomeration independently of whether our mechanism is in operation. Fortunately, one can use additional implications of the model in order to provide stronger evidence for it.

2. The effect of conglomeration on allocative efficiency is non-monotonic in the level of investor protection. In particular, the effect is more strongly negative for intermediate levels of investor protection

Result 2 also follows from proposition 3. This result is important because it provides for a way to differentiate our empirical implications from those of a model in which conglomerates allocate capital inefficiently. Existing models of inefficient investment in conglomerates, such as Scharfstein and Stein (2000) and Rajan, Servaes and Zingales (2000) do not make clear predictions regarding the relationship between the effect of conglomerates on efficiency and the level of investor protection. Other models have the implication that, as the financing-related benefits of conglomeration decrease, costs of conglomeration such as less effective monitoring (Stein, 1997), coordination costs (Fluck and Lynch, 1999), free cash-flow (Matsusaka and Nanda, 2002 and Inderst and Mueller, 2003) and incentive problems (Gautier and Heider, 2003) decrease the efficiency of conglomerates' investments. However, these papers generally imply a *monotonic* relationship between the underlying imperfection in capital allocation and the efficiency of conglomerates.³⁵ Thus, we believe that the particular non-monotonicity that we identify is a novel implication of our model.³⁶

An alternative way to test our model would be to examine the particular mechanism by which conglomerates adversely affect the efficiency of capital allocation.

3. The level of conglomeration in a country's corporate sector should be positively related to the financing constraints faced by independent firms, and thus negatively related to their growth

In our model, high-productivity independent firms are less likely to be able to raise capital in

³⁵The only exception seems to be Inderst and Mueller (2003). In their model, the (private) *value* of conglomeration is highest when the underlying imperfection is in an intermediate range. Notice this suggests the opposite of our implication that the social *cost* of conglomeration is highest for countries with moderate levels of investor protection.

³⁶Notice, however, that a cross-sectional test of this non-monotonic relationship would require an even larger sample of countries than a test of implication 1.

the external market if the degree of conglomeration is high. This is the main mechanism by which conglomerates adversely affect the equilibrium allocation of capital in the model, as explained in Section 4.4.³⁷

Because previous theory on internal capital markets generally ignores the effects that conglomeration might have on other firms in the economy, implication 3 is an additional implication that is particular to our model. It appears that such an implication would be testable, conditional on the construction of a conglomeration index for a large enough sample of countries (similarly to implications 1 and 2). The theory also suggests a way of sharpening a test of the mechanism by which conglomerates affect capital allocation.

4. The effect of conglomeration on the financing constraints faced by independent firms should be particularly strong for countries with intermediate levels of investor protection

The reasoning behind implication 4 is very similar to that behind implication 2. If investor protection is very low, high productivity firms cannot raise capital irrespective of conglomeration, and if investor protection is very high all the inefficiencies disappear. Thus, the effect of conglomerates on other firms' financing constraints should be more pronounced for intermediate levels of investor protection.³⁸

One general problem with any empirical test of implications 1 to 4 is that the level of conglomeration is (generally) endogenous to the level of investor protection and the efficiency of capital allocation in a country. While our theory also suggests that a model with endogenous conglomeration generates similar implications (section 6), for empirical purposes it might be desirable to isolate exogenous variations of conglomeration. As we discuss in section 4, there is evidence that corporate grouping affiliation is affected to a large extent by history and political pressure. One might be able to use such sources of variation in order to identify experiments that facilitate testing and identification.³⁹

³⁷In fact, the theory suggests that financing constraints could also be tightened for some types of conglomerates with high productivity projects. However, because conglomerates' internal capital markets relax their financing constraints, we believe it is cleaner to focus only on independent firms.

³⁸The only difference between implications 2 and 4 is that conglomerates can never increase the probability with which independent firms raise capital. Thus the effect of conglomerates on other firms' financing constraints is (weakly) monotonic in the level of investor protection.

³⁹One example, though in a different context, is Yafeh (1995), who uses the dissolution of the Japanese Zaibatsu following World War II as a large scale experiment to study the relationship between ownership structure and firm

Finally, our theory generates the following policy implication.

5. Even if conglomerates have a negative effect on the efficiency of capital allocation, individual conglomerates will have no private incentives to dismantle. Deconglomeration might require direct government intervention

Implication 5 is a direct consequence of the fact that the cost of conglomeration that we identify in our paper is an externality.

We end this section by discussing a recent example of the relation between conglomerates and the overall economy that appears to be consistent with our theory.

The Case of South Korea

The recent history of South Korea gives some anecdotal evidence for the predictions of our theory. Up until the 1990's, the Korean conglomerates, or chaebols, were credited with being one of the most important factors in Korea's rapid growth. This view appeared to change in the 1990's, as the chaebols began to be seen as an obstacle to growth. More importantly for our purposes, one of the reasons for this change in perception is that the chaebols are believed to inhibit the growth of small and medium sized firms, among other things, because most of the finance available was concentrated on the chaebols (see *The Financial Times*, April 23, 1998, "Small business living with the crumbs").⁴⁰ From the late 1990s, the Korean government has been exerting pressure on the chaebols to slim their empires. As a consequence, "with the chaebol no longer dominating access to South Korea's huge pool of savings, credit began to flow to small- and medium-sized firms" (*The Economist*, April 17, 2003, "Unfinished business").

The Korean example is broadly consistent with the picture painted by our model. First, when conglomeration was high, independent firms could not get capital. Second, despite this fact, the conglomerates did not voluntarily dismantle and thus government action was required. Third, after the conglomerates had started reforming, more financing was made available to independent firms. Finally, the fact that the role of the chaebols changed from being the driver of economic growth in the early stages of development to inhibiting development in its later stages could also be explained

performance.

⁴⁰Too much political power (as evidenced by a number of corruption scandals), almost total control of product markets and excessive debt levels are other reasons why the chaebols were believed to be hampering growth.

by our model because it predicts a positive effect of conglomeration for low level of institutional development and a negative effect at intermediate levels.

8 Conclusion

We develop an equilibrium model to understand how the efficiency of capital allocation depends on the degree of conglomeration. We show that conglomerates can be detrimental to capital allocation even when they have efficient *internal* capital markets, because of their effect on the efficiency of the *external* capital markets. Thus, our results suggest that efficient internal capital markets is not a sufficient condition to advocate the presence of conglomerates in developing economies. Conglomeration may impose a negative externality to other firms by making it more difficult for good projects outside the conglomerate to raise funds.

Our model is consistent with anecdotal evidence on the role of business groups in developing countries. In particular, the model gives a rationale for why the presence of business groups may inhibit the growth of new independent firms due to lack of finance. In addition, our model suggests that even when the economy as a whole benefits from having fewer funds allocated through internal capital markets, individual conglomerates cannot be expected to voluntarily dismantle. Thus, there might be a role for policies that directly discourage the presence of conglomerates in developing economies.

One way to reinterpret our result is that, in an equilibrium framework, mitigating an agency cost for only a few firms is not necessarily beneficial for the overall economy. This insight could potentially be extended to the literature on financial intermediaries (e.g. Bencivenga and Smith, 1991; Boyd and Smith, 1992; King and Levine, 1993; Galetovic, 1996). This literature has argued that financial intermediaries perform several roles that aid the allocation of capital, such as discovering information about productivity, pooling funds and diversifying risks. In the context of our model, this reasoning suggests that financial intermediaries could increase pledgeability of cash flows in the economy. However, our results on conglomeration suggest that it is important that banks increase the *aggregate* pledgeability level (our parameter λ), as opposed to increasing pledgeability locally for a group of firms with more direct relationships with banks. If the latter occurs, banks might have similar effects to conglomerates: they might at the same time facilitate reallocation of capital across firms in their local relationships, and decrease the efficiency of overall reallocation because

they compromise reallocation of capital across firms with different banking relationships.

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Appendix

Proof of Proposition 1

We divide the proof in several steps. First, given \mathcal{E} , sets S , C , and O , and any set of contracts offered by firms that have projects in C , we find the optimal allocation rule for investors. Next, given \mathcal{E} , and sets S , C , and O , we find the optimal contracts offered by firms. As promised in the text, in this part we also show that the optimal contracts P^j and P^k offered by a conglomerate $\{j, k\}$ are identical to what two stand-alone firms $\{j\}$ and $\{k\}$ would offer if the pledgeability constraint for these firms were $P^s \leq \bar{P}^s$ $s = j, k$ with \bar{P}^s defined as in the text. In the last step we impose market clearing to derive Equations (4) and (4).

Step 1 (allocation rule). We take as given \mathcal{E} , sets S , C , and O and the set of contracts offered by firms seeking finance. Once the contracts are announced, investors allocate their capital. The following Lemma characterizes the contracts that are taken and the allocation of capital to the general technology.

Lemma 1 *There is a threshold level, R^* , such that investors allocate $\omega^* = x^{-1}(R^*)$ to the general technology and*

- *take all contracts that offer strictly more than R^* (i.e., if $P^i > R^*$, then $r^i = 1$),*
- *do not take any contract that offers strictly less than R^* (i.e., if $P^i < R^*$, then $r^i = 0$), and*
- *take any fraction of the projects that offers exactly R^* .*

Proof. With this allocation, all investment opportunities that do not receive capital yield a lower return than all investment opportunities that do receive capital. As a result, no investor can profitably switch his capital to an available investment opportunity. The precise level of R^* is determined by a market clearing condition, as we show below.

As the Lemma above indicates, investor maximization behavior does not pin down the allocation rule to contracts offering exactly R^* . When there are more contracts offering weakly more than R^* than there is capital available, not all contracts offering exactly R^* receive capital. In this case, investors are indifferent as to the allocation rule to contracts offering exactly R^* . As we will see below, however, not all allocation rules to these contracts guarantee an equilibrium of the offering stage. We describe the equilibrium rule to contracts offering exactly R^* in Lemma 2.

Step 2 (optimal contracts). We still take \mathcal{E} , and the sets S , C , and O as given, but now analyze the optimal contract offered by firms seeking finance. Conglomerates either supply both units of capital to the market, demand two units of capital, or opt out of the market completely. That is, there is no conglomerate that supplies one unit of capital to the market and demands one unit of capital. This is because such transaction is weakly dominated by internal reallocation. Therefore, we only analyze the optimal contracts offered by stand-alone firms that seek one unit of capital and conglomerates that seek two units.

Lemma 2 *The allocation rule for projects offering an amount different than R^* is in Lemma 1. The equilibrium allocation rule to projects offering exactly R^* guarantees one unit of capital with certainty*

- *to contracts $P^i = R^*$ when offered by a stand alone firm $F = \{i\}$ with $\lambda Y_{t(i)} > R^*$,*
- *to contracts $P^i = R^*$ when offered by a conglomerate $G = \{i, j\}$ with $Y_{t(i)} \geq Y_{t(j)}$ and $Y_{t(i)} > R^*$, and*
- *to contracts $P^i = R^*$ when offered by a conglomerate $G = \{i, j\}$ with $Y_{t(i)} < Y_{t(j)}$ and $\lambda(Y_{t(j)} + Y_{t(k)})/2 > R^*$,*

and allocates capital with probability r^ to all other contracts offering exactly R^**

The optimal contracts offered by firms seeking finance are as follows. A stand-alone firm $F = \{i\}$ announces

$$P^i = \begin{cases} R^* & \text{if } \lambda Y_{t(i)} \geq R^* \\ 0 & \text{otherwise} \end{cases} . \text{ A conglomerate } G = \{i, j\} \text{ with } Y_{t(i)} \geq Y_{t(j)} \text{ announces } P^i = \begin{cases} R^* & \text{if } \lambda Y_{t(i)} \geq R^* \\ 0 & \text{otherwise} \end{cases}$$

$$\text{and } P^k = \begin{cases} R^* & \text{if } \frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)}) \geq R^* \\ 0 & \text{otherwise} \end{cases} .$$

Proof. According to Lemma 1, any allocation to projects offering exactly R^* is consistent with investor maximization behavior. However, as we explain below, the particular rule in the Lemma 2 is the only one that guarantees the existence of optimal offers by projects.

We now show the optimality of the contracts offered by firms given the allocation rule by investors. By construction of the set C , projects in this set benefit by raising capital at R^* . Consider the stand alone firm $F = \{i\}$. When $\lambda Y_{t(i)} < R^*$, all feasible announcements by the firm must be strictly lower than R^* and as a result the firm does not raise capital regardless of the proposed contract. Thus, it cannot profitably deviate from the equilibrium contract.

When $\lambda Y_{t(i)} > R^*$, the optimal strategy calls for proposing $P^i = R^*$ and the allocation rule implies that the contract is taken with probability 1. The firm cannot deviate to a better contract. A higher announcement only increases the amount paid with no effect on the probability of receiving capital, and a lower announcement leads to no capital being allocated to the firm. When $\lambda Y_{t(i)} = R^*$, the equilibrium contract calls for $P^i = R^*$ and the allocation rule assigns capital to this firm with some probability r^* . Again, the firm cannot deviate from this strategy. It cannot announce a higher amount due to the pledgeability constraint, and it does not benefit by offering less because that would imply that the firm does not get capital at all.

Now, consider the conglomerate $G = \{i, j\}$ with $Y_{t(i)} \geq Y_{t(j)}$. By the pledgeability constraint in Equation (3) and the IC constraint $P^i \geq P^j$, it follows that

$$P^j \leq \frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)}). \quad (10)$$

We consider all possible cases. 1) When $\lambda Y_{t(i)} < R^*$, it follows by Equation (2) that $P^i < R^*$ and, by the incentive compatibility constraint $P^i \geq P^j$, it must also be that $P^j < R^*$. Thus the conglomerate cannot raise capital with any feasible announcements. That is, it cannot do better than equilibrium strategy $P^i = P^j = 0$. 2) When $\lambda Y_{t(i)} = R^*$ we consider two cases: a) $Y_{t(i)} > Y_{t(j)}$ and b) $Y_{t(i)} = Y_{t(j)}$. In case a), we have that $\frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)}) < R^*$ so the equilibrium strategy calls for $P^i = R^*$ and $P^j = 0$, and the conglomerate raises one unit of capital with probability r^* . In this case, Equation (10) becomes $P^j < R^*$ so the conglomerate cannot raise a second unit of capital with any feasible announcement. As a result, the conglomerate does not benefit from deviating from $P^j = 0$. By the limited pledgeability constraint in Equation (2), the conglomerate cannot raise P^i . Also, reducing P^i is not optimal since that leads to the conglomerate not raising any capital. In sum, the conglomerate cannot profitably deviate from $P^i = R^*$. In case b), we have that $\frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)}) = R^*$ and so the optimal strategy calls for $P^i = P^j = R^*$ and each contract is taken with probability r^* . Increasing either P^i or P^j is precluded by limited liability constraints. Decreasing any of these announcements eliminates the possibility that that particular contract is taken. Thus, the conglomerate cannot profitably deviate from these announcements. 3) When $\lambda Y_{t(i)} > R^* > \frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)})$, the equilibrium strategy calls for $P^i = R^*$ and $P^j = 0$ and the conglomerate raises one unit of capital with probability 1. In this case, Equation (10) implies that $P^j < R^*$. That is, the conglomerate cannot raise a second unit with any feasible announcement and thus cannot profitably deviate from $P^j = 0$. $P^i = R^*$ is optimal because it allows the conglomerate to raise one unit with probability one with the minimum announcement possible. 4) When $\lambda Y_{t(i)} > R^* = \frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)})$, the equilibrium strategy is $P^i = P^j = R^*$. Contract P^i is taken with probability 1 and contract P^j is taken with probability r^* . Decreasing any of these two offers would lead to that particular contract not being taken. Also, the conglomerate cannot raise any of the offers because the pledgeability constraint in Equation (3) binds for these values. 5) Finally, $\frac{\lambda}{2}(Y_{t(i)} + Y_{t(j)}) > R^*$ the equilibrium strategy calls for $P^i = P^j = R^*$ and the equilibrium allocation is such that the conglomerate receives two units of capital for sure. Clearly, there is no profitable deviation because the conglomerate is getting each unit of capital with the minimum announcement possible.

Finally, note that, with the definition of \bar{P} in the text, the contract offered to raise capital for any project i in the economy, can be written as $P^i = \begin{cases} R^* & \text{if } \bar{P}^i \geq R^* \\ 0 & \text{otherwise} \end{cases}$ regardless of whether the project is in a stand-alone firm or in a conglomerate. Also, the probability of a project i receiving capital when $P^i = R^*$ is 1 if $\bar{P}^i > R^*$ and r if $\bar{P}^i = R^*$ regardless of whether the project is in a stand-alone or in a conglomerate. For this reason, once we incorporate the information about the type of firm project i belongs to in the definition of \bar{P}^i , we can treat project i as a stand-alone firm.

The allocation rule in Lemma 2 is the only one that guarantees the existence of an optimal strategy for projects. The key feature of the allocation rule is that it allocates capital for sure to projects that can potentially offer more. If the allocation rule does not guarantee a unit of capital with certainty to those firms that can potentially offer more, then these firms could offer $R^* + \varepsilon$ and get capital with probability 1 (by Lemma 1). But, in this case, an equilibrium would not exist because ε can always be made smaller. Thus, the allocation rule above is the only one for which an equilibrium always exist.

Step 3 (Market clearing). Combining the optimal announcement for each project $i \in C$ in Lemma 2 with the equilibrium allocation rule, we get that a project $i \in C$ receives capital with certainty if $\bar{P}^i > R^*$, receives capital with probability r^* if $\bar{P}^i = R^*$, and does not receive capital if $\bar{P}^i < R^*$. The market clearing condition is then:

$$x^{-1}(R^*) + \int_{\{i \in C | \bar{P}^i > R^*\}} di + \int_{\{i \in C | \bar{P}^i = R^*\}} r^* di = K + \int_{\{i \in S\}} di.$$

Because r^* must be between zero and one, the value of R^* satisfies

$$x^{-1}(R^*) + \int_{\{i \in C | \bar{P}^i > R^*\}} di \leq K + \int_{\{i \in S\}} di \leq x^{-1}(R^*) + \int_{\{i \in C | \bar{P}^i \geq R^*\}} di. \blacksquare$$

Proof of Proposition 2
In the text. ■

Proof of Proposition 3

We start by determining the probabilities that projects in C receive capital as a function of c and λ . This is a simple application of Propositions 1 and 2. From Proposition 2, set C is formed by projects that belong to stand-alone firms M and H , and by projects that belong to type MH conglomerates. Note that there are only three possible values of \bar{P} for projects in this set: λY_H (for projects that belong to the H stand-alone firms and for the type H project that belong to the MH conglomerate), $\lambda \frac{(Y_H + Y_M)}{2}$ (for the M projects that belong to the MH conglomerate), and λY_M (for projects that belong to the M stand-alone firms). We denote these values as \bar{P}_H, \bar{P}_{HM} , and \bar{P}_M . We also let r_H, r_{HM} , and r_M be the probability that projects with \bar{P} equal \bar{P}_H, \bar{P}_{HM} , and \bar{P}_M , respectively, receive capital in the external market. We let T be the amount of liquidation, i.e., $T \equiv (1 - c)p_L + cp_L^2$. We also let $Y_{HM} \equiv (Y_H + Y_M)/2$

We explain the derivation of r_H , the probability that projects with $\bar{P} = \bar{P}_H$ receive capital. As explained in the text there are $(1 - c)p_H + cp_H^2 + cp_{HPM}$ projects in C with $\bar{P} = \lambda Y_H$. This measure can be written more succinctly as $p_H - cp_{LPH}$. For a given level of conglomeration c , we can write r_H as:

$$r_H = \begin{cases} 0 & \text{if } \lambda Y_H < x(K + T) \\ \frac{K+T-x^{-1}(\lambda Y_H)}{p_H - cp_{LPH}} & \text{if } x(K + T) \leq \lambda Y_H < x(K + T - p_H + cp_{LPH}) \\ 1 & \text{if } \lambda Y_H \geq x(K + T - p_H + cp_{LPH}) \end{cases}$$

The probability that projects with $\bar{P} = \lambda Y_H$ get capital depends on whether the required return on capital (the return of the general technology) is higher or lower than λY_H . If $\lambda Y_H < x(K + T)$, then these projects cannot get capital because even when the entire capital supply is invested in the general technology the required return on capital is too high. If $\lambda Y_H \geq x(K + T)$, then projects can get some capital. However, if $\lambda Y_H < x(K + T - p_H + cp_{LPH})$ then if all of the projects get capital the return on capital becomes lower than their pledgeable income. In this case projects with $\bar{P} = \lambda Y_H$ are rationed, and the return on capital is such that $x(\omega^*) = \lambda Y_H$, or $\omega^* = x^{-1}(\lambda Y_H)$. An amount of capital equal to $x^{-1}(\lambda Y_H)$ is invested in the general technology, and thus the probability that a project gets capital is equal to $\frac{K+T-x^{-1}(\lambda Y_H)}{p_H - cp_{LPH}}$. Finally, if $\lambda Y_H \geq x(K + T - p_H + cp_{LPH})$ then all projects can get capital, and $r_H = 1$.

Exactly analogous reasoning leads to the following equations for r_{HM} and r_M :

$$r_{HM} = \begin{cases} 0 & \text{if } \lambda Y_{HM} < x(K + T - p_H + cp_{LPH}) \\ \frac{K+T-p_H+cp_{LPH}-x^{-1}(\lambda Y_{HM})}{cp_{HPM}} & \text{if } x(K + T - p_H + cp_{LPH}) \leq \lambda Y_{HM} < \\ & < x(K + T - p_H + cp_{LPH} - cp_{MPH}) \\ 1 & \text{if } \lambda Y_{HM} \geq x(K + T - p_H + cp_{LPH} - cp_{MPH}) \end{cases}$$

$$r_M = \begin{cases} 0 & \text{if } \lambda Y_M < x(K + T - p_H + cp_{LPH} - cp_{MPH}) \\ \frac{K+T-p_H+cp_{LPH}-cp_{HPM}-x^{-1}(\lambda Y_M)}{(1-c)p_M+cp_M^2} & \text{if } x(K + T - p_H + cp_{LPH} - cp_{MPH}) \leq \lambda Y_M < \\ & < x(K + T - p_H + cp_{LPH} - cp_{MPH} - (1-c)p_M - cp_M^2) \\ 1 & \text{if } \lambda Y_M \geq x(K + T - p_H + cp_{LPH} - cp_{MPH} - (1-c)p_M - cp_M^2) \end{cases}$$

The definition of r_H, r_{HM} and r_M motivate the definition of the following functions of λ : $\tilde{\lambda}_1 = x(K + T)/Y_H$, $\tilde{\lambda}_2 = x(K + T - p_H + cp_{LPH})/Y_H$, $\tilde{\lambda}_3 = x(K + T - p_H + cp_{LPH})/Y_{HM}$, $\tilde{\lambda}_4 = x(K + T - p_H + cp_{LPH} - cp_{MPH})/Y_{HM}$, $\tilde{\lambda}_5 = x(K + T - p_H + cp_{LPH} - cp_{MPH})/Y_M$ and $\tilde{\lambda}_6 = x(K + T - p_H + cp_{LPH} - cp_{MPH} - (1 - c)p_M - cp_M^2)/Y_M$. For any c , the value of these functions satisfy $\tilde{\lambda}_1 < \tilde{\lambda}_2 < \dots < \tilde{\lambda}_6$.

To lighten notation we let $r'_t \equiv \frac{\partial r_t}{\partial c}$ for $t = H, HM$, and M and $f(\omega) = \omega x(\omega)$. The aggregate payoff function is given by:

$$\Pi = f(\omega) + (1 - c)[p_H(Y_H + r_H Y_H) + p_M(Y_M + r_M Y_M)] + \frac{c}{2} \left[p_H^2(2)(Y_H + r_H Y_H) + p_M^2(2)(Y_M + r_M Y_M) + 2p_H p_M(2Y_H + r_H Y_M + r_{HM} Y_M) + 2p_H p_L(2Y_H) + 2p_M p_L(2Y_M) \right] \quad (11)$$

where $\omega = K + (1 - c)p_L + cp_L^2 - r_H(p_H - cp_{LPH}) - r_{HM}(cp_{HPM}) - r_M((1 - c)p_M + cp_M^2)$. We analyze $\frac{d\Pi}{dc}$ in all the regions defined by $\tilde{\lambda}_k$ $k = 1, 2, \dots, 6$. We denote by $\frac{\partial \Pi}{\partial c}$ the derivative of Π wrt c assuming that r_H, r_{HM} and r_M are constants:

$$\frac{\partial \Pi}{\partial c} = p_{LPH}(1 - r_H)(Y_H - f'(\omega)) + p_{HPM}(1 - r_H)(Y_H - Y_M) + p_M(1 - p_M)(1 - r_M)(Y_M - f'(\omega)) + p_{HPM}(r_{HM} - 1)(Y_M - f'(\omega)) \quad (12)$$

For $\lambda < \tilde{\lambda}_1$, $r_H = r_{HM} = r_M = 0$ and since $r'_H = r'_{HM} = r'_M = 0$ we can use equation 12 to obtain $\frac{d\Pi}{dc} = \frac{\partial \Pi}{\partial c} = p_{LPH}(Y_H - f'(\omega)) + p_{HPM}(Y_H - Y_M) + p_{MPH}(Y_M - f'(\omega)) > 0$ since $f'(\omega) = x(\omega) + \omega x'(\omega) \leq x(\omega) < Y_M < Y_H$.

For $\tilde{\lambda}_1 < \lambda < \tilde{\lambda}_2$, $r_H \in (0, 1)$, $r_{HM} = 0$ and $r_M = 0$ also $r'_H \neq 0$ and $r'_{HM} = r'_M = 0$. Also in this region, simple algebra leads to $\frac{\partial \omega}{\partial c} = 0$. Thus, $\frac{d\Pi}{dc} = p_L p_H (1 - r_H) Y_H + p_H p_M (1 - r_H) (Y_H - Y_M) + p_M p_L Y_M + r'_H [(1 - c) p_H Y_H + c p_H^2 Y_H + c p_H p_M Y_M]$ and $r'_H = \frac{-p_L + p_L^2 + r_H p_H p_L}{p_H - c p_L p_H}$. In the limit as $\lambda \rightarrow \tilde{\lambda}_2$, $r_H \rightarrow 1$ and $\frac{d\Pi}{dc} = p_M p_L Y_M - p_M p_L [\gamma Y_H + (1 - \gamma) Y_M] < 0$ where $\gamma = (1 - c + c p_H) / (1 - c p_L)$. Also $\frac{\partial}{\partial \lambda} \left(\frac{d\Pi}{dc} \right) = \frac{\partial}{\partial r_H} \left(\frac{d\Pi}{dc} \right) \frac{\partial r_H}{\partial \lambda}$. Since $x(\cdot)$ is a decreasing function $\frac{\partial r_H}{\partial \lambda}$ is increasing. And since $\frac{\partial}{\partial r_H} \left(\frac{d\Pi}{dc} \right) = -p_H p_L Y_H - p_H p_M (Y_H - Y_M) + p_H p_L [\gamma Y_H + (1 - \gamma) Y_M] < 0$ then $\frac{\partial}{\partial \lambda} \left(\frac{d\Pi}{dc} \right) < 0$.

If $\frac{d\Pi}{dc} \Big|_{\tilde{\lambda}_1} \leq 0$ then we define $\hat{\lambda}_1 = \tilde{\lambda}_1$. If $\frac{d\Pi}{dc} \Big|_{\tilde{\lambda}_1} > 0$ then since $\frac{\partial}{\partial \lambda} \left(\frac{d\Pi}{dc} \right) < 0$ and $\frac{d\Pi}{dc} \Big|_{\tilde{\lambda}_2} < 0$, there is a $\lambda^* \in (\tilde{\lambda}_1, \tilde{\lambda}_2)$ such that $\frac{d\Pi}{dc} \Big|_{\lambda^*} = 0$. In this case we define $\hat{\lambda}_1 = \lambda^*$. We also define $\hat{\lambda}_2 = \tilde{\lambda}_2$. So far we have shown that to the left of $\hat{\lambda}_1$, $\frac{d\Pi}{dc}$ is positive, and from $\hat{\lambda}_1$ to $\hat{\lambda}_2$, $\frac{d\Pi}{dc}$ is negative. Left to prove is that to the right of $\hat{\lambda}_2$, $\frac{d\Pi}{dc}$ is non-negative.

For $\tilde{\lambda}_2 < \lambda < \tilde{\lambda}_3$, $r_H = 1$, $r_{HM} = r_M = 0$ and $r'_H = r'_{HM} = r'_M = 0$. Using equation 12, $\frac{d\Pi}{dc} = \frac{\partial \Pi}{\partial c} = p_M p_L (Y_M - f'(\omega)) > 0$.

For $\tilde{\lambda}_3 < \lambda < \tilde{\lambda}_4$, $r_H = 1$, $r_{HM} \in (0, 1)$, $r_M = 0$ and $r'_{HM} \neq 0$ and $r'_H = r'_M = 0$. Also in this region, simple algebra leads to $\frac{\partial \omega}{\partial c} = 0$. Thus, $\frac{d\Pi}{dc} = p_M p_L Y_M + p_H p_M r_{HM} Y_M + c p_H p_M r'_{HM} Y_M$ and $r'_{HM} = \frac{-p_L + p_L^2 - p_H p_L + r_{HM} p_H p_M}{c p_H p_M}$. Substituting the value of r'_{HM} and simplifying leads to $\frac{d\Pi}{dc} = 0$.

For $\tilde{\lambda}_4 < \lambda < \tilde{\lambda}_5$, $r_H = 1$, $r_{HM} = 1$, $r_M = 0$ and $r'_H = r'_{HM} = r'_M = 0$. Using equation 12, $\frac{d\Pi}{dc} = \frac{\partial \Pi}{\partial c} = p_M (1 - p_M) (Y_M - f'(\omega)) > 0$.

For $\tilde{\lambda}_5 < \lambda < \tilde{\lambda}_6$, $r_H = 1$, $r_{HM} = 1$, $r_M \in (0, 1)$ and $r'_M \neq 0$ and $r'_{HM} = r'_M = 0$. Also in this region, simple algebra leads to $\frac{\partial \omega}{\partial c} = 0$. $\frac{d\Pi}{dc} = p_M p_L Y_M + p_H p_M Y_M - p_M r_M Y_M + p_M^2 r_M Y_M + r'_M ((1 - c) p_M Y_M + c p_M^2 Y_M)$ and $r'_M = \frac{-p_L + p_L^2 + p_L p_H - p_H p_M - r_M (-p_M + p_M^2)}{(1 - c) p_M + c p_M^2}$. Substituting the value of r'_M and simplifying leads to $\frac{d\Pi}{dc} = 0$.

Finally, for $\lambda > \tilde{\lambda}_6$, $r_H = 1$, $r_{HM} = 1$, $r_M = 1$ and $r'_H = r'_{HM} = r'_M = 0$. Using equation 12, $\frac{d\Pi}{dc} = \frac{\partial \Pi}{\partial c} = 0$.

Thus, to the right of $\hat{\lambda}_2$, $\frac{d\Pi}{dc}$ is non-negative ■

Results of section 5

Suppose that a contract $\{D_1, D_2\}$ was offered at date t_0 . Once the productivity s is realized at date t_1 , one of two things can happen: either $y_s < D_1$, in which case the entrepreneur cannot meet his obligations and the firm is liquidated, or $y_s \geq D_1$, in which case the entrepreneur can meet its debt obligation and can decide whether or not to liquidate.

Let's analyze the decision to liquidate when $y_s \geq D_1$. The entrepreneur's payoff from liquidation is:

$$y_s R + (1 - \min\{1, D_1 + \frac{D_2}{R}\}) R = y_s R + R - D_1 R - D_2 + \Delta,$$

where $\Delta \equiv \max\{R D_1 + D_2 - R, 0\}$. The entrepreneur's payoff from continuation is:

$$\begin{aligned} (y_s - D_1) R + Y_s - \min\{D_2, \lambda Y_s\} + r_s (Y_s - R) \\ = (y_s - D_1) R + Y_s - D_2 + \Theta_s + r_s (Y_s - R), \end{aligned}$$

where $\Theta_s \equiv \max\{0, D_2 - \lambda Y_s\}$ and r_s is the probability that a project of type s receives additional capital at date t_1 . Therefore, the entrepreneur continues in state s if and only if:

$$\begin{aligned} (y_s - D_1) R + Y_s - D_2 + \Theta_s + r_s (Y_s - R) &\geq y_s R + R - D_1 R - D_2 + \Delta \\ Y_s + r_s (Y_s - R) + \Theta_s &\geq R + \Delta \end{aligned}$$

We solve the problem under the assumption that $D_1 + \frac{D_2}{R} \leq 1$, i.e., the present value of the repayments is lower than 1. Recall that the total investment cost is 1, and that the entrepreneur contributes all of his wealth to the project. Therefore, it is reasonable to assume that the present value of the repayments is lower than 1. Finally, this inequality implies that $\Delta = 0$.

Now, note that in states M and H , the entrepreneur always continues because $Y_s + r_s (Y_s - R) + \Theta_s \geq Y_s \geq R = R + \Delta$, where the second inequality follows from $R < Y_M < Y_H$. In state L , however, it is possible that the entrepreneur continues rather than liquidate if Θ_L is high enough, i.e., $\Theta_L > R - Y_L$. Because $R - Y_L > 0$, it must be that $\Theta_L = D_2 - \lambda Y_L > 0$. The inequality becomes $D_2 - \lambda Y_L > R - Y_L$ or $D_2 > R - (1 - \lambda) Y_L$.

Case 1 (low financing needs)

Let's design a contract that 1) always leaves the entrepreneur with the choice of liquidation vs. continuation and 2) provides incentives so that the entrepreneur chooses the optimal action.

To satisfy 1), we need $D_1 < y_s$ for all s . This implies that $D_1 \leq y_L$.

Regarding 2), recall that we are trying to implement liquidation in state L and continuation in states M and H . We showed above that, when $D_1 \leq y_s$, for $s = M, H$, the entrepreneur always continues and, as long as $D_2 \leq R - (1 - \lambda) Y_L$,

the entrepreneur liquidates when the state is L . Thus, a contract with $D_1 \leq y_L$ and $D_2 \leq R - (1 - \lambda)Y_L$ implements the optimal liquidation rule.

We now compute the amount of external finance that can be raised with this contract. For this we set $D_1 = y_L$ and $D_2 = R - (1 - \lambda)Y_L$. In state L , the project is liquidated and the investor receives $D_1 + \frac{D_2}{R}$ (as explained above this is lower than 1). In states M and H the project is continued so that at date t_1 the investor receives D_1 and at date t_2 the investor receives $\min\{\lambda Y_s, D_2\}$. Thus, this solution is feasible whenever:

$$D_1 + p_L\left(\frac{D_2}{R}\right) + p_M\left(\frac{\min\{\lambda Y_M, D_2\}}{R}\right) + p_H\left(\frac{\min\{\lambda Y_H, D_2\}}{R}\right) \geq Z^{SA}, \quad (13)$$

where $D_1 = y_L$ and $D_2 = R - (1 - \lambda)Y_L$

Case 2 (high financing needs)

When inequality (13) does not hold, it is impossible to write a contract that 1) always gives the liquidation choice to the entrepreneur and 2) provides incentives so that the entrepreneur chooses the optimal action.

We consider two subcases. In the first one, it is not optimal to take away the choice from the entrepreneur and, as a result, the contract must involve the entrepreneur taking a suboptimal action. In the second subcase, it is possible to take away the choice from the entrepreneur, but force him to liquidate in state L .

Subcase A ($y_L = y_M = y_H = \bar{y}$).

If inequality (13) does not hold, then either $D_1 > y_L = \bar{y}$ or $D_2 > R - (1 - \lambda)Y_L$. If $D_1 > \bar{y}$, the entrepreneur always liquidates. In this case, the investment is 1 and the project always generates 1 at date t_1 . Because the rate of return between date t_0 and date t_1 is 0, the project is zero NPV. Thus, the entrepreneur is indifferent between setting up the project or not.

If $D_2 > R - (1 - \lambda)Y_L$, the entrepreneur continues in all states of the world. The payoff of this project as of date t_2 is $p_L Y_L + p_M Y_M + p_H (Y_H + r_H (Y_H - R))$. If this expression is bigger than R^* , then the project is positive NPV. This is the situation in which we see projects being taken and continued in all states of the world.

Subcase B ($y_L < y_M \leq y_H$)

In this case we can restore the optimal liquidation rule by setting $y_L < D_1 < y_M$. In this case, the project is liquidated for sure in state L because the entrepreneur cannot pay the entire D_1 . Because the project is liquidated in state L by using a sufficiently high D_1 , we do not need to impose $D_2 \leq R - (1 - \lambda)Y_L$. Thus D_2 can be as high as needed to raise external finance. Recall that changing D_2 does not affect the entrepreneur's decision to continue in states M and H .

Optimal contracts for a conglomerate

We consider the case of the conglomerate. The analysis is almost identical to the one for the stand-alone firm. The following are sufficient conditions to implement the optimal liquidation rule in the case of a conglomerate. We assume that we are in the case in which $y_L < y_M < y_H$. Set $D_1 = y_L + y_M$ and $D_2 = 2\lambda Y_H$. Because $D_1 > 2y_L$, $D_1 \leq y_L + y_M \leq y_L + y_H$, $D_1 \leq 2y_M$, $D_1 \leq y_H + y_M$, $D_1 \leq 2y_H$, the entrepreneur liquidates in state LL but has the choice of continuation or liquidation in all other states. As in the case of the stand-alone firm, the entrepreneur follows the optimal decision rule (which is continuation), and if anything, has a bias towards continuation. Therefore, $D_1 = y_L + y_M$ and $D_2 = 2\lambda Y_H$ implements the optimal liquidation rule in all states and raises the most money possible.

If Z^C is sufficiently high, it is possible that this contract does not pledge sufficient cash flows to the date- t_0 investors. In this case, D_1 will have to be increased. However, this will induce excessive liquidation, i.e., liquidation in state LM . In the next section we focus on the case in which the optimal liquidation rule can be implemented, both for the conglomerate and the stand-alone firm.

Proof of Proposition 4

The probability $r_H(\lambda, c)$ is decreasing in c , and increasing in λ . Thus, we can define λ_1 such that:

$$r_H(\lambda_1, 0) = 0$$

and λ_2 as:

$$r_H(\lambda_2, 1) = 1$$

Given the properties of r_H , we know that for all $\lambda < \lambda_1$, r_H will be equal to zero for all c . Similarly, for all $\lambda > \lambda_2$, r_H will be equal to one for all c .

We now characterize the behavior of the function $U^C(c) - U^{SA}(c)$ in these extreme ranges of λ . An equilibrium level of conglomeration obtains when this function is equal to the conglomeration cost d . We restrict the analysis to a parameter range in which only high productivity projects can raise additional capital in the reallocation market, that is, $r_{MH} = r_M = 0$. As explained in section 5, in order to obtain efficient liquidation decisions we need to have first period cash flows that are positively correlated with productivity. However, the absolute size of these cash flows

is irrelevant. In order to simplify the notation, we assume that the first period cash flows y_s are close to zero, so that we can ignore them in the analysis below. This assumption changes nothing in the results, since the time- t_2 cash flow of the first unit of capital Y_s can be interpreted as including the first period cash flow.

Under these assumptions, $U^{SA}(c)$ can be written as:

$$U^{SA}(c) = p_H(Y_H + r_H(Y_H - R)) + p_M Y_M + p_L R - R \quad (14)$$

and $U^C(c)$ is:

$$U^C(c) = p_H^2(2Y_H + 2r_H(Y_H - R)) + 2p_M p_H(2Y_H + r_H(Y_M - R)) + p_M^2 2Y_M + 2p_H p_L 2Y_H + 2p_M p_L 2Y_M + p_L^2 2R - 2R \quad (15)$$

If $\lambda < \lambda_1$, or if $\lambda > \lambda_2$, r_H is constant and thus:

$$\frac{\partial[U^C - U^{SA}]}{\partial c} = \frac{\partial[U^C - U^{SA}]}{\partial R} \frac{\partial R}{\partial c}$$

If $\lambda < \lambda_1$, r_H is zero and thus:

$$\frac{\partial[U^C - U^{SA}]}{\partial R} = p_L(2p_L - 1) - 1 < 0$$

If $\lambda > \lambda_2$, r_H is one and thus:

$$\begin{aligned} \frac{\partial[U^C - U^{SA}]}{\partial R} &= -2p_H^2 - 2p_H p_M + 2p_L^2 + p_H - p_L - 1 \\ &= -2p_H^2 - 2p_H p_M - p_M - 2(p_L - p_L^2) < 0 \end{aligned}$$

Since $\frac{\partial R}{\partial c} > 0$, we conclude that if $\lambda \leq \lambda_1$, or if $\lambda \geq \lambda_2$, $\frac{\partial[U^C - U^{SA}]}{\partial c} < 0$. As Figure 4, Panel B shows, in this case there will be a unique equilibrium level of conglomeration c^* , determined at the point at which $U^C - U^{SA} = d$. Notice that if d is too low/high, the equilibrium could be at a corner solution with zero or full conglomeration.

We now consider the range $\lambda_1 < \lambda < \lambda_2$. We restrict the analysis for a range $(\lambda'_1, \lambda'_2) \subset (\lambda_1, \lambda_2)$ such that within this range a variation in c from 0 to 1 causes r_H to vary from 0 to 1, for all λ . In this range of λ there exist three cutoff values for c such that:⁴¹

$$\begin{aligned} c_1(\lambda) < c \leq c_2(\lambda), \quad r_H(c, \lambda) &= 1 \\ c_2(\lambda) < c \leq c_3(\lambda), \quad r_H(c, \lambda) &\in (0, 1) \\ c_3(\lambda) < c \leq 1, \quad r_H(c, \lambda) &= 0 \end{aligned} \quad (16)$$

To simplify the notation we write these cutoffs as c_1 , c_2 , and c_3 from now on, but it is understood that they depend on λ . We now characterize the derivative $\frac{\partial[U^C - U^{SA}]}{\partial c}$ for the different ranges of c defined in equation 16.

Range 1 - $c_1 < c \leq c_2$

In this range we have $\frac{\partial[U^C - U^{SA}]}{\partial c} = \frac{\partial[U^C - U^{SA}]}{\partial R} \frac{\partial R}{\partial c}$. Since $\frac{\partial R}{\partial c} > 0$, the derivative has the same sign as $\frac{\partial[U^C - U^{SA}]}{\partial R}$, which we showed above to be negative when $r_H(c, \lambda) = 1$. Thus, $\frac{\partial[U^C - U^{SA}]}{\partial c} < 0$.

Range 2 - $c_2 < c \leq c_3$

In this range we have $\frac{\partial[U^C - U^{SA}]}{\partial c} = \frac{\partial[U^C - U^{SA}]}{\partial r_H} \frac{\partial r_H}{\partial c}$. Since $\frac{\partial r_H}{\partial c} < 0$, this has the opposite sign of:

$$\begin{aligned} \frac{\partial[U^C - U^{SA}]}{\partial r_H} &= 2p_H^2(Y_H - R) + 2p_H p_M(Y_M - R) - p_H(Y_H - R) = \\ &= -p_H[(1 - 2p_H)(Y_H - R) - 2p_M(Y_M - R)] \end{aligned}$$

This can be positive or negative.

Range 3 - $c_3 < c \leq 1$

The analysis is similar to range 1, since we have $\frac{\partial[U^C - U^{SA}]}{\partial c} = \frac{\partial[U^C - U^{SA}]}{\partial R} \frac{\partial R}{\partial c}$. Given that $\frac{\partial R}{\partial c} > 0$, the derivative has the same sign as $\frac{\partial[U^C - U^{SA}]}{\partial R}$, which we have shown above to be negative when $r_H = 0$. Thus, $\frac{\partial[U^C - U^{SA}]}{\partial c} < 0$.

This analysis shows that there are basically two cases to analyze if $\lambda \in (\lambda'_1, \lambda'_2)$. If $\frac{\partial[U^C - U^{SA}]}{\partial r_H} > 0$, then $\frac{\partial[U^C - U^{SA}]}{\partial c}$ is (weakly) negative for all c . In this case, there will be a unique equilibrium level of conglomeration c^* , determined at the point at which $U^C - U^{SA} = d$ (see Figure 4, Panel B).

⁴¹The first value $c_1(\lambda)$ is defined such that conglomerates of type HM cannot raise capital for any $c > c_1(\lambda)$.

On the other hand, if $\frac{\partial[U^C-U^{SA}]}{\partial r_H} < 0$, then $\frac{\partial[U^C-U^{SA}]}{\partial c} > 0$ in the range $c_2 < c \leq c_3$. In this case we might have multiple equilibria. This is the case depicted in Figure 4, Panel A. The intermediate equilibrium is always unstable, though, so we ignore it. As stated in the proposition, the lower equilibrium level \underline{c} is always associated with a higher probability that high productivity projects can raise capital, that is, $r_H(\underline{c}) > r_H(\bar{c})$.

Notice as well from Figure 4, Panel A that the stable equilibria must be in the range in which $\frac{\partial[U^C-U^{SA}]}{\partial c} < 0$. Thus, the low conglomeration equilibrium \underline{c} is such that $r_H(\underline{c}) = 1$, and similarly we must have $r_H(\bar{c}) = 0$. ■

Welfare comparison between the two equilibria

We will show that if the $x(\cdot)$ function is sufficiently steep, and if $p_H \geq p_L$, the equilibrium with low conglomeration is always better from society's point of view.

First we define what we mean by a 'steeper' $x(\cdot)$ function. We start with any $x(\cdot)$ function that leads to two equilibrium levels of conglomeration \underline{c} and \bar{c} , with respective date t_1 equilibrium returns \underline{R} and \bar{R} . We also define $\bar{\omega}$ as the amount of capital going to the general technology in the high conglomeration equilibrium. We consider a family of $x(\cdot)$ functions that pass through the high conglomeration equilibrium, that is all $x(\cdot)$ function in this family satisfy $x(\bar{\omega}) = \bar{R}$. For each $x(\cdot)$ we define $\Delta\omega$ as $x(\bar{\omega} + \Delta\omega) = \underline{R}$. That is, $\Delta\omega$ is the additional amount of capital that has to be invested in the general technology to drive the return down from \bar{R} to \underline{R} . Intuitively, the smaller the $\Delta\omega$, the 'steeper' the $x(\cdot)$ function. We show that there is a level $\widehat{\Delta\omega}$ such that for all $x(\cdot)$ functions in the family defined above with $\Delta\omega < \widehat{\Delta\omega}$, the low conglomeration equilibrium is the better one.

First, notice that for a given set of parameters $\{Y_H, Y_M, p_H, p_L, p_M, d\}$ the equilibrium returns \bar{R} and \underline{R} must be such that $U^C(c) - U^{SA}(c) = d$ in both equilibria. Because $U^C(c)$ and $U^{SA}(c)$ do not depend on the $x(\cdot)$ function (see expressions 15 and 14 above), it is clear that \bar{R} and \underline{R} are independent of the steepness of the $x(\cdot)$ function. However, the level of c at the low conglomeration equilibrium will be not be the same as different amounts of capital need to be released to the external market to achieve a return of \underline{R} . In other words, for the family of $x(\cdot)$ functions we consider, there are two equilibria: (\bar{c}, \bar{R}) , and $(\underline{c}(\Delta\omega), \underline{R})$. The only unknown is $\underline{c}(\Delta\omega)$.

To solve for $\underline{c}(\Delta\omega)$, we use the market clearing conditions at the two equilibria:

$$\begin{aligned} K + (1 - \bar{c})p_L + \bar{c}p_L^2 &= \bar{\omega} \\ K + (1 - \underline{c})p_L + \underline{c}p_L^2 &= \bar{\omega} + \Delta\omega + p_H - \underline{c}p_L p_H \end{aligned}$$

These expressions follow from the fact that at the high conglomeration equilibrium $r_H = r_{HM} = r_M = 0$ and at the low conglomeration equilibrium $r_H = 1$ and $r_{HM} = r_M = 0$. Letting $\underline{c} = \bar{c} - \Delta c$, subtracting one equation from the other, and simplifying leads to:

$$\Delta c = \frac{p_H - \underline{c}p_L p_H + \Delta\omega}{p_L(1 - p_L)}$$

We use equation 11 to compute $\Pi(\underline{c}) - \Pi(\bar{c})$. We do not consider the cost d of conglomeration in the aggregate payoff. Including this cost only helps our result since the number of conglomerates is smaller and consequently so is the total cost of conglomeration in the low conglomeration equilibrium. After some algebraic simplification we obtain:

$$\begin{aligned} \Pi(\underline{c}) - \Pi(\bar{c}) &= f(\bar{\omega} + \Delta\omega) - f(\bar{\omega}) + (1 - \underline{c})p_H Y_H + \\ &\quad \underline{c}(p_H^2 Y_H + p_M p_H Y_M) - \Delta c(p_H(1 - p_H)Y_H + p_M(p_L - p_H)Y_M) \end{aligned}$$

We first evaluate this expression at $\Delta\omega = 0$. Notice that $(1 - \underline{c})p_H Y_H - \Delta c p_H(1 - p_H)Y_H \geq \Delta c p_H Y_H - \Delta c p_H(1 - p_H)Y_H \geq 0$, so the only potentially negative term in the expression is $-\Delta c p_M(p_L - p_H)Y_M$. If $p_L \leq p_H$ this expression is positive, so $\Pi(\underline{c}) - \Pi(\bar{c}) > 0$ at $\Delta\omega = 0$.

The derivative of $\Pi(\underline{c}) - \Pi(\bar{c})$ with respect to $\Delta\omega$ is: $x(\bar{\omega} + \Delta\omega) + (\bar{\omega} + \Delta\omega)x'(\bar{\omega} + \Delta\omega) - (p_H(1 - p_H)Y_H + p_M(p_L - p_H)Y_M)\frac{d\underline{c}}{d\Delta\omega}$, where $\frac{d\underline{c}}{d\Delta\omega} = \frac{1}{p_L(1 - p_L)}$. This derivative is negative, because $x'(\bar{\omega} + \Delta\omega) < 0$, and because $-(p_H(1 - p_H)Y_H + p_M(p_L - p_H)Y_M)\frac{d\underline{c}}{d\Delta\omega} = \frac{-p_M p_H(Y_H - Y_M) - p_L p_H Y_H - p_L p_M Y_M}{p_L(p_M + p_H)} < \frac{-p_M p_H(Y_H - Y_M) - p_L p_H Y_M - p_L p_M Y_M}{p_L(p_M + p_H)}$

$< -Y_M$, and $Y_M > x(\bar{\omega} + \Delta\omega)$. Therefore, there is a level $\widehat{\Delta\omega}$ such that for all $x(\cdot)$ with $\Delta\omega < \widehat{\Delta\omega}$, the low conglomeration equilibrium is associated with higher welfare. ■

Figure 2

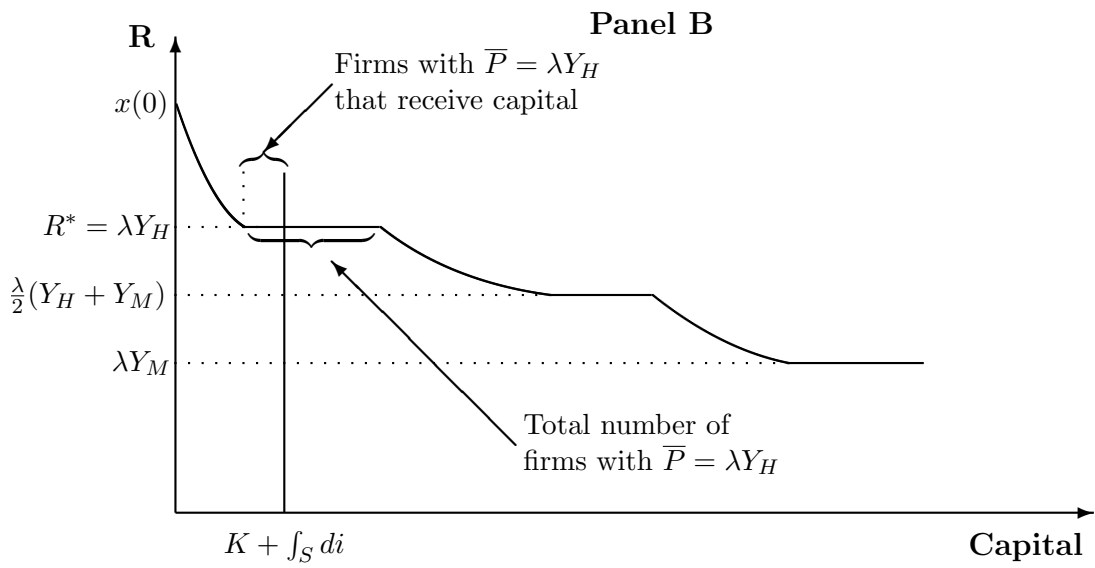
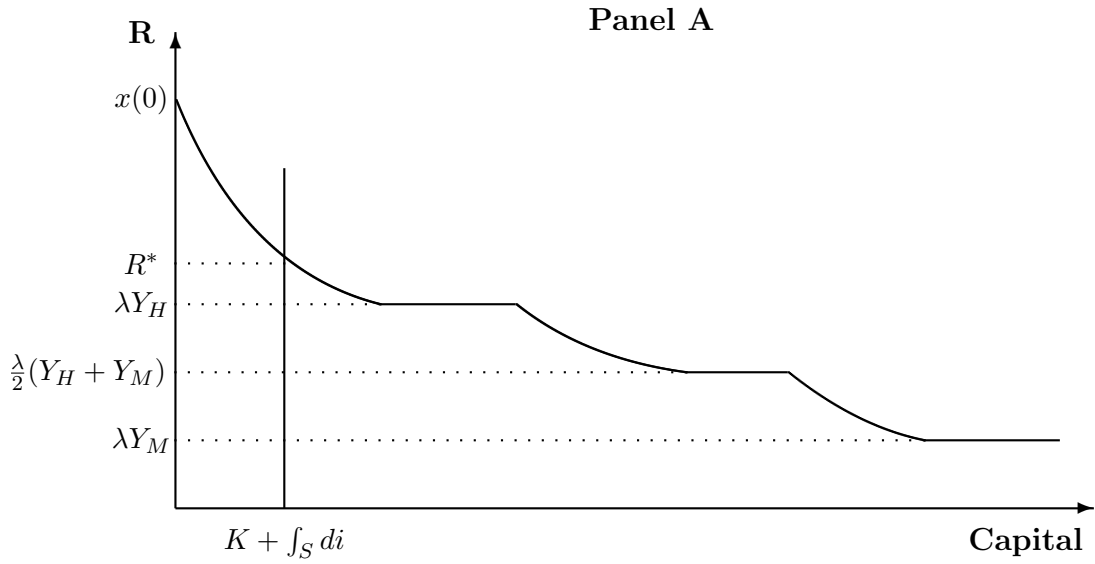


Figure 3

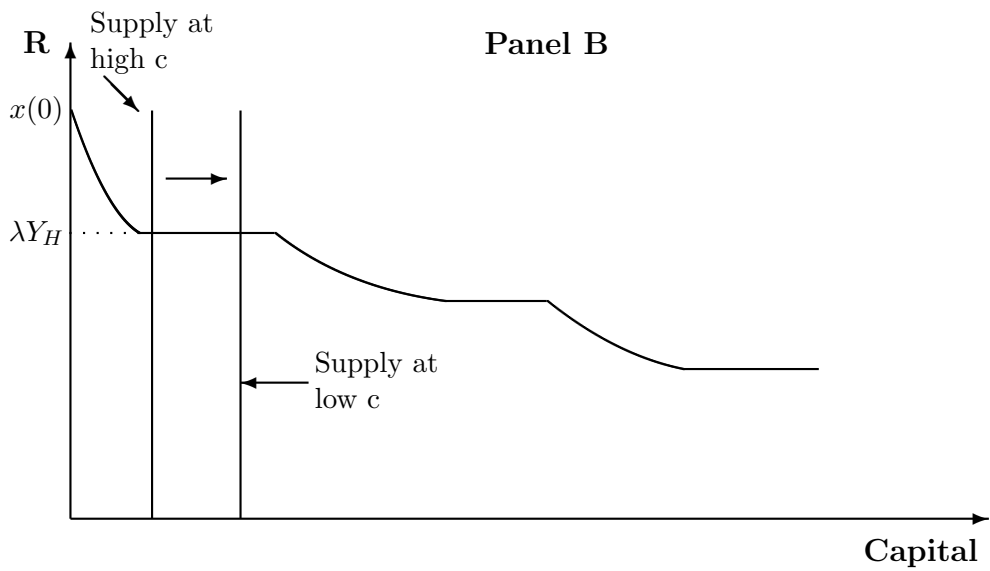
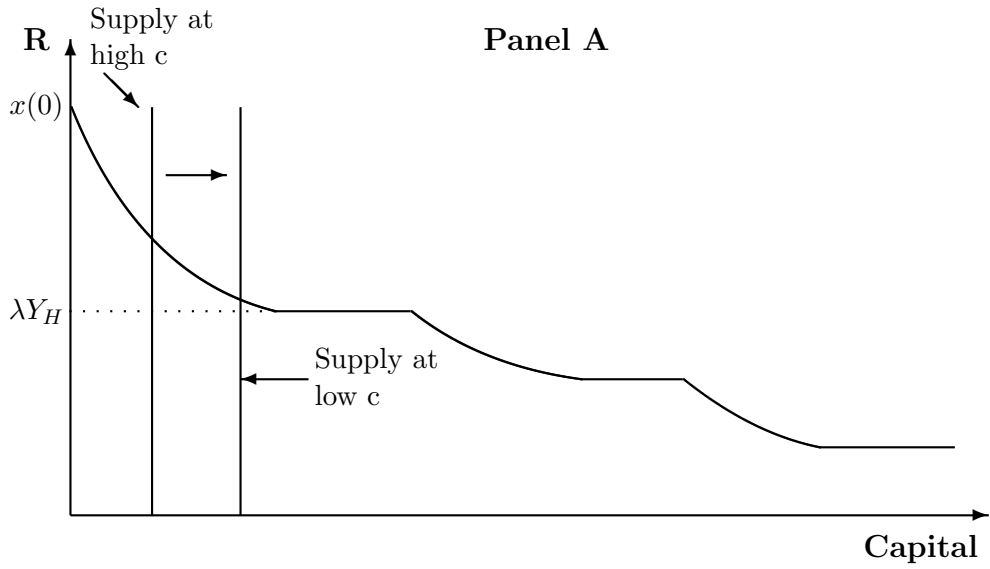
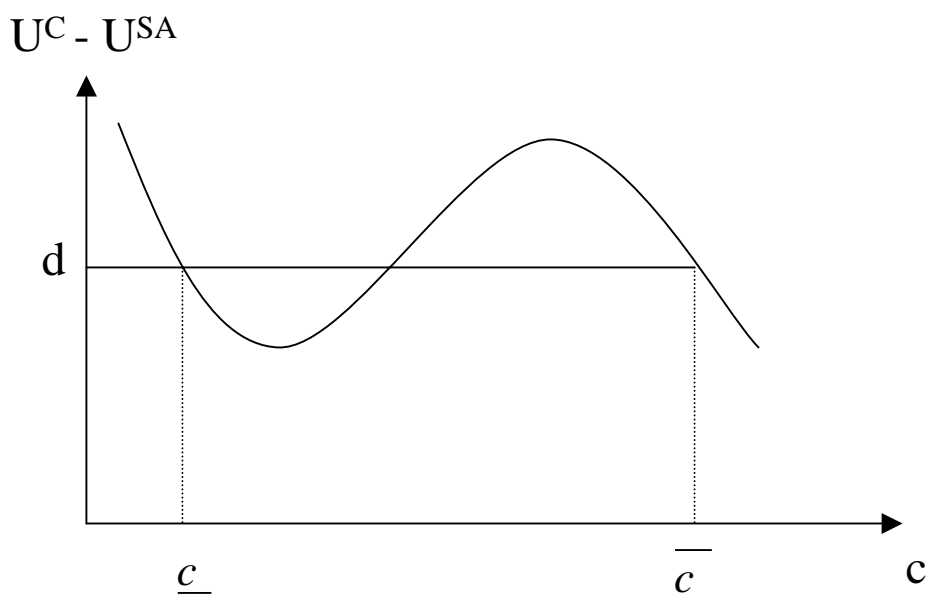


Figure 4

Panel A



Panel B

