Financial Frictions, Internal Capital Markets, and the Organization of Production

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Abstract

This paper evaluates the role of internal capital markets in business groups for allocating capital to its most productive use. A quantitative model in which business groups arise endogenously as substitutes for imperfect credit markets explains several stylized facts about establishment size distribution and cross-firm productivity differences. The impact of internal capital markets on economic development is positive: shutting down business conglomeration in the model calibrated to the Canadian economy would lead to a 3 percent reduction in output per capita. These losses are higher in economies with less developed financial markets.

Keywords: misallocation, credit constraint, business conglomeration, TFP

1. Introduction

Recent economic development literature documented substantial dispersion in the marginal products of resources across heterogeneous productive establishments in several countries and argued that misallocation of resources can account for a large part of cross-country differences in aggregate total factor productivity (TFP) and income per capita (Banerjee et al., 2003; Alfaro et al., 2008; Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Bartelsman et al., 2013). One privileged explanation for resource misallocation is that financial market imperfections hinder the flow of capital to the most productive firms (see Jeong and Townsend, 2007; Amaral and Quintin, 2010; Buera et al., 2011, for quantitative evaluations of this mechanism).

However, allocation of capital to individual establishments is determined not only by financial markets but also by firm's internal organization. In fact, reshuffling capital among establishments *inside* the enterprise could, at least partially, overcome the (mis)allocative effects of financial market imperfections. Such internal reallocation is likely to play an especially important role in diversified conglomerates and business groups.[1] Although these forms of organizing production are ubiquitous in countries with less developed financial markets (see Khanna and Yafeh, 2007; Masulis et al., 2011), existing macroeconomic literature has largely ignored the effects on economic development.

In this paper, I ask how important internal capital markets are for aggregate resource allocation and economic development. I build a quantitative general equilibrium model with heterogeneous establishments that explicitly allows for formation of business groups, which enable the affiliated partners to pool capital across their establishments. I calibrate the model to match

[1]Conglomerates are broadly defined as firms under common ownership that operate in multiple, often unrelated industries. Business groups are groups of legally independent firms that are linked together by strong equity or family ties. In this paper, the distinction between the two concepts is not important, since they imply the crucial feature of enabling internal transfers of resources across affiliated divisions/subsidiaries. Notice that internal reallocation is also possible among the plants of non-diversified, multi-plant firms.

selected moments from Canadian aggregate and plant-level data and use simulations to quantify the effects of business conglomeration on the cross-firm allocation of inputs and production outcomes, the determination of the average size and productivity of establishments, the level of entrepreneurship, and the country's output per capita.

My model embeds business group formation into an otherwise standard heterogeneous agents model of entrepreneurship with credit constraints, such as Evans and Jovanovic (1989), Cagetti and De Nardi (2006), and Buera et al. (2011). Agents of differing abilities and wealth decide whether to work for wages or become entrepreneurs. Entrepreneurs choose whether to operate a stand-alone (single-segment) business firm or to pay an additional cost and become part of a business group (conglomerate) with a randomly met partner. Because of credit market frictions, only wealthier individuals have full access to external finance. Business groups emerge endogenously as a way for firms to create an internal capital market, reducing their reliance on external funds. Internal markets therefore allow firms to avoid external credit market imperfections and reallocate the available capital across the affiliated productive units more efficiently.

The model with internal capital markets is fairly successful in reproducing several stylized facts concerning establishment size and productivity distribution. In particular, the model generates a concentration of establishments affiliated with business groups in large-size categories and a concentration of stand-alone establishments in small-size categories. The model is also consistent with the fact that low-productivity establishments are relatively smaller in business groups compared to their counterparts in stand-alone firms and high-productivity establishments are larger in conglomerates than in stand-alone firms.

I find that internal capital markets have a positive effect on economic development. Shutting down the possibility of business conglomeration in the model calibrated to the Canadian economy (an economy with well-developed financial markets) reduces the steady-state level of output per capita by 3 percent. This magnitude is relatively modest because of general equilibrium effects: although business groups better allocate resources among the affiliated establishments, their presence raises the prices of production inputs and leads to tighter credit constraints for non-affiliated establishments. However, the relative losses from a ban on business conglomeration are higher in economies with less-developed financial markets. For example, in an economy with the ratio of external finance to gross domestic product (GDP) that is half of the value observed in Canada, a ban on business conglomeration would imply decrease in the steady-state output per capita of 5 percent. Put together, my results indicate that business conglomeration is a potentially important additional margin along which the production sector may adjust in response to financial frictions. Previous literature did not take this adjustment margin into account and, as a result, overestimated the importance of misallocation resulting from financial frictions for economic development.

Indeed, the main mechanism curbing the misallocative effects of financing frictions recognized in the macroeconomic literature is self-financing: over time, productive entrepreneurs will accumulate a sufficiently large stock of assets to finance their firms internally. Most of this literature concluded that borrowing constraints have a large impact on resource misallocation across heterogeneous producers (Jeong and Townsend, 2007; Amaral and Quintin, 2010; Buera et al., 2011; Jones, 2013). Midrigan and Xu (2014) argued that financial frictions reduce aggregate TFP mainly by distorting entry and technology adoption decisions, but because of strong self-financing, the misallocation of capital across existing producers accounts for a relatively small fraction of aggregate TFP losses. Moll (forthcoming) showed that if productivity shocks are persistent, entrepreneurs may overcome financial frictions in the long run by self-financing, but the transition period is very long and thus costly. My paper proposes a different, complementary mechanism that also curbs the impact of financial frictions on misallocation: organizing production in large conglomerates provides a substitute for the external financial market. This mechanism seems particularly relevant in economies with lower levels of economic and financial development where business groups and conglomerates are omnipresent.

1.1. Modeling Business Conglomeration

The principal aim of this paper is to quantify the allocative role of internal capital markets in business groups in the presence of constraints on external financing. In order to achieve this aim in a tractable and clear way, I focus on one particular aspect of business conglomeration: the capacity to reallocate resources across the affiliated establishments. The gains from this reallocation will be the sole reason for which two stand-alone entrepreneurs would merge and form a conglomerate in my model. In a nutshell, I embed Stein's (1997) theory of efficient internal capital markets in a full-fledged dynamic general equilibrium model.

Although internal capital markets are a well-recognized feature of conglomerates and business groups and most literature agrees that mergers and asset sales involve substantial reallocation (see below for relevant recent references), they are not the only reason businesses might conglomerate. Indeed, the corporate finance and industrial organization literature offers several other possibilities. They include, for example, vertical integration as a solution to hold-up problems, horizontal mergers as a means to realize economies of scale or scope through synergies and spillover or network effects, building of corporate empires that allow managers to consolidate control and eventually expropriate (minority) shareholders, or consolidation of market power through corporate takeovers. Testing these alternative theories or providing a new theory of why firms form business groups is beyond the scope of this paper. I also abstract from all issues associated with imperfect competition.

The empirical corporate finance literature provides support for the existence of well-functioning internal capital markets. In particular, Maksimovic and Phillips's (2001; 2002) and Schoar's (2002) results are consistent with efficient reallocation of resources through internal transfers in conglomerates and sales of plants and divisions. Kuppuswamy and Villalonga (2010), Gopalan and Xie (2011), and Matvos and Seru (2014) showed how conglomerates use internal capital markets to alleviate misallocation and financial constraints during episodes of industry economic distress or financial market distress. Hoshi et al. (1991), Masulis et al. (2011), and Natividad (2013) presented empirical evidence on the functioning of efficient internal capital markets in developing countries and in environments with financial frictions.

The conglomeration mechanism that I explore is also broadly related to Jovanovic and Rousseau's (2002) and Jovanovic and Braguinsky's (2004) Q-theory of mergers. As in these papers, the selection of plants into business groups in my model is driven by the possibilities of profitable reallocation. However, I abstain from explicitly modeling the market for acquisition targets and allow business groups to run several productive establishments in order to concentrate on the implications for the cross-sectional distribution of establishment size and TFP.

Gomes and Livdan (2004) and Basaluzzo (2006) studied business conglomeration in quantitative models, but they did not directly focus on its impact on economic development. My framework differs from these studies in that it features two crucial aspects of conglomerates and business groups: diversification of a firm's operations across several productive projects *and* pooling of financing through internal capital markets. In contrast, the other papers have only one or the other of these features. In Gomes and Livdan (2004), a single stand-alone firm can diversify by initiating a new technology, but diversification does not affect the overall amount of capital available to the firm or its ability to raise external financing. Basaluzzo (2006), on the other hand, allowed for finance pooling among the partners of an entrepreneurial team, but he assumed that the team could operate only a single productive project. As a result, the firms and partnerships in these papers do not feature a fully functional internal capital market. This is particularly important in settings with credit constraints in which internal reallocation can lead to substantial gains.[2]

[2] Another difference is that Basaluzzo (2006) focuses on entrepreneurial partnerships in small businesses and assumes that large corporate firms face perfect credit markets and cannot merge. Although this facilitates the numerical solving of the model, it leads to the counter-factual implication that the number of small entrepreneurial businesses increases

The rest of the paper is organized as follows. Section 2 introduces the basic set-up of the heterogeneous agents model with business conglomeration, and Section 3 defines the competitive equilibrium. Section 4 analyzes the workings of internal capital markets and their effects on occupational choice decisions. I calibrate the model in Section 5, and Sections 6 and 7 present the quantitative results and discuss their relationship to the observed stylized facts. Finally, Section 8 concludes.

2. Model

Consider an economy with measure one of infinitely-lived agents that value stochastic consumption streams according to

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t),$$

where $\beta \in (0,1)$ is the individual discount factor, and the period utility function $u(c)$ is strictly increasing, strictly concave, and satisfies the usual Inada conditions. Agents are endowed with one unit of time per period, which they can either supply in the labor market or use to manage their own entrepreneurial project. Leisure is not valued. The return to each occupation for agent i depends on his working and managerial abilities, denoted by $\zeta_{i,t}$ and $\theta_{i,t}$, respectively. These abilities evolve according to two independent AR(1) processes $\log \zeta_{i,t} = \rho_\zeta \log \zeta_{i,t-1} + \epsilon_{\zeta,i,t}$ and $\log \theta_{i,t} = \rho_\theta \log \theta_{i,t-1} + \epsilon_{\theta,i,t}$, where $\rho_\zeta, \rho_\theta \in (0,1)$, $\epsilon_{\zeta,i,t} \sim N(0, \sigma_\zeta)$, and $\epsilon_{\theta,i,t} \sim N(0, \sigma_\theta)$. As a worker, agent i supplies $\zeta_{i,t}$ efficiency units of labor paid at the equilibrium wage

with economic development.

rate w_t per efficiency unit. As an entrepreneur, agent i manages his own productive establishment. He rents capital $k_{i,t}$, hires labor $l_{i,t}$, and combines these inputs according to a standard neoclassical production function $y_{i,t} = \theta_{i,t}\left(k_{i,t}^{\alpha}l_{i,t}^{1-\alpha}\right)^{\nu}$. The share parameters α and ν have values between zero and one. As in Lucas (1978), the returns to scale parameter ν can be interpreted as the span of control of the entrepreneur-manager.

The sole asset in the economy is productive capital. Consumers save by accumulating capital, which is then lent to entrepreneurial firms at the equilibrium interest rate r_t. Borrowing for consumption is not allowed, and capital depreciates at rate δ. Borrowing by firms is subject to a collateral constraint, which limits the maximum amount of external financing to a multiple of the borrower's net worth.[3]

In addition to borrowing in the external capital market, entrepreneurs have the option to create internal capital markets by forming business groups (conglomerates). A business group consists of a headquarters and the productive establishments of the affiliated entrepreneurs. The headquarters pools the internal assets of the partners and, eventually, raises additional capital on the external market. The headquarters then reallocates the total available capital among the affiliated establishments as to maximize the group profit.

In order to introduce internal capital markets in a tractable fashion, I make the following restrictive assumptions concerning business groups. First, the scope of a business group is limited to two establishments. Second, inter-

[3] This collateral constraint is assumed for parsimony and can be motivated by a simple static limited enforcement problem in which the debt repayment can be enforced only up to a multiple λ of borrower's net worth and there are no dynamic consequences for defaulting (e.g. reputation or cerdit market exclusion).

nal reallocation of capital is free from frictions. This assumption guarantees that conglomeration allows the affiliated entrepreneurs to allocate capital among their establishments more efficiently than the external capital market. Third, business conglomeration entails a fixed cost γ at the business group level. This cost may be interpreted as the cost of creating and operating the headquarters or the cost of managing a conglomerate firm with a more complicated organizational structure. Fourth, the profit in a business group is shared between the affiliated partners according to the Shapley value sharing rule.[4] As a result, each partner is rewarded according to his contribution to the creation of group profits. Particularly, capital provision and managerial talent (or technology) provision are accounted for in the remuneration. In this aspect, a business group acts as an internal capital market, but also as an imperfect substitute for a market for ideas.

I make two additional assumptions concerning business group formation and dissolution. I abstract from explicitly modeling the mergers market and assume that the potential partners for business group formation meet randomly. This greatly simplifies equilibrium solving, but it implies that my model cannot generate implications concerning prices and trade volumes on the mergers market. Finally, I suppose that business groups are dissolved at the end of each period and formed anew in the next period. This assumption allows me to collapse the business group formation decision into a tractable

[4]Because I allow only for two-member groups, the Shapley value solution is particularly simple and identical to the outcome of generalized Nash bargaining with equal bargaining powers. I consider the Shapley value because I like to think of business group formation as a cooperative game with a specific surplus-sharing rule. The Shapley value can easily be extended to the more general case of more than two partners.

static problem. However, it limits the usefulness of my model for studying the internal dynamics of business groups. In this paper, I concentrate on cross-sectional and aggregate implications of internal capital markets, and I leave the interesting subject of detailed modeling of the internal dynamics of business groups for future research.

Denoting future period variables with a prime, the timing of events within each period is depicted in Figure 1. Each agent starts the period with net worth a_i and a realization of the individual working and managerial abilities (ζ_i, θ_i). Then the agents choose their occupation. Those who decided to become entrepreneurs meet randomly in pairs and observe each other's managerial abilities and net worth. Based on the payoffs and costs of conglomeration, they choose whether to form business groups or operate their projects as two stand-alone firms. Production takes place, and agents receive payoffs from their activity. I denote $Z^{SA}(\theta_i, a_i)$ the indirect profit function when entrepreneur i operates a stand-alone firm, and $Z_i^G(\theta_i, a_i, \theta_j, a_j)$ the function that gives i's share of the group profit when entrepreneurs i and j form a business group. Given the assets on hand at the end of the period, every agent chooses how much net worth a_i' he saves for the future period.

Notice that occupational choice is irreversibly made before the business groups form. This means that only the agents who have already committed to investing their net worth in developing an entrepreneurial establishment may affiliate with business groups. As a result, agents need to anticipate the composition of the pool of potential business partners when choosing their occupations.

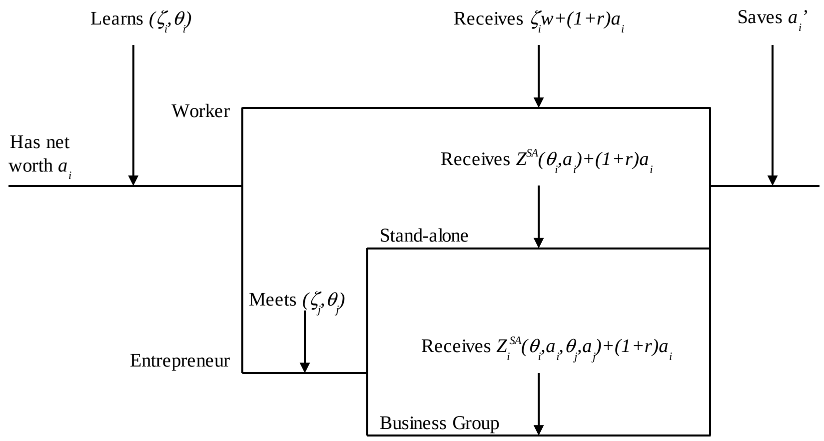


Figure 1: Timing

3. Competitive Equilibrium

The joint distribution over the individual states Ψ is an aggregate state variable of the economy, and in principle, the agents need to know its law of motion in order to predict future prices and the eventual business partners' types. However, in this paper, I focus on stationary equilibria in which prices are constant and the distribution over individual states is invariant. All maximization problems that follow can thus be written as parametrized in the prices and the stationary distribution Ψ. To increase readability, I do not include r, w, and Ψ in the arguments of value functions.

3.1. Consumption-saving Decision

At the end of the period, the agents decide how much to save. Let $V(\zeta_i, \theta_i, \omega_i)$ denote the end-of-period value function of an agent with abilities (ζ_i, θ_i) and end-of-period assets ω_i. Also, let $W(\zeta_i, \theta_i, a_i)$ denote the value function at the beginning of the period of an agent who observed his abilities (ζ_i, θ_i) and who has saved a_i from the last period. The saving decision of agent i is given by the following Bellman equation:

$$V\left(\zeta_i,\theta_i,\omega_i\right)=\max_{a_i'\geq 0}\left\{u\left(\omega_i-a_i'\right)+\beta E_{\zeta_i',\theta_i'}W\left(\zeta_i',\theta_i',a_i'\right)\right\}. \qquad (1)$$

3.2. Occupational Choice

At the beginning of the period, after observing his working and managerial abilities, the agent can become a worker and invest his net worth a_i in the capital market, which will yield at the end of the period assets $\omega_i^W \equiv \zeta_i w+(1+r)\,a_i$. Alternatively, the agent can become an entrepreneur and use a_i as capital in his business. In this case, the amount of assets that will be generated at the end of the period depends on whether the entrepreneur affiliates with a business group or not. Given functions $Z^{SA}\left(\theta_i,a_i\right)$ and $Z_i^G\left(\theta_i,a_i,\theta_j,a_j\right)$, which give the entrepreneurial income in each case, the end-of-period assets of entrepreneur i are $\omega_{ij}^E \equiv \max\left\{Z^{SA}\left(\theta_i,a_i\right),Z_i^G\left(\theta_i,a_i,\theta_j,a_j\right)\right\}+(1+r)\,a_i$.

However, at the moment the agent decides on his occupation, he does not know the managerial ability and net worth of his business partner and has to conjecture the partner's type. The expectation is taken over the set of entrepreneurs B with respect to the invariant measure over the individual states Ψ. The occupational choice is then given by

$$W\left(\zeta_i,\theta_i,a_i\right)=\max\left\{V\left(\zeta_i,\theta_i,\omega_i^W\right),E_{(\zeta_j,\theta_j,a_j)\in B}V\left(\zeta_i,\theta_i,\omega_{ij}^E\right)\right\}. \qquad (2)$$

Compared to a standard occupational choice problem without business groups, the value of entrepreneurship is a random variable dependent upon the random match with a partner.

3.3. Profits and Factor Demands

Entrepreneur i who meets entrepreneur j contracts $l(\theta_i, a_i, \theta_j, a_j)$ units of labor and $k(\theta_i, a_i, \theta_j, a_j)$ units of capital. These factor demands are the solution of profit maximization either for a stand-alone firm of entrepreneur i or for a business group $\{i, j\}$.

3.3.1. Stand-alone firms

A stand-alone project generates profits according to:

$$Z^{SA}(\theta_i, a_i) = \max_{k_i, l_i} \left\{ \theta_i \left(k_i^{\alpha} l_i^{1-\alpha} \right)^{\nu} - (r + \delta) k_i - w l_i \right\} \tag{3}$$

subject to

$$(k_i - a_i)(1 + r) \leq \lambda a_i. \tag{4}$$

Credit constraint (4) restricts the maximum amount of capital that can be used as input in production to multiple $\left(1 + \frac{\lambda}{1+r}\right)$ of the entrepreneur's net worth. When λ is low, for example, due to low levels of financial development and investor protection, some entrepreneurs are constrained to operate their establishments at a sub-optimal size. The borrowing constraint thus prevents the external credit market from allocating capital optimally across the productive establishments in the economy.

3.3.2. Business groups

I assume that each establishment in a business group continues to be managed by its original entrepreneur, and only capital may be reallocated between the affiliated establishments. A business group that disposes with managerial abilities θ_i and θ_j and total net worth $a = a_i + a_j$ generates profits according to:

$$Z^G(\theta_i,\theta_j,a)=\max_{k_i,l_ik_j,l_j}\left\{\theta_i\left(k_i^{\alpha}l_i^{1-\alpha}\right)^{\nu}+\theta_j\left(k_j^{\alpha}l_j^{1-\alpha}\right)^{\nu}-\gamma\right.$$
$$\left.-(r+\delta)(k_i+k_j)-w(l_i+l_j)\right\} \quad (5)$$

subject to

$$(k_i+k_j-a)(1+r)\leq\lambda a. \quad (6)$$

An important feature of problem (5) is that a business group acts as a single entity when going to the external capital market. Thus, credit constraint (6) applies at the group level and not at the level of each affiliated establishment.

The group profit is shared among the partners according to the Shapley value rule. Each partner is paid the average of his marginal contributions to the creation of the group profit. Partner i obtains

$$Z_i^G(\theta_i,a_i,\theta_j,a_j)=\frac{1}{2}\left[Z^G(\theta_i,\theta_j,a_i+a_{j,})-Z^{SA}(\theta_j,a_j)+Z^{SA}(\theta_i,a_i)\right]. \quad (7)$$

A business group is feasible if each partner's remuneration is higher than the profit he could obtain as a stand-alone entrepreneur. This is guaranteed whenever

$$Z^G(\theta_i,\theta_j,a_i+a_j)\geq Z^{SA}(\theta_i,a_i)+Z^{SA}(\theta_j,a_j). \quad (8)$$

In that case, business group formation is a convex cooperative game, and the Shapley value is included in the core of that game.

Definition 1. *Denote the vector of individual beginning-of-period states* $\mathbf{m}=$

(ζ_m, θ_m, a_m). *A stationary recursive competitive equilibrium is a joint distribution of agents over individual end-of-period states* Ψ, *prices* r *and* w, *set of entrepreneurs* B, *sets of suitable partners for business conglomeration* $G(\mathbf{m})$ *for each* $\mathbf{m} \in B$, *indirect profit functions* $Z^{SA}(\theta_m, a_m)$, $Z^G(\theta_m, \theta_n, a)$, $Z^G_m(\theta_m, a_m, \theta_n, a_n)$ *together with the allocation functions* $k(\theta_m, a_m, \theta_n, a_n)$, $l(\theta_m, a_m, \theta_n, a_n)$ *for* $\mathbf{m}, \mathbf{n} \in B$, *and value functions* $V(\zeta_m, \theta_m, \omega_m)$ *and* $W(\zeta_m, \theta_m, a_m)$ *together with the associated saving decision rule* $a_i = g(\zeta_i, \theta_i, \omega_i)$ *such that:*

- *Given* Ψ, r, *and* w, *the indirect profit functions and allocation functions solve* (3), (5), *and* (7), *the value functions and the decision rule solve* (1) *and* (2), *the optimal occupational choice defines the set of entrepreneurs* $B = \left\{(\zeta_i, \theta_i, a_i) : V\left(\zeta_i, \theta_i, \omega_i^W\right) \leq E_{(\zeta_j, \theta_j, a_j) \in B} V\left(\zeta_i, \theta_i, \omega_{ij}^E\right)\right\}$, *and for each* $\mathbf{m} \in B$ *the set of suitable partners for business conglomeration is given by*
  $G(\mathbf{m}) = \left\{(\zeta_i, \theta_i, a_i) : Z^G(\theta_i, \theta_m, a_i + a_m) \geq Z^{SA}(\theta_i, a_i) + Z^{SA}(\theta_m, a_m)\right\}$.

- *Labor market clears:*

$$\int_{\mathbf{m} \in B} \int_{\mathbf{n} \in B} l(\theta_m, a_m, \theta_n, a_n)\, d\Psi d\Psi = \int \zeta_i d\Psi - \int_{\mathbf{m} \in B} \zeta_m d\Psi.$$

- *Capital market clears:*

$$\int_{\mathbf{m} \in B} \int_{\mathbf{n} \in B} k(\theta_m, a_m, \theta_n, a_n)\, d\Psi d\Psi = \int a_i d\Psi.$$

- *Goods market clears:*

$$\int_{\mathbf{m}\in B}\int_{\mathbf{n}\in B}\theta_m\left[k\left(\theta_m,a_m,\theta_n,a_n\right)^{\alpha}l\left(\theta_m,a_m,\theta_n,a_n\right)^{1-\alpha}\right]^{\nu}d\Psi d\Psi$$
$$-\frac{\gamma}{2}\int_{\mathbf{m}\in B}\int_{\mathbf{n}\in G(\mathbf{m})}d\Psi d\Psi$$
$$=\int\left(\omega_i-a_i\right)d\Psi+\delta\int_{\mathbf{m}\in B}\int_{\mathbf{n}\in B}k\left(\theta_m,a_m,\theta_n,a_n\right)d\Psi d\Psi.$$

- *Distribution Ψ is stationary and consistent with agents' optimal behavior:*

$$\Psi\left(\hat{S}\right)=\int_S P\left(x,\hat{S}\right)d\Psi\left(x\right)\ \textit{for all}\ \hat{S}\in\mathcal{B}_S,$$

where $S\equiv\mathbb{R}^3_+$ is the agent's state space, $P:S\times\mathcal{B}_S\rightarrow[0,1]$ is a transition function generated by the decision rules and the stochastic processes for ζ_i and θ_i, and $\mathcal{B}_S$ is the Borel σ-algebra of subsets of S.

4. Analysis

4.1. Occupational Choice

Given the working and managerial abilities, occupational choice is characterized by a threshold $\bar{a}\left(\zeta_i,\theta_i\right)$ defined by the indifference condition

$$V\left(\zeta_i,\theta_i,\omega_i^W|_{a_i=\bar{a}}\right)=E_{(\zeta_j,\theta_j,a_j)\in B}V\left(\zeta_i,\theta_i,\omega_{ij}^E|_{a_i=\bar{a}}\right).$$

If $\bar{a}\left(\zeta_i,\theta_i\right)$ exists, then the occupational choice follows a simple cut-off rule: the agent becomes an entrepreneur if his net worth $a_i\geq\bar{a}\left(\zeta_i,\theta_i\right)$. If $\bar{a}\left(\zeta_i,\theta_i\right)$ does not exist, then either $V\left(\zeta_i,\theta_i,\omega_i^W|_{a_i=0}\right)>E_{(\zeta_j,\theta_j,a_j)\in B}V\left(\zeta_i,\theta_i,\omega_{ij}^E|_{a_i=0}\right)$, and the agent never becomes an entrepreneur, or $V\left(\zeta_i, \theta_i, \omega_i^W|_{a_i=0}\right) < E_{(\zeta_j,\theta_j,a_j)\in B} V\left(\zeta_i, \theta_i, \omega_{ij}^E|_{a_i=0}\right)$, and the agent always becomes an entrepreneur.[5]

Occupational choice depends on the agent's net worth because in an environment with financial frictions the indirect profit functions are increasing in the entrepreneur's net worth a_i. The labor income is independent of a_i. Therefore, people will start an entrepreneurial project only if they are rich enough to guarantee themselves an adequate expected entrepreneurial income. This contrasts with a frictionless economy where the working and managerial abilities alone would determine the optimal occupation for each individual. The dependence of occupational choice on an agent's net worth introduces an inefficiency in the form of misallocation of talent: some talented but poor agents will not choose to become entrepreneurs, whereas some less talented but rich individuals may become entrepreneurs, although they would not do so in a frictionless economy.[6]

Figure 2 illustrates the threshold $\bar{a}\left(\zeta_i, \theta_i\right)$ for two values of ζ_i and twenty values of θ_i.[7] The threshold is increasing in the working ability ζ_i and decreasing in the managerial ability θ_i. This is intuitive; for any given net worth, higher ζ_i increases the labor income and, thus, the value of working

[5] Notice that in contrast to standard occupational choice models (e.g. Buera et al., 2011), in my model it is not sufficient to compare potential labor earnings to potential entrepreneurial profits. The reason is that when the occupation is chosen, the entrepreneurial profit is a random variable dependent upon the random match with a partner. Since I assumed a concave utility function, the risk associated with entrepreneurship has to be taken into account by directly comparing the expected values for each occupation.

[6] The second part of this assertion is related to a general equilibrium effect. In general, the wage rate and the interest rate will be lower in an economy with financial frictions, making entrepreneurship interesting even for less talented individuals.

[7] Figure 2 is constructed using the benchmark calibration detailed in Section 5. Qualitative conclusions are unchanged for alternative calibrations.

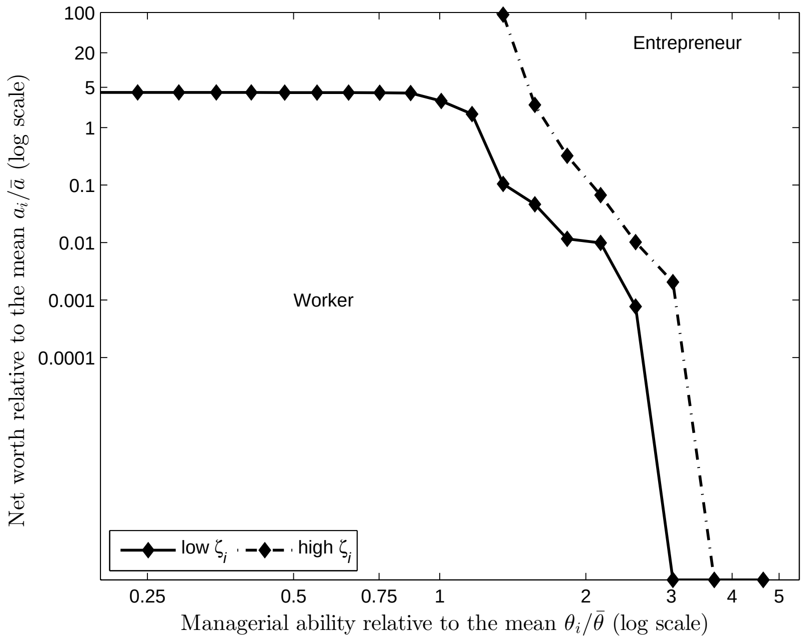


Figure 2: Occupational choice

for a wage, but leaves the value of entrepreneurship unchanged. In a similar fashion, for any given net worth, higher θ_i increases the profits for any possible match with a partner and, thus, the expected value of entrepreneurship, but leaves the value of working for a wage unchanged.

Studying threshold $\bar{a}(\zeta_i, \theta_i)$ for the high and low values of θ_i provides insight into how introducing business conglomeration influences the misallocation of talent. First, $\bar{a}(\zeta_i, \theta_i)$ is very low (almost zero) for the highest values of θ_i. This would not be the case without the possibility of business conglomeration. The intuition is that people with very good entrepreneurial projects are almost certain to find a suitable partner willing to provide funding through the internal capital market. As a result, they prefer entrepreneurship even if they are not wealthy, as they would in a frictionless economy. Therefore, the possibility of becoming part of a business group alleviates the distortion of the occupational choice decision for the very talented.

Second, $\bar{a}(\zeta_i, \theta_i)$ plateaus at some level for low θ_i and low ζ_i agents. In the baseline calibration of the model, this level is around four times the average net worth and implies $\bar{a}(\zeta_i, \theta_i)$ way higher than the level of net worth that would guarantee these entrepreneurs that their projects would operate at the unconstrained scale. In fact, low θ_i individuals are interested in entrepreneurship only if they are wealthy enough to be almost certain to find a suitable partner in whose project they could profitably invest through the internal capital market. Therefore, the possibility of becoming part of a business group and using the internal capital market as a better investment alternative to the credit market pushes these wealthy, untalented individuals into entrepreneurship. Contrast this with the frictionless economy, where these agents would not choose to become entrepreneurs, to deduce that business conglomeration exacerbates the distortion of the occupational choice decision for the untalented.

4.2. Internal Capital Markets and Business Conglomeration

Deriving the first-order conditions of the business group profit maximization problem (5) with respect to capital inputs we obtain that the optimal reallocation implies equating the marginal products of capital (MPK) across the affiliated establishments:

$$\nu\alpha\theta_i k_i^{\alpha-1} l_i^{1-\alpha} \left(k_i^{\alpha} l_i^{1-\alpha}\right)^{\nu-1} = r + \delta + \mu \tag{9}$$

$$\nu\alpha\theta_j k_j^{\alpha-1} l_j^{1-\alpha} \left(k_j^{\alpha} l_j^{1-\alpha}\right)^{\nu-1} = r + \delta + \mu, \tag{10}$$

where μ is the Lagrange multiplier of the group-level credit constraint (6). If binding, the credit constraint limits the amount of capital that can be raised and creates a wedge between the MPK and the market rental rate. Equations (9) and (10) say that optimal reallocation requires the capital to flow from the project with relatively lower MPK to the one with relatively higher MPK.

The bottom line is that, unless a business group has a high enough net worth to completely avoid the credit constraint, internal capital reallocation implies that the capital input of some affiliated projects will be rationed and transferred to projects with higher MPK. In particular, business conglomeration does *not* necessarily relax credit constraints for all affiliated projects when compared to stand-alone operations. Internal capital reallocation also does *not* imply that business groups necessarily run establishments with high total factor productivity (θ) on a larger scale than stand-alone firms. Whether this will be the case on average in equilibrium is a quantitative question that depends on the selection of entrepreneurs into business groups. I explore this question in the next section of the paper, after discussing the main mechanism behind the selection.

To gain more insight into the selection of establishments into business groups, it is helpful to represent the conglomeration decision in the space of state variables. Given prices, four individual state variables are relevant for the conglomeration decision: each partner's managerial ability, θ_i and θ_j, and each partner's net worth, a_i and a_j. In order to illustrate the conglomeration decision in a two-dimensional plane, I fix the total amount of the net worth available to the group at a and assume that partner i's net worth accounts for share ϕ of this total net worth; therefore, $a_i = \phi a$ and $a_j = (1 - \phi) a$. For any given ϕ and a, the conglomeration decision can be depicted in the (θ_i, θ_j) space by plotting curves along which the joint group profit equals the sum of profits if the two establishments were operated as stand-alone firms. More formally, I draw the set of pairs (θ_i, θ_j) that satisfy $Z^G(\theta_i, \theta_j, a) = Z^{SA}(\theta_i, \phi a) + Z^{SA}(\theta_j, (1 - \phi) a)$. These pairs represent matches in which the entrepreneurs are indifferent between operating their projects in a business group or as stand-alone firms.

Refer to Figure 3. Each panel depicts such "indifference" curves for $\phi =$ 0.3, 0.5, and 0.9, respectively, as thick solid lines.[8] For convenience, I also include the 45-degree dotted line along which the partners have exactly the same managerial ability. The solid lines divide the space into three regions. Regions labeled with C represent the set of matches that lead to business conglomeration. The SA region represents the set of matches in which the entrepreneurs prefer to operate as two stand-alone firms. The shape of the curves is related to the costs of conglomeration. Specifically, if both partners have managerial ability lower than some threshold, no internal reallocation

[8] I constructed Figure 3 with a arbitrarily fixed at 30 and values of parameters α, ν, γ, and λ as in the benchmark calibration detailed in Section 5. I do not provide scales on axes in Figure 3 since the figure illustrates the qualitative features of the conglomeration decision, which are the same for a wide range of parametrization of the model.

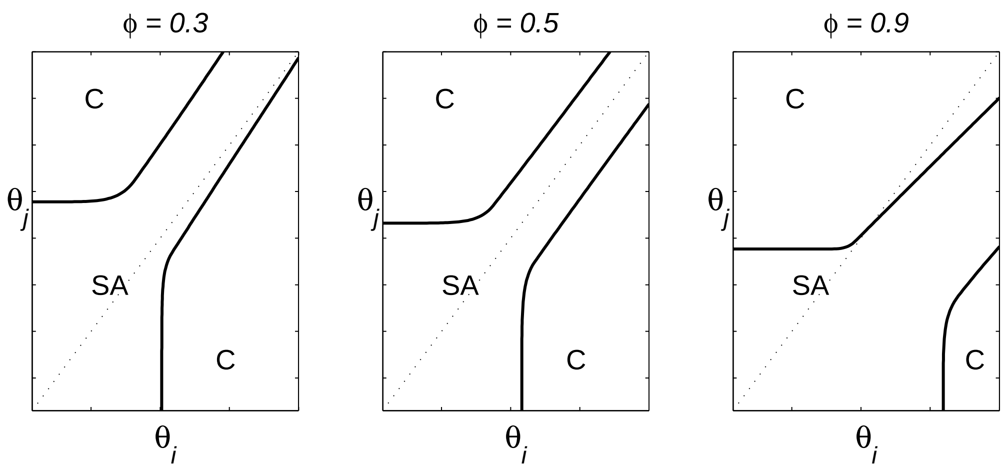


Figure 3: Conglomeration decision

can generate enough gains to compensate for the costs of conglomeration.

Now concentrate on the middle panel of the figure. It plots the conglomeration decision when both partners have the same amount of net worth ($\phi = 0.5$). In this case, the 45-degree line is never in a C region. This is intuitive, since there are no possible gains from internal capital reallocation if both partners are of exactly the same type. The C regions are located in opposing corners, where the partners are heterogeneous enough in managerial abilities. Because capital is reallocated efficiently inside the business group, the more productive establishment will be operated at a larger scale. From this fact, we can identify the internal flows of capital. In the upper left C region, capital is reallocated from establishment i to establishment j. In the lower right C region, capital flows in the opposite direction.

This interpretation applies to the other panels of the figure as well. The only difference is that, as ϕ increases (decreases), the indifference curves shift down (up) and to the right (left). The intuition is that, with more net worth inequality between the partners (further ϕ is away from 0.5), less productivity inequality is necessary to find a profitable reallocation of capital through conglomeration. Eventually, a portion of the 45-degree line will cross one of the C regions, as in the right panel in Figure 3. In that case, the points in the upper-left C region that are below the dotted line correspond to the matches in which a relatively wealthy entrepreneur i pairs up with a relatively poor partner j, who also has a *lower* managerial ability. The partners agree to conglomerate because the credit constraint and the difference in their net worth imply a gap in the marginal products of capital were their establishments operated as stand-alone firms. This gap is large enough to warrant net gains from internal reallocation. Accordingly, the capital will flow internally from establishment i to establishment j so that the marginal products are equalized. The analysis stays qualitatively the same for different values of the total net worth available to the group a; only the indifference curves shift closer to each other when a increases, since there is more capital to beneficially reallocate. In conclusion, matches that lead to business conglomeration must feature high enough differences in partners' managerial abilities and/or net worth.

Since in a business group a partner's net worth can also make up for missing collateral, an affiliated plant's expenditures on capital are less sensitive to the net worth of the managing entrepreneur. This can be interpreted as consistent with the evidence that the investment of business group subsidiaries is less sensitive to their internal funds than the investment of stand-alone firms (Hoshi et al., 1991; Shin and Park, 1999; Perotti and Gelfer, 2001).

5. Calibration

I now calibrate the model and solve it numerically to compare its quantitative implications to several empirical stylized facts.[9] For the period utility function, I choose the constant elasticity of substitution form $u(c) = {}^{(c^{1-\sigma}-1)}/_{(1-\sigma)}$. AR(1) processes for logarithms of working and managerial abilities are discretized into first-order Markov chains using the technique of Tauchen and Hussey (1991).[10]

I assign values to the first set of parameters following standard practice in macroeconomics. The inverse of the inter-temporal elasticity of substitution σ is set to 1.5 and the discount factor β to 0.9. The share parameter α is chosen to match the aggregate capital income share by imposing $\alpha\nu = 0.33$.

The remaining eight parameters $(\nu, \delta, \lambda, \gamma, \rho_\theta, \sigma_\theta, \rho_\zeta, \sigma_\zeta)$ are jointly calibrated so that the model approximately matches as many moments in the data on the Canadian economy. These moments are the average aggregate ratios of investment to capital, investment to GDP, and external finance to GDP over the period 1990–2009, the average share of income accounted for by the top 5 percent earners and the average Gini coefficient of income over the same period, the average Gini coefficient of net worth over 1999 and 2005 in the Survey of Financial Security as reported by Brzozowski et al. (2010), the proportion of plants operating in conglomerates, and the median rela-

[9] See the Online Appendix for a detailed description of the computational algorithm.

[10] I consider two states for the working ability and twenty states for the managerial ability. The number of grid points for the working ability is kept low for parsimony. I choose a larger number of grid points for the managerial ability in order to obtain a reasonably good approximation of the productivity distribution.

Table 1: Baseline calibration

Parameter	Description	Value
σ	Inverse of inter-temporal elasticity of substitution	1.5
β	Discount factor	0.9
ν	Variable factors output share	0.85
α	Capital share in the output to variable factors	0.388
δ	Depreciation rate	0.09
λ	Severity of credit constraints	4.2
γ	Fixed cost of conglomeration	2.9
ρ_θ	Persistence of the managerial ability	0.82
σ_θ	Dispersion of the managerial ability	0.21
ρ_ζ	Persistence of the working ability	0.9
σ_ζ	Dispersion of the working ability	0.8

tive size of plants in stand-alone firms over the period 1996–2006 obtained from detailed plant-level data on manufacturing sector producers from the Canadian Annual Survey of Manufacturers.

To classify firms as conglomerates or stand-alone in the data, I follow Maksimovic and Phillips (1998, 2002) and construct so-called *firm-segments*. A firm-segment is obtained by aggregating the firm's plant-level data at the four-digit North American Industry Classification System (NAICS) code, therefore representing a firm's operations in a given industry. A firm is then classified as a conglomerate if it operates in more than one four-digit NAICS industry.[11] The relative size of a plant in the data is defined as the ratio of

[11]Internal capital markets may also operate among the plants of non-diversified (single-segment) multi-plant firms. However, when defining the firm-segments at the relatively fine four-digit NAICS level, a vast majority (77 percent) of plants in multi-plant firms belong to multi-industry firms (conglomerates). At the same time, only 5 percent of plants that are not in conglomerates belong to multi-plant firms. Thus, the bias from ignoring internal capital markets in non-diversified multi-plant firms is negligible. I verified that all main empirical stylized facts used in the following sections of the paper go through if we divide the analysis according to multi-plant/signle-plant dimension instead of single-

the plant's value added to the median value added of all plants in the same industry and year, and the direct model counterpart is simply the ratio of the output of each active establishment to the median output in the whole cross-section of active establishments. The Online Appendix provides additional information on the data from the Canadian Annual Survey of Manufacturers.

Tables 1 and 2 summarize the baseline calibration, the moments matched, and their sources. Although the moments in the model are jointly determined by the values of all parameters, identification follows a relatively transparent logic. I follow Buera et al. (2011) and use the top 5 percentile income share to pin down the span of control parameter (ν), which determines the fraction of the output that goes to the entrepreneurial input. Top earners are mostly entrepreneurs, in the model and in the data.[12] The investment–capital ratio pins down the depreciation rate (δ). The ratio of external finance to GDP, constructed as the sum of private credit, private bond market capitalization, and stock market capitalization over GDP, informs us about the severity of the credit constraints (λ).[13] The proportion of plants in conglomerates is largely determined by the conglomeration cost parameter (γ). $\gamma = 2.9$ implies a cost of conglomeration roughly equal to 12 percent of the average

segment/multi-segment. I choose to concentrate on the the latter to ensure comparability of my results to corporate finance literature.

[12]The value for ν is in the ballpark of values used in the recent macroeconomic literature on entrepreneurship and firm dynamics. Burnside (1996) estimated the value for ν at 0.92, Gomes and Livdan (2004) used 0.95, Cagetti and De Nardi (2006) used 0.88, Gollin (2008) used 0.9, Amaral and Quintin (2010) used 0.85, and Buera et al. (2011) calibrated ν to 0.79, and Midrigan and Xu (2014) set it to 0.85.

[13]I follow Buera et al. (2011) and multiply the reported stock market capitalization to GDP ratio by 0.33 (the average book-to-market ratio in the data) to correct for the fact that the market value of equity overstates the book value, which is conceptually closer to the notion of financial capital in my model.

Table 2: Moments matched

Moment	Source	Data	Model
Income share top 5 pct.	CANSIM II database	0.26	0.26
Investment/Capital	CANSIM II database	0.09	0.09
Investment/GDP	CANSIM II database	0.20	0.22
External finance/GDP	Beck et al. (2000)	1.75	1.75
Gini income	CANSIM II database	0.43	0.44
Gini net worth	Brzozowski et al. (2010)	0.66	0.64
Pct. plants in conglomerates	ASM micro-data	14.0	14.7
Median rel. size (stand-alone firms)	ASM micro-data	0.85	0.84

output per plant in equilibrium. The remaining four moments—the aggregate investment–GDP ratio, the median relative size of plants in stand-alone firms, and the measures of the wealth and earnings inequality—are mainly related to the parameters of the working and managerial ability processes.

6. Cross-sectional Results

In the model, every establishment can be interpreted as either one plant or one firm-segment (division). I prefer the plant-level interpretation, which seems more easily mapped into its empirical counterpart in the Canadian micro-data. However, if the aggregation of plant-level observations to the firm-segment level is not affected by strong composition effects, the simulations should also be comparable to the evidence from existing studies at the firm-segment level (for example, Maksimovic and Phillips, 2002).

6.1. Production Size Distribution

Table 3 compares statistics on the relative production size distribution by firm type obtained from the model to those obtained from plant-level

Table 3: Distribution of relative production size

Deciles of relative size distribution	Percent of establishments: Stand-alone, Canada Plants[a]	Stand-alone, Model	Conglomerate, Canada Plants[a]	Conglomerate, Model
1	11.1	11.5	3.0	23.1
2	11.2	7.3	2.3	3.8
3	11.2	11.1	2.7	3.4
4	11.1	18.9	3.5	2.1
5	11.0	3.9	4.5	1.8
6	10.6	11.1	5.7	3.5
7	10.4	14.2	7.8	5.2
8	9.8	7.7	11.5	3.9
9	8.5	9.2	19.0	23.5
10	5.1	5.1	40.1	29.6
Nbr. plants	279,858		45,410	
Pct. plants	86.0		14.0	

Notes:
[a] Statistics were computed directly from the plant-level data from the Canadian Annual Survey of Manufacturers and Business Register. The relative production size is the ratio of the plant's value added to the median value added of all plants in the same industry and year. The sample spans period 1997–2006. For more information on the data and sample selection procedure, see the Online Appendix. Columns may not add up to 100 due to rounding.

data from the Canadian Annual Survey of Manufacturers. In the data, the relative production size is the ratio of the establishment's value added to the median value added of all establishments in the same industry and year. This measure has the advantage of controlling for industry-specific differences in establishment size, and allows us to make meaningful comparisons even across establishments in different industries.[14]

Table 3 shows that the model is fairly successful in reproducing some of

[14] This is important since conglomerates may concentrate their operations in specific industries (for example, industries with a high minimum efficient size of operation).

the salient features of the relative production size distribution. In line with the empirical evidence from the Canadian micro-data, the model generates relatively less of the stand-alone establishments in the top two deciles of the relative size distribution and a concentration of conglomerated establishments in these deciles. However, the model generates too many conglomerated establishments in the bottom decile of the relative size distribution.

To understand this discrepancy, recall from Section 4 that conglomeration is most beneficial between partners with unequal net worth and unequal managerial abilities. Because the gain from internal reallocation must be high enough to outweigh the cost of conglomeration, entrepreneurs in the extremes of the distribution of net worth and managerial abilities are most likely to conglomerate. The optimal allocation of resources in a business group equalizes the marginal products of capital across the affiliated plants, which then implies that establishments in business groups tend to operate either at a larger scale or at a smaller scale relative to their counterparts in stand-alone firms. This leads to a concentration of affiliated establishments in both extremes of the size distribution rather than only in the right tail as found in the data. The difference may point to the existence of additional costs of conglomeration at the plant level that would lead business groups to shut down the plants that are not sufficiently productive.[15]

[15]Including such costs in my model is possible. However, since in my stylized model a business group is limited to have at most two establishments, it would generate many business groups with only one establishment operating. This would interfere with the definition of a conglomerate used in the data that requires several plants active in several industries, blurring the mapping between the model and the data. Strictly speaking, in the model closing down one affiliated establishment implies complete refocusing, and the firm should then be counted as a stand-alone firm. In contrast, in the data the majority of conglomerates have more than two plants and more than two firm-segments (the most

6.2. Establishment-level Productivity

I now examine the implications of the model for the relationship between the establishments' TFP and business conglomeration. Since in my model the factor shares are calibrated, I measure the establishment-level TFP using the standard accounting approach as:

$$TFP_i \equiv \ln \theta_i = \ln y_i - \nu\alpha \ln k_i - \nu (1-\alpha) \ln l_i.$$

As explained in Section 4, the model has two key implications concerning the plants in conglomerates. First, the cost of conglomeration implies a particular selection of plants into conglomerates: given potential partners' net worth (a_i, a_j), only the pairs of entrepreneurs that have managerial abilities high enough for the reallocation mechanism to generate positive surplus will decide to conglomerate. The gains from internal reallocation of capital are likely to be high for entrepreneurs with high managerial ability, which makes them suitable partners for business conglomeration. It follows that a disproportionally larger fraction of establishments that end up in business groups should have high TFP. Figure 4, which plots the distribution of establishment TFP in the model by firm types, visualizes this selection effect. The TFP distribution for establishments in business groups has a thicker right tail than its counterpart for stand-alone firms. This is consistent with the non-parametric estimates of the plant-level relative TFP distributions from

diversified conglomerates have over seven active firm-segments). In that context, shutting down the least productive plants or firm-segments would rarely imply complete refocusing of the firm.

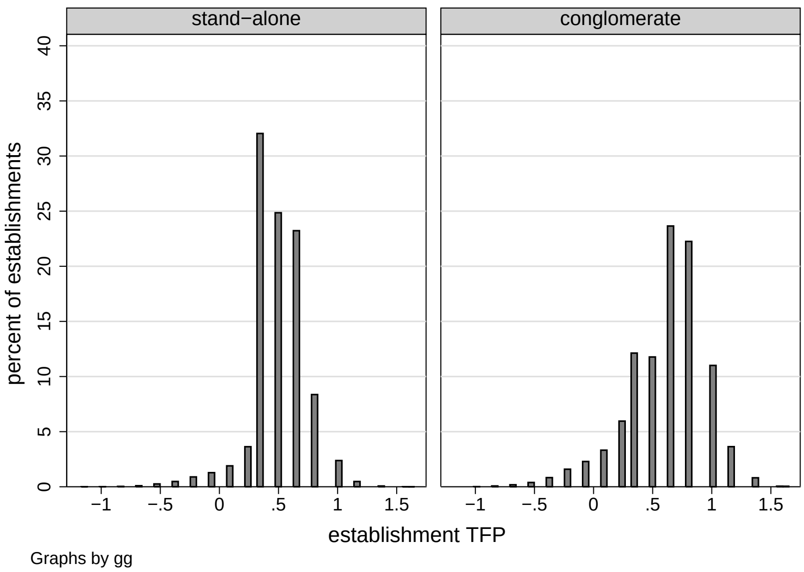
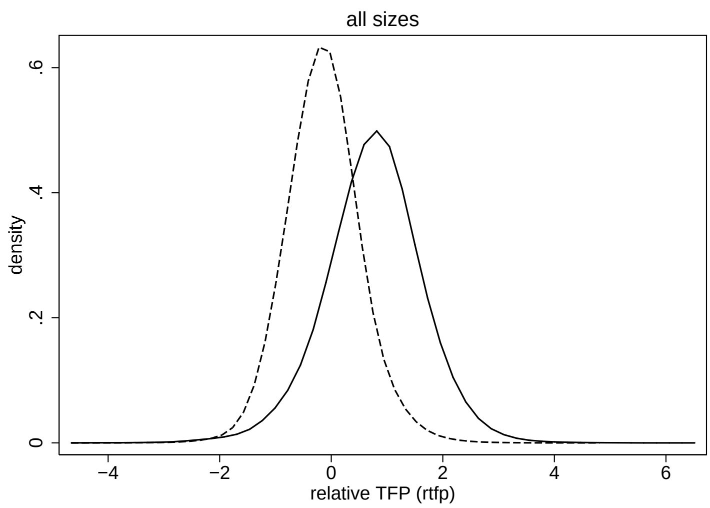


Figure 4: Establishment TFP distribution by firm type – model



Solid line - conglomerates, dashed line - stand-alone firms. Source: Canadian Annual Survey of Manufacturers.

Figure 5: Plant relative TFP distribution by firm type – Canadian ASM

the Canadian micro-data reproduced in Figure 5.[16]

The second key implication of the model is that business groups transfer capital from affiliated establishments with relatively low marginal product of capital to those with high marginal product, thus eliminating the capital-productivity mismatch due to financial frictions. This means that establishments in business groups face a more efficient allocation of capital than those in stand-alone firms, and there should be a higher correlation between productivity and size across these establishments compared to those in stand-alone firms. In particular, an establishment in a business group is more likely to be small because it has low TFP and capital was internally transferred to the more productive division rather than because the group as a whole is tightly capital constrained. Thus, among the small establishments, there should be fewer high-productivity establishments in business groups than in stand-alone firms. For large establishments, the composition effect goes in the opposite direction. Figure 6 visualizes this effect. It gives the distribution of TFP for establishments in the lowest and highest quintiles of the size distribution. Interestingly, the model-predicted shifts in the TFP distribution illustrated in Figure 6 are also in line with the evidence from the Canadian plant-level data as can be seen in Figure 7.[17]

[16]The relative TFP is obtained by subtracting the industry average TFP from the establishment's TFP. This is just a convenient normalization, which allows controlling for industry-specific factors. The Online Appendix provides an overview of the procedure used to construct the relative TFP measure in the data.

[17]Figure 7 compares the empirical TFP distribution in narrower size categories (deciles) than those used in Figure 6 for model-simulated data (quintiles). Using deciles in Figure 6 would not change the main result of the comparison. When looking at decile-defined size categories in the model, TFP distribution for plants in stand-alone firms still has a thicker right tail in the small-size category and a thinner right tail in the large-size category, but, due to discretization of TFP, the differences are visually less discernible.

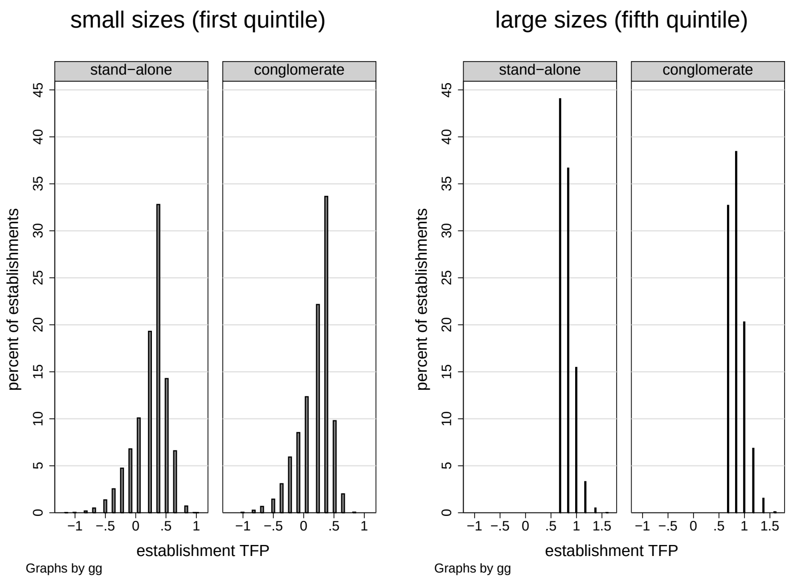
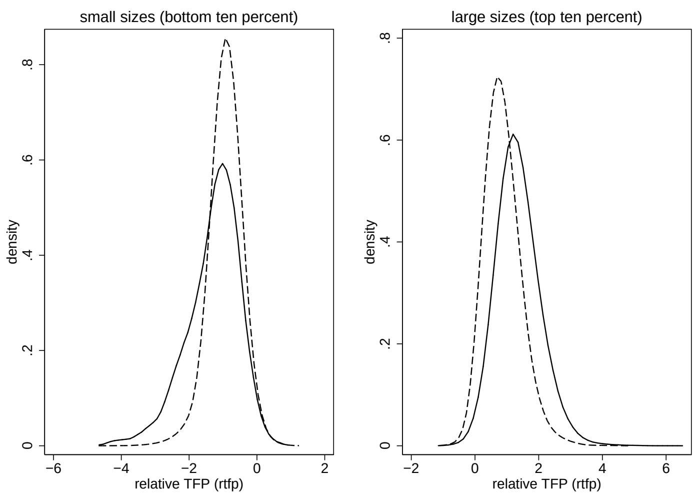


Figure 6: Establishment TFP distribution by firm type and size class – model



Solid line - conglomerates, dashed line - stand-alone firms. Source: Canadian Annual Survey of Manufacturers.

Figure 7: Plant relative TFP distribution by firm type and size class – Canadian ASM

Overall, my cross-sectional results indicate that efficient internal capital markets could explain a non-negligible part of the observed size and productivity differences between the plants in conglomerates and stand-alone firms.

7. Conglomeration and Economic Development

In this section, I evaluate the magnitude of the effect of business conglomeration on economic development and its interdependence with the severity of credit constraints. I first compute stationary equilibria varying the value of the parameter that governs the severity of the credit constraint (λ) for an economy in which the fixed cost of conglomeration is set to the calibrated value ($\gamma = 2.9$). Then I repeat this exercise for an economy in which the possibility of creating internal capital markets is shut down by making the costs of business conglomeration arbitrarily large ($\gamma = \infty$). Figure 8 plots the key macroeconomic variables against the (endogenous) external finance to GDP ratios implied by the values of λ in each case. In the top panels of Figure 8, GDP and aggregate TFP are normalized by their levels in the perfect-credit-market economy ($\lambda = \infty$).[18]

In the model, for any given prices, internal capital markets reduce the mis-

[18] The aggregate TFP is derived from the aggregate production function in terms of gross output, which I define as GDP plus the aggregate fixed costs of conglomeration. Since the individual plant's factor demands can be shown proportional to the aggregate factor demands, the model admits a well-defined aggregate production in terms of gross output in the form $Y = TFP \times \left(K^{\alpha} L^{1-\alpha}\right)^{\nu}$, where K and L are aggregate quantities of capital and labor, and TFP can be expressed as a function of individual plants' productivities, equilibrium interest rate, and the Lagrange multipliers associated with the plants' credit constraints μ_i, $TFP = \left(\int_{i \in B} [r+\delta+\mu_i]^{\frac{-\alpha\nu}{1-\nu}} \theta_i^{\frac{1}{1-\nu}} \, d\Psi\right)^{1-(1-\alpha)\nu} \Big/ \left(\int_{i \in B} [r+\delta+\mu_i]^{\frac{(1-\alpha)\nu-1}{1-\nu}} \theta_i^{\frac{1}{1-\nu}} \, d\Psi\right)^{\alpha\nu}$.

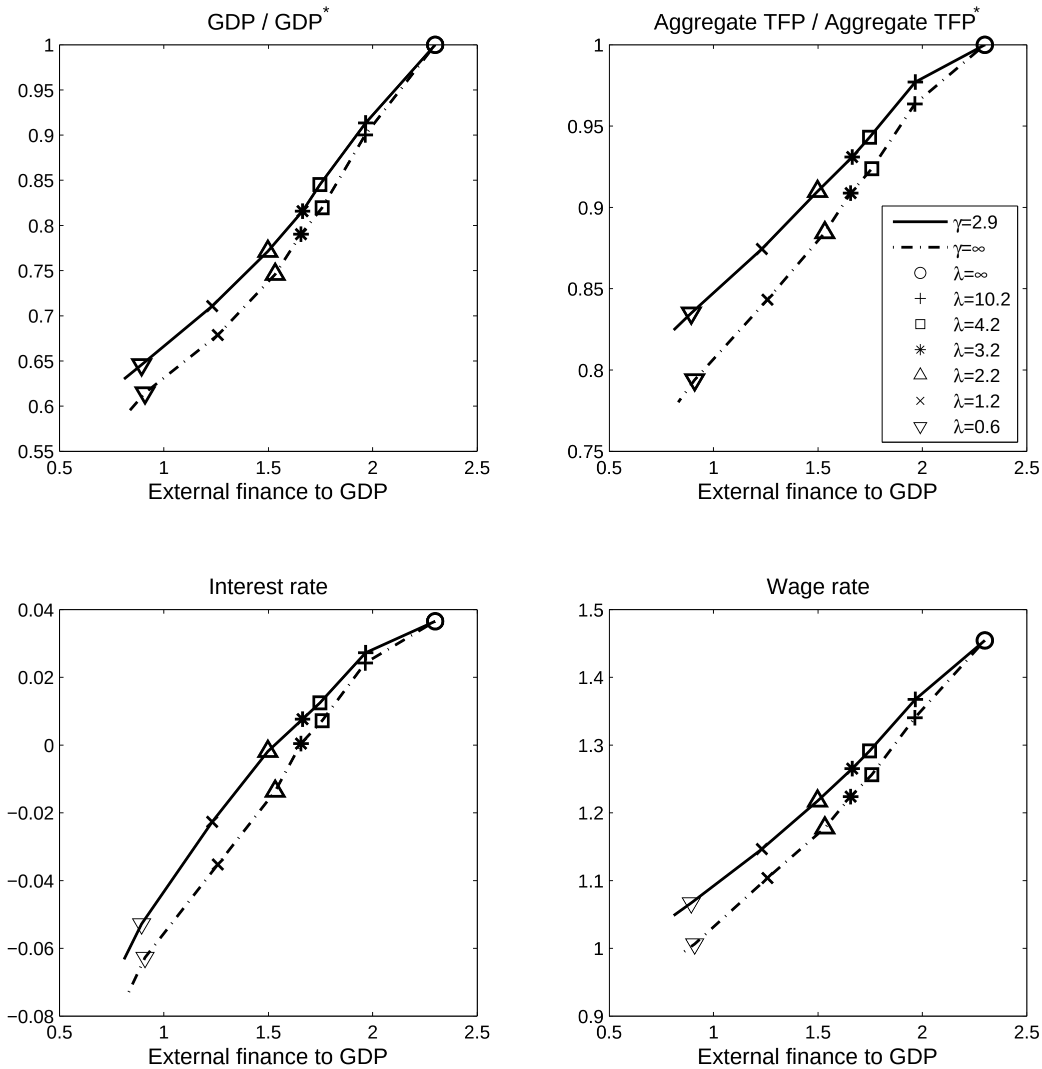


Figure 8: Comparative statics with respect to λ and γ

allocation. As a result the aggregate level of production rises. However, this positive effect is dampened by general equilibrium restrictions: business conglomeration pushes up the prices of production factors. This reduces factor demands, makes the credit constraint stricter, and decreases the aggregate level of production.[19] One interesting implication of this general equilibrium effect is that the resulting external finance to GDP ratios for a given value of λ are very similar across the economies with and without business conglomeration. On top of this negative effect, conglomeration entails real fixed costs that further reduce GDP.

The top panels of Figure 8 show that the overall effect of business conglomeration on economic development is positive and tends to be larger for economies with lower external finance to GDP ratios. Indeed, a ban on business conglomeration in an economy calibrated to match the salient features of the Canadian data ($\lambda = 4.2$) would result in a loss equivalent to 2.6 percent of the perfect-credit-market GDP per capita and to 1.9 percent of the perfect-credit-market aggregate TFP. In an economy with an external finance to GDP ratio roughly half of that observed in Canada ($\lambda = 0.6$), these losses would be 3.1 percent and 4.1 percent respectively. In more relative terms, this means that banning business conglomeration would reduce the GDP per capita by roughly 3 percent in the first economy, but by roughly 5 percent in the second economy. These results suggest that business conglomeration plays a more important role in allocating resources in economies with lower financial development.

Figure 9 shows how entrepreneurship and business conglomeration respond to the variation in the severity of credit constraints. More severe credit

[19]The negative interest rates in Figure 8 do not indicate a flaw. In all models in which capital depreciates even when not utilized, equilibrium interest rates can be as low as $-\delta$. See, e.g., Aiyagari (1994).

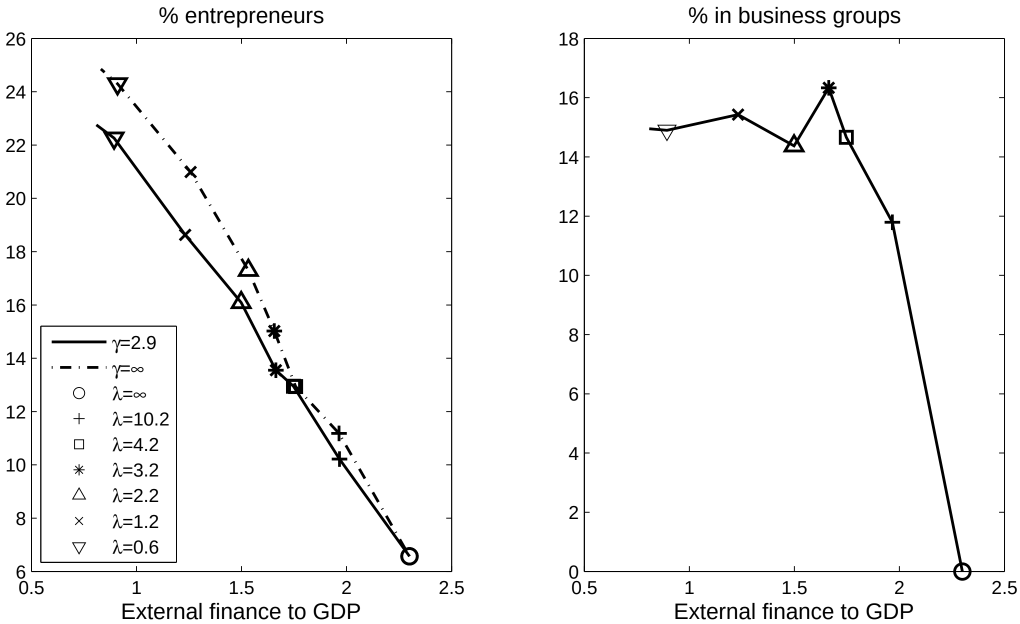


Figure 9: Comparative statics with respect to λ and γ

constraints lead to higher rates of entrepreneurship. Moreover, entrepreneurship rates tend to be higher in economies without business conglomeration. The intuition behind these results is that higher wages and interest rates make entrepreneurship less profitable for people with lower managerial abilities and lower net worth, implying tougher selection into entrepreneurship. As a result, the model is consistent with the fact that economies with lower levels of economic development have a higher number of entrepreneurs who operate at smaller scales (Gollin, 2008; Poschke, 2014).

The degree of business conglomeration, measured by the fraction of entrepreneurs in business groups, tends to zero as the economy approaches the perfect-credit-market case ($\lambda = \infty$) because the gains from internal capital reallocation tend to zero and business conglomeration implies a fixed cost.

For values of λ in the lower and intermediate range, the proportion of business groups in the economy fluctuates little, and in a non-monotone way. To understand this result, realize that lower financial development has two effects on the profitability of business conglomeration. First, worse external credit markets mean higher dispersion in the marginal products of capital between the potential partners. This raises the benefit that can be obtained from reallocating one additional unit of capital through the internal capital market. Second, lower financial development makes business groups more credit-constrained, which limits the total amount of capital that could be reallocated internally. As a result, fewer establishments can be operated on a scale large enough to compensate for the cost of conglomeration. The equilibrium degree of business conglomeration is given by the balance between these two opposing effects. For several chosen parametrizations, the negative "volume" effect largely compensates the increase in the marginal benefit of internal reallocation, resulting in a proportion of entrepreneurs in business groups that is never far from 15 percent, unless the credit constraint is relatively slack.

In contrast, anecdotal evidence and several empirical studies suggested that business groups and conglomerates are much more prevalent in poorer countries with less developed financial markets (Khanna and Palepu, 1997, 2000; Khanna and Yafeh, 2007; Almeida and Wolfenzon, 2006). Figure 10 illustrates this relationship by plotting the proportion of group-affiliated firms against the ratio of external finance to GDP in a cross-section of countries. The data on group affiliation is from Masulis et al. (2011), who used information on ultimate ownership of listed companies and defined a group as two or

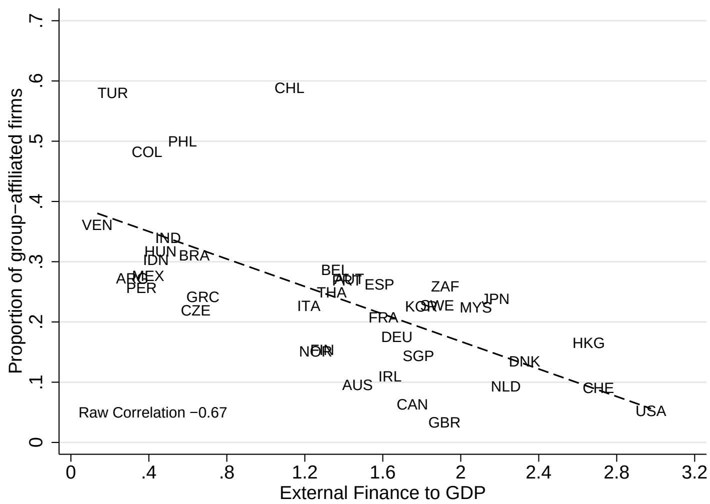


Figure 10: Conglomeration and financial development

more firms that are listed in the same market and share the same ultimate controlling shareholder.[20] Since my model does not deliver any implications about ownership concentration, this definition cannot be directly mapped to the simulated data. However, it is reasonable to think that internal capital markets are especially active in business groups with concentrated ownership, and I believe it is possible to use Figure 10 as suggestive evidence that the prevalence of internal capital markets rises with lower financial development.

My results advise against interpreting this negative correlation as causation. Instead, the model implies that factors other than credit constraints are more likely to determine the degree of business conglomeration in a coun-

[20]Masulis et al. (2011) defined the controlling shareholder as the largest shareholder who effectively controls (directly or through holdings of affiliates) at least 20 percent of a firm's voting rights, or controls at least 10 percent of voting rights and has other forms of control, such as being a firm's founder, CEO, or chairman of the board.

try. A plausible conjecture is that the cost of conglomeration also varies across countries. In particular, in countries with less financial development there seem to be fewer regulations on mergers and acquisitions and more government policies or corruption that may favor large business groups and conglomerates. Unfortunately, empirical studies that would systematically review and compare such policies across countries, which would allow me to carefully map them into the model, are lacking. One crude way to generate the observed pattern in the model is to vary the cost of conglomeration parameter (γ). Higher prevalence of business groups in countries with less developed financial markets would then amplify the quantitative importance of internal capital markets compared to the results obtained earlier in this section.

8. Concluding Remarks

The analysis in this paper showed that the use of internal capital markets through business conglomeration allows firms to partially avoid external credit market imperfections. The quantitative analysis showed that although financial frictions remain an important source of misallocation of resources across heterogeneous producers, this additional adjustment margin may reduce the extent of misallocation by a non-negligible magnitude.

Diversified conglomerates and business groups are a distinctive feature of many developing economies, and I believe much research is left to be done to better understand their role for economic development. Collecting data on cross-country differences in restrictions on business conglomeration and studying more systematically their relationship to financial and economic development should be an interesting direction for the empirical literature. From the applied theory point of view, I can think of at least three interesting extensions for future research. First, integrating more explicitly the elements of the theory of the firm, which define firms' boundaries and growth, would allow us to connect differential firm growth patterns to a country's levels of economic and financial development. Clearly, formation of an internal capital market is only one of several possible reasons for businesses to conglomerate. Other theories, especially those involving synergies, technology transmission, and diffusion of innovations (e. g., Jovanovic and Rousseau, 2008), deserve to be exploited by the economic development literature. A second, related issue worth exploring is business groups dynamics. Allowing for long-lived business groups may help us understand the observed persistence in group affiliation and long-term interactions among affiliated firms. Finally, I have not considered the market and political power that is often concentrated in the hands of large business groups. This may be important for understanding the market structure and the emergence of subsidy policies, barriers to entry, or even barriers to financial development.

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