Université de Montréal

Essais en économie avec frictions financières

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Thèse présentée à la Faculté des études supérieures
en vue de l'obtention du grade de Philosophiæ Doctor (Ph.D.)
en sciences économiques

Mai, 2010

Université de Montréal
Faculté des études supérieures

Cette thèse intitulée:

Essais en économie avec frictions financières

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Thèse acceptée le: 7 juillet, 2010

RÉSUMÉ

Les trois essais dans cette thèse étudient les implications des frictions financières, telles que les contraintes de collatérale ou de crédit, pour les décisions économiques des agents et leur impact sur les variables macro-économiques agrégées.

Dans le premier chapitre «Financial Contracts and the Political Economy of Investor Protection»nous proposons une théorie du niveau de protection des investisseurs. Une faible protection des investisseurs implique un coût de financement externe plus élevé à cause des problèmes d'agence plus aigus entre les investisseurs et les entrepreneurs. À l'équilibre, ceci exclut les agents plus dépendants sur le financement externe de l'entrepreneuriat, ce qui augmente les profits des entrepreneurs qui restent actifs. Quand le niveau de la protection des investisseurs est choisi par un vote majoritaire, la théorie génère (i) une protection des investisseurs plus faible dans les économies avec plus grande inégalité dans les besoins de financement externe parmi les entrepreneurs, (ii) une dynamique non-monotone de l'output, (iii) améliorations (détériorations) de la protection des investisseurs suite à des ralentissements (accélérations) de l'output agrégé. L'évidence empirique donne un support à ces prédictions de la théorie.

Dans le deuxième chapitre «Financial Frictions, Internal Capital Markets, and the Organization of Production», nous examinons comment la présence des frictions financières peut mener à la formation des conglomérats et des «business groups»diversifiées. Particulièrement, nous construisons un modèle d'équilibre général d'entrepreneuriat dans lequel les conglomérats émergent de façon endogène et substituent partiellement le marché du crédit imparfait. Nous montrons que ce modèle est capable d'expliquer quantitativement plusieurs faits stylisés concernant l'organisation de la production, les différences de productivité entre les firmes et les différences en présence des conglomérats entre les pays.

Le troisième chapitre «Size and Productivity of Single-segment and Diversified Firms : Evidence from Canadian Manufacturing»étudie empiriquement la relation entre la taille, la productivité, et la structure organisationnelle d'une firme. Utilisant les micro-données sur les établissements manufacturiers canadiens, nous documentons plusieurs faits stylisés concernant la taille et la productivité totale des facteurs des établissements dans les conglomérats et dans les firmes non-diversifiées. Nous trouvons que les établissements dans les conglomérats sont en moyenne plus larges que leurs contreparties dans les firmes non-diversifiées, les petits établissements dans les conglomérats sont moins productifs que les établissements de taille similaire dans les firmes non-diversifiées, mais les larges établissements dans les conglomérats sont plus productifs que ceux de taille similaire dans les firmes non-diversifiées. Cette évidence est consistante avec réallocation interne efficiente des ressources au sein des conglomérats.

Mots clés: frictions financières, protection des investisseurs, contrats financiers, économie politique, conglomérat, distribution de la taille des établissements, productivité totale des facteurs.

ABSTRACT

The three essays in this thesis study the implications of financial frictions, such as collateral and credit constraints, for economic decisions of agents and their impact on aggregate macroeconomic variables.

In the first chapter "Financial Contracts and the Political Economy of Investor Protection", we propose a theory of the level of investor protection. Lower investor protection implies higher cost of external financing due to more severe agency problems between outside investors and entrepreneurs. In equilibrium, this excludes more financially dependent agents from entrepreneurship, increasing the profits of the remaining entrepreneurs. When the level of investor protection is chosen by majority voting, the theory generates (i) lower investor protection in economies with higher inequality in financial dependence across entrepreneurs, (ii) non-monotone output dynamics, (iii) improvements (worsening) of investor protection following output slowdowns (accelerations). The empirical evidence provides some support to these predictions.

In the second chapter "Financial Frictions, Internal Capital Markets, and the Organization of Production", we investigate how the presence of financial frictions may lead to formation of diversified conglomerates or business groups. Specifically, we build a general equilibrium model of entrepreneurship in which business groups arise endogenously and partially substitute for imperfect credit market. We show that the model is able to quantitatively explain several key stylized facts on the way production is organized, on cross-firm productivity differences, and on cross-country differences in the degree of conglomeration.

The third chapter "Size and Productivity of Single-segment and Diversified Firms: Evidence from Canadian Manufacturing" studies empirically the relation between size, productivity, and the organizational structure of a firm. Using micro-data on Canadian manufacturing plants, we document several stylized facts about size and total factor productivity of establishments in conglomerates and single-segment firms. We find that

establishments in conglomerates are on average larger than their counterparts in single-segment firms, small plants in conglomerates are less productive than plants of similar size in single-segment firms, but large plants in conglomerates are more productive than those of similar size in single-segment firms. This evidence is consistent with efficient internal reallocation of resources in conglomerates.

Keywords: financial frictions, investor protection, financial contracts, political economy, conglomerate, establishment size distribution, total factor productivity.

TABLE DES MATIÈRES

LISTE DES TABLEAUX

LISTE DES FIGURES

LISTE DES ANNEXES

LISTE DES SIGLES

ASM	Annual Survey of Manufacturers
BITS	Business Information Tracking Series
BR	Business Register
CAD	Canadian Dollar
LRD	Longitudinal Research Database
NAICS	North American Industry Classification System
TFP	Total Factor Productivity

À mes parents Jindra et Zdeněk.

REMERCIEMENTS

Je remercie mes directeurs de recherche Rui Castro et Alessandro Riboni. Ils m'ont guidé toute au longue de mes travaux de recherche. Leurs précieux conseils et leur soutien constant m'ont permis de surmonter tous les obstacles et de me rendre jusqu'au terme de cette belle expérience.

Je tiens ensuite à remercier Baris Kaymak dont les conseils et commentaires ont contribué à une amélioration substantielle de certaines parties de cette thèse.

Je suis honoré par l'attention que Boyan Jovanovic a accordé à mes travaux et je le remercie d'avoir accepté d'être mon évaluateur externe de cette thèse.

Je tiens également à remercier le personnel de la division de l'analyse économique de Statistique Canada de m'avoir permis de réaliser une partie de ma recherche au sein de leur équipe. Pendant mon séjour à Statistique Canada, j'ai bénéficié des conversations inspirantes avec John Baldwin et de la disponibilité de Robert Gibson qui a toujours traité rapidement toutes mes requêtes concernant les micro-données.

Je suis reconnaissant à mes collègues étudiants avec qui j'ai partagé mes années à l'Université de Montréal pour leur amitié, le climat de support mutuel, et les longues conversations sur nos sujets de recherche. Je remercie en particulier Nelnan Koumtingue, Bernard-Daniel Solomon, Firmin Doko Tchatoka, Johan Latulippe, Marie-Helène Cloutier, Bruno Feunou Kamkui, Constant Aimé Lonkeng Ngouana et Rachidi Kotchoni.

Merci à mes parents Jindra et Zdeněk. Sans leur support inconditionnel je n'aurais pu commencer mes études à l'université et les continuer jusqu'au ce niveau avancé. Je remercie également mon épouse Zuzana, qui a partagé avec moi la vie étudiante et qui m'a soutenu dans tous les moments difficiles.

Finalement, je veux remercier le Département de sciences économiques de l'Université de Montréal, le Centre de recherche en économie quantitative et Statistique Canada pour leur soutien financier.

NOTE SUR LA CONFIDENTIALITÉ

Tous les résultats obtenus à partir des micro-données et présentés dans cette thèse ont été vérifiés par Statistique Canada pour assurer qu'aucune information confidentielle ne soit révélée.

INTRODUCTION GÉNÉRALE

Cette thèse est constituée de trois essais qui étudient les implications des frictions financières pour le développement économique, la macro-économie, et l'organisation des activités productives d'un pays. Le premier essai présente une théorie de détermination politique et économique du niveau de protection des investisseurs. La protection des investisseurs est considérée comme l'un des facteurs les plus importants dans la déterminations des frictions financières. Cet essai tente d'expliquer pourquoi nous observons des niveaux de protection des investisseurs différents dans différents pays et pourquoi les réformes de la protection des investisseurs sont rares.

Les deuxième et troisième essais étudient comment les frictions financières influencent le choix de la structure organisationnelle des entreprises. Certaines formes organisationnelles, telles que les conglomérats ou les «business groups», permettent une réallocation interne des ressources au sein de l'entreprise ou d'un groupe d'entreprises. Ceci permet à ce type d'entreprises d'éviter la nécessité de faire face aux frictions sur les marchés financiers externes. Les deux essais étudient théoriquement et empiriquement les implications d'une telle réallocation interne des ressources sur la taille des établissements, leur productivité et plus généralement, sur l'organisation du secteur productif dans une économie.

La plupart des entrepreneurs qui démarrent un nouveau projet ou considèrent l'expansion de leur projet existant, font appel aux investisseurs externes (banques, actionnaires, ou créditeurs) pour obtenir des ressources financières nécessaires à couvrir les coûts de démarrage. Un entrepreneur est dit plus ou moins financièrement dépendant selon le montant du financement externe qu'il désire d'obtenir. La protection des investisseurs, définie comme le contenu et la mise en application de l'ensemble des lois qui protègent les investisseurs externes contre l'expropriation par les entrepreneurs, influence d'une façon cruciale la forme et le volume des contrats disponibles pour le financement externe des projets entrepreneuriaux. Plusieurs études ont démontré qu'une bonne protection des investisseurs améliore la disponibilité du financement externe, ce qui a un impact positif sur le développement financier et économique du pays (La Porta et al., 1997, Levine, 1999, Levine et al., 2000, Rajan and Zingales, 1998). Néanmoins, en regardant les données des mesures standards du niveau de protection des investisseurs, tels que les indices des droits des actionnaires et des droits des créditeurs (Djankov et al., 2007, La Porta et al., 1998) et les indices de la mise en application des lois et contrats (Djankov et al., 2008a, b, World Bank, 2009), nous apercevons une grande disparité dans les niveaux de protection des investisseurs à travers différents pays. Dans le premier essai, nous proposons une théorie qui peut expliquer pourquoi tous les pays n'adoptent pas la protection des investisseurs la plus haute malgré son effet bénéfique sur la performance économique du pays. Notre théorie tente aussi d'expliquer le fait que les reformes qui engendrent l'amélioration de la protection des investisseurs semblent être relativement rares, ce qui cause la disparité entre les pays en matière de protection des investisseurs d'être un phénomène persistant.

Notre théorie est basée sur l'idée que les réformes des lois qui agisse sur la protection des investisseurs et leur mise en application sont en large partie issues d'un processus politique. Nous proposons alors un modèle politico-économique qui relie la dynamique et le niveau de long terme de la protection des investisseurs à l'inégalité en termes des besoins de financement externe parmi les entrepreneurs. Nous utilisons un modèle à deux secteurs et à générations imbriquées similaire à celui de Bernanke and Gertler (1989) pour formaliser notre théorie. Particulièrement, nous supposons que les agents diffèrent en termes des coûts de démarrage d'un projet entrepreneurial dont le retour est stochastique. Seul l'entrepreneur peut observer la réalisation du retour de son projet, ce qui crée un problème d'agence entre les entrepreneurs et les investisseurs externes. Le financement externe est alors disponible seulement à travers des contrats optimaux avec un intermédiaire financier qui a accès à une technologie de vérification du retour d'un projet entrepreneurial. Néanmoins, comme dans Townsend (1979) cette vérification est coûteuse.

Nous supposons que le niveau de protection des investisseurs détermine le coût de vérification et donc la sévérité du problème d'agence. Une faible protection des investisseurs rend le problème d'agence plus sévère, ce qui implique un coût de financement externe plus élevé. À l'équilibre, ceci exclut les agents avec des besoins de financement externe élevés de l'entrepreneuriat, ce qui diminue l'offre du bien produit par les entrepreneurs et rend ce bien plus cher. En conséquence, les profits des entrepreneurs qui restent sur le marché deviennent plus élevés. Quand le niveau de protection des investisseurs est déterminé par un vote à la majorité, notre modèle génère des niveaux plus faibles de protection des investisseurs dans les économies avec une plus grande inégalité en termes des besoins de financement externe parmi les entrepreneurs. Le modèle prédit aussi une dynamique d'output non-monotone et des reformes améliorant la protection des investisseurs qui suivent les périodes de ralentissement de l'output agrégé. Les données empiriques semblent supporter ces prédictions du modèle théorique.

Le premier essai contribue à la récente littérature sur les déterminants politiques du niveau de protection des investisseurs (Biais and Mariotti, 2009, Pagano and Volpin, 2005, Perotti and Volpin, 2007). Notre travail partage avec ces études l'idée que la protection des investisseurs imparfaite peut jouer comme une barrière à l'entrée dans l'entrepreneuriat. Le principal apport de notre travail est l'analyse dans un cadre explicitement dynamique. En contraste avec les études précédentes, ceci nous permet de regarder les implications pour la dynamique des réformes de la protection des investisseurs, ainsi que le niveau de protection des investisseurs et d'output agrégé vers lequel l'économie est susceptible de converger à long-terme.

Les deuxième et troisième essais étudient comment les frictions financières créent un rôle pour la réallocation des ressources sur les marchés internes au sein des larges entreprises diversifiées. Cette réallocation interne engendre des implications importantes pour la productivité mesurée des établissements, la distribution de la taille des établissements et plus généralement, l'organisation de production dans un pays. Les entreprises larges qui opèrent dans de multiples industries (les conglomérats) ainsi que les groupes des entreprises liées par des liens financiers ou familiaux forts (les «business groups») représentent une large proportion des actifs corporatifs et des activités économiques dans beaucoup de pays. Étant donné le poids économique de ces entreprises diversifiées, il est important de comprendre les effets de conglomération sur l'allocation des ressources à travers les firmes, l'entrepreneuriat, la taille et la productivité des établissements et sur les variables macro-économiques.

Dans le deuxième essai, nous construisons un modèle quantitatif dans lequel la conglomération permet aux entreprises d'éviter partiellement les imperfections sur le marché du crédit. Nous évaluons la capacité de ce modèle à reproduire quantitativement des faits stylisés sur l'organisation de production et les différences parmi les pays en présence des conglomérats. Nous implantons la formation des conglomérats dans un modèle standard d'équilibre général d'entrepreneuriat à agents hétérogènes avec contraintes de crédit comme celui de Cagetti and De Nardi (2006). Les agents avec différentes habilités et richesse décident de leur occupation en tant que travailleurs ou entrepreneurs. Les entrepreneurs choisissent s'ils vont opérer leur propre entreprise ou s'ils deviennent une partie d'un conglomérat diversifié. À cause des contraintes de crédit, seulement les agents suffisamment riches ont un accès illimité au financement externe. Les conglomérats émergent de façon endogène donnant la possibilité de créer au sein de la firme un marché de crédit interne, ce qui réduit la dépendance sur le financement externe de certains projets affiliés au conglomérats. Les marchés de crédit internes permettent aussi de réallouer le capital à travers les projets affiliés d'une manière plus efficace.

Nous calibrons le modèle pour l'accorder avec quelques moments empiriques concernant l'importance de l'entrepreneuriat, et l'inégalité de richesse et revenu. Le modèle est capable de reproduire certains faits saillants de la distribution de la taille des établissements. Particulièrement, à travers de la réallocation interne du capital, les conglomérats génèrent une concentration des projets affiliés dans les catégories de taille large. Le modèle est aussi capable d'expliquer et de concilier les deux observations empiriques concernant la productivité des projets qui semblaient contradictoire. Particulièrement, Schoar (2002) trouve que les établissements dans les conglomérats tendent à être plus productifs en moyenne que ceux dans les firmes non-diversifiées, mais Maksimovic and Phillips (2002) trouvent que cette relation est inversée lorsqu'on contrôle pour la taille du projet. Notre modèle montre que les projets les plus productifs ont une probabilité plus grande de se sélectionner dans les conglomérats, d'où la relation positive non-conditionnelle entre la conglomération et la productivité. De l'autre côté, parce que la conglomération relâche la contrainte de crédit, la masse des projets à très grande productivité qui sont contraints à opérer à une taille sous-optimale est plus petite dans les conglomérats que dans les firmes non-diversifiées. En conséquence, si nous regardons la productivité moyenne des projets dans une classe de taille donnée, nous allons trouver, pour la plupart des tailles à l'exemption des plus larges, que les projets en conglomérats sont en moyenne moins productifs que ceux en firmes non-diversifiées.

Dans des expériences quantitatives, nous montrons que les contraintes de crédit plus sévères mènent à un degré plus important de conglomération dans l'économie. Nous montrons aussi que, en général, la conglomération est susceptible d'avoir des impacts positifs sur le développement économique lorsque les marchés financiers sont affectés par des frictions.

Le deuxième essai contribue à la littérature qui étudie la diversification des entreprises et son impact à la productivité et la taille des établissements (Almeida and Wolfenzon, 2006a, Maksimovic and Phillips, 2002, Schoar, 2002) ainsi qu'à la littérature sur les fusions et acquisitions (Jovanovic and Braguinsky, 2004, Jovanovic and Rousseau, 2002), les partenariats parmi les entrepreneurs (Basaluzzo, 2006) et la littérature sur la relation entre l'allocation des ressources à travers des établissements et le développement économique (Alfaro et al., 2008, Banerjee et al., 2003, Buera et al., 2009, Hsieh and Klenow, 2009, Restuccia and Rogerson, 2008).

Le troisième essai établit plusieurs faits empiriques sur la distribution de la taille et de la productivité totale des facteurs des établissements dans les conglomérats et dans les firmes non-diversifiées. À partir des micro-données sur le secteur manufacturier canadien, nous d'abord montrons que, bien qu'au Canada les conglomérats ne sont pas nombreux, leur rôle dans l'économie est important. En effet, les conglomérats représentent autour de 18% des établissements manufacturiers, mais autour de 70% de la valeur ajoutée totale du secteur manufacturier au Canada. Nous apportons une nouvelle évidence sur la distribution de la taille des établissements conditionnellement à la structure organisationnelle de l'entreprise. Particulièrement, nous estimons séparément les distributions de taille pour les établissement faisant partie des conglomérats et pour ceux dans les firmes non-diversifiées en utilisant les estimateurs non-paramétriques des fonctions de densité. Nos résultats montrent que la distribution de la taille des établissements dans les conglomérats est décalée vers les tailles plus larges comparativement à la distribution de la taille des établissements dans les firmes non-diversifiées. Par la suite, nous nous posons la question si la taille plus large des établissements dans les conglomérats est justifiée par leur plus grande productivité. Pour répondre à cette question, nous estimons la productivité totale des facteurs suivant la procédure de Levinsohn and Petrin (2003) qui corrige pour le biais d'endogénéité des inputs de production. Nous trouvons que les établissements en conglomérats sont en moyenne plus productifs que ceux dans les firmes non-diversifiées, mais cette relation est inversée lorsque nous contrôlons pour la taille d'établissement. Ce résultat peut paraître surprenant.

Nous montrons que la comparaison des productivités moyennes cache des détails très importants concernant la relation entre la taille d'un établissement et sa productivité. Particulièrement, nous trouvons que dans des classes de taille large, la distribution de la productivité totale des facteurs des établissements dans les conglomérats est décalée vers les niveaux de productivité plus élevés par rapport à la distribution de la productivité totale des facteurs des établissements dans les firmes non-diversifiées. De l'autre côté, si nous regardons la productivité des établissements dans une classe de taille plus petite, la distribution de la productivité totale des facteurs des établissements dans les conglomérats est décalée vers les niveaux de productivité plus bas par rapport à la distribution de la productivité totale des facteurs des établissements dans les firmes non-diversifiées. Ce résultat est consistant avec la théorie de réallocation efficace des ressources au sein des conglomérats telle que proposée par Stein (1997) et implantée dans un modèle d'équilibre général dans le deuxième essai de cette thèse.

Le troisième essai contribue à la littérature sur la distribution de la taille des établissements (Angelini and Generale, 2008, Axtell, 2001, Cabral and Mata, 2003, Desai et al., 2003, Dunne et al., 1989, Evans, 1987, Hall, 1987, Rossi-Hansberg and Wright, 2007) et à la littérature qui regarde les implications pour la productivité et l'allocation des ressources suite à la diversification des firmes (Maksimovic and Phillips, 2002, Schoar, 2002) et suite aux fusions et acquisitions (Jovanovic and Braguinsky, 2004, Jovanovic and Rousseau, 2002). Nos résultats peuvent être aussi intéressants pour la littérature qui tente d'expliquer le rôle des frictions financières dans la misallocation des ressources à travers des établissements (Castro et al., 2009, Hsieh and Klenow, 2009, Restuccia and Rogerson, 2008).

CHAPITRE 1

FINANCIAL CONTRACTS AND THE POLITICAL ECONOMY OF INVESTOR PROTECTION

1.1 Introduction

Most entrepreneurs that start a new business or expand an existing one call upon outside investors (banks, shareholders, or creditors) to provide financial resources to cover at least a part of the upfront business set-up costs. An entrepreneur is said to be more or less financially dependent according to the amount of external finance that he wishes to obtain. Investor protection, broadly defined as the contents and enforcement of the laws that protect outside investors from expropriation by the entrepreneurs, crucially shapes the contracts available for external financing. In fact, several studies have documented that good investor protection enhances the availability of external finance, which has a positive impact on financial development and broad economic outcomes (La Porta et al., 1997, Levine, 1999, Levine et al., 2000, Rajan and Zingales, 1998). On the other hand, standard indicators of investor protection, such as shareholder rights, creditor rights, and contract enforcement indices, vary widely across countries.[1] Moreover, in most countries reforms of laws governing investor protection are rare, making these cross-country differences very persistent. Why do not all countries implement the highest investor protection ? What determines the level of investor protection ?

The laws that define investor protection and their enforcement are to a large extent outcomes of a political process. This paper tries to shed some light on political determinants of investor protection by proposing a theory that links the dynamics and the long run level of investor protection to cross-entrepreneur heterogeneity in the dependence on external finance. My theory has two main implications. First, more inequality in finan-

[1]See for example Djankov et al. (2007), La Porta et al. (1998), and the World Bank's web site at http ://www.doingbusiness.org.

cial dependence across entrepreneurs leads to lower levels of investor protection in the long run. If entrepreneurs that operate in the same industry and use similar technologies have substantially different needs for external financing, then this is most likely due to high wealth inequality, unequal access to alternative sources of internal financing (for example through business groups), or preferential treatment of some entrepreneurs by public administration (access to preferential public credit, access to government subsidies, corruption). My result therefore suggests that reforming investor protection might be particularly difficult in countries where these problems are highly prevalent. Second, my theory predicts a particular timing of investor protection reforms. Specifically, reforms improving investor protection should be more likely to occur after periods of low economic growth, when agents are less wealthy and have to rely more on external finance in order to start their businesses.

The data provides some support for these two implications. Across countries, the Gini coefficient of the wealth distribution as well as an interaction term of corruption and start-up costs are negatively and significantly correlated to most indicators of investor protection. These correlations are significant even when controlling for country's legal origin, which, as shown by La Porta et al. (1998), is a factor explaining differences of investor protection across countries. Over time, the data is also suggestive of a negative relationship between changes in indices of investor protection and lagged GDP growth.

The starting point in my theory is a two-sector overlapping generations model of capital accumulation. Firms in the consumption good sector are perfectly competitive and produce with standard neoclassical technology with constant returns to scale. The capital good, on the other hand, is produced in fixed size entrepreneurial projects. Agents differ with respect to project start-up costs and decide whether or not they become entrepreneurs. A part of the business start-up cost may be covered by resources obtained from outside investors. I refer to the agent as being more or less financially dependent according to the amount of external finance that he needs to obtain in order to pay his start-up cost. Because the output of an entrepreneurial project is stochastic and its realization is private information to the entrepreneur, external financing is available only through optimal contracts with a financial intermediary in the spirit of Bernanke and Gertler (1989). In particular, I assume that the intermediary has access to an auditing technology, which makes the production publicly observable, but at a cost. Under perfect investor protection this cost is zero and there are no agency problems. By contrast, under imperfect investor protection the auditing cost is positive and the agency problem raises the cost of external funding. Consequently, agents with high dependence on external finance do not become entrepreneurs and choose instead to invest on international markets. Therefore, a low level of investor protection lowers the entrepreneurship and the supply of capital good, and leads to a higher price of capital. For some entrepreneurs this general equilibrium effect compensates the higher cost of external funds, resulting in higher profits. In other words, low investor protection induces a redistribution of profits from more to less financially dependent agents. If reforms of investor protection are made by voting, imperfect investor protection can be sustained if the less financially dependent agents have enough political power.

Under a simple majority voting rule voters face a trade-off between higher agency costs and a higher relative price of capital good. I order the voters according to their business start-up cost and show that the median voter theorem applies. Imperfect investor protection may emerge in equilibrium when (i) the median voter has low enough financial dependence and (ii) there is enough heterogeneity in external finance dependence among potential entrepreneurs. The first condition ensures that the rise in the agency cost of the median voter resulting from a marginal worsening of investor protection is not too high. The second condition ensures that the rise in the price of capital good resulting from a marginal worsening of investor protection via general equilibrium effect is sufficiently strong.

The long run outcome and dynamics of the politico-economic equilibrium crucially depend on the shape of the distribution of financial dependence. This shape determines the level of capital accumulation that prevails under perfect investor protection, which is the economy's first-best level of capital accumulation. It also pins down the identity of the decisive voter and the strength of the general equilibrium effect on the price of capital good. I study how changes in the shape of the distribution of financial dependence influence the political outcome. I first consider distributional changes that leave the first-best level of capital accumulation unchanged, but imply different degrees of inequality in financial dependence among entrepreneurs. In economies with more inequality the decisive voter is relatively less dependent on external finance and the general equilibrium effect on the price of capital good is relatively weaker. In the decisive voter's trade-off, this decreases both the marginal cost and benefit of worsening investor protection. I show numerically that the decrease in the marginal cost is always dominant, so that higher inequality in financial dependence leads to lower investor protection, a lower level of capital accumulation, and lower aggregate output in the politico-economic steady-state equilibrium. This result appears to be consistent with the cross-country empirical evidence. I then consider distributional changes that also affect the economy's first-best level of capital accumulation. I show numerically that higher variance and skewness towards low financial dependence induce lower equilibrium levels of investor protection, but may lead to a lower or a higher level of capital accumulation and aggregate output in the politico-economic steady-state equilibrium. Therefore, with such distributional changes there is not a clear negative relationship between investor protection and economic development. This ambiguity arises because of shifts in the economy's first-best level of capital accumulation. In fact, some of these distributional changes imply an increase in the economy's first-best level of capital accumulation that is sufficiently high to compensate the negative effect of poorer investor protection selected in the politico-economic equilibrium. These results help to rationalize why certain countries, such as France and Belgium, are remarkably rich in spite of having bad investor protection. The literature has regarded such examples as being puzzling (La Porta et al., 1997, Levine et al., 2000).

Finally, the relation between economic growth and reforms of investor protection is examined. Imperfect investor protection is more likely to emerge after periods with high aggregate output because the decisive voter is relatively wealthy and relies less on external finance. On the other hand, low investor protection depresses aggregate output, which may lead to a reform that improves the level of investor protection in the future. Generally, in contrast to a model of capital accumulation without voting, the addition of politics generates non-monotone equilibrium dynamics.

There is a recent literature studying the political determinants of investor protection (Biais and Mariotti, 2009, Pagano and Volpin, 2005, Perotti and Volpin, 2007) to which this paper is related. My paper shares the underlying idea that imperfect investor protection or soft bankruptcy laws act as a barrier to entry into entrepreneurship with Biais and Mariotti (2009) and Perotti and Volpin (2007). However, in contrast to my paper, the remaining literature does not consider the political determination of investor protection in a dynamic framework. In this case, it is not possible to analyze the dynamics and long run outcomes of the political equilibrium. Perotti and Volpin (2007) develop a political economy model in which choosing the level of investor protection is equivalent to choosing an entry cost. They stress the the role of political accountability of the government as the key determinant of investor protection. They also provide empirical support for the idea that low investor protection and financial underdevelopment act as a barrier to entry. Biais and Mariotti (2009) consider a model in which soft bankruptcy laws worsen credit rationing which hinders firm creation and depresses labor demand. This leads to lower wages and higher profits for the richer entrepreneurs who therefore favor soft bankruptcy laws. While the mechanism that generates imperfect investor protection in my model is similar to theirs, the two studies focus on different issues. Biais and Mariotti (2009) are interested in theoretical and normative implications of their model. They show under which circumstances soft bankruptcy laws may generate greater utilitarian welfare than tougher laws. By contrast, my study has a positive perspective and delivers predictions that are compared to the key empirical stylized facts concerning investor protection. Particularly, my dynamic model suggests an important role of political determinants in explaining the timing of investor protection reforms as well as persistent cross-country differences in levels of investor protection. Pagano and Volpin (2005) show how proportional electoral systems may to lead to selection of lower investor protection and stronger employment protection than majoritarian systems. Their model, however, does not feature endogenous occupational choice and the proportion of each group of stakeholders in the population is given exogenously, while their political power is determined by the features of the electoral system.

More broadly, my paper is also related to the vast literature that has shown how the net worth of potential entrepreneurs matters in presence of financial frictions (Aghion and Bolton, 1997, Banerjee and Newman, 1993, Bernanke and Gertler, 1989, Piketty, 1997), as well as to more recent contributions of Castro et al. (2004, 2009), Erosa and Hidalgo Cabrillana (2008), and Rajan and Zingales (2003, 1998) that link financial development to economic growth.

The remainder of the paper is organized as follows. In Section 1.2 I spell out the model and characterize the economic and political equilibria. In Section 1.3 I analyze the main implications of the theory and illustrate them with several numerical examples. In Section 1.4 I examine whether empirical evidence supports the theory's main predictions. Finally, I conclude in Section 5.

1.2 Model

My model builds on Bernanke and Gertler's (1989) general equilibrium version of Townsend's (1979) costly state verification framework. I first describe and characterize the economic equilibrium for a given level of investor protection. Then, in Section 1.2.5, I analyze the political determination of investor protection.

1.2.1 The Environment

I consider a small open economy with overlapping generations of two-period lived risk-neutral agents. Each generation has measure one. Time is denoted by subscript t and goes from zero to infinity. The economy has two goods, a consumption good and a capital good. The consumption good is the numeraire and q_t denotes the relative price of the capital good. I assume that the capital good has to be produced domestically. The international financial market allows to save at an exogenous gross interest rate $r \geq 1$.

All agents born at time t work when they are young and receive labor income w_t in consumption units. Then they decide the occupation for the second period of their lives. They can either become investors or entrepreneurs. If an agent chooses to become an investor, he saves w_t in the international financial market at the gross interest rate r. Otherwise, he uses his labor income to cover the cost of setting up a business. Potential entrepreneurs are endowed with production technologies, which are identical except for different set up costs. An agent of type z has to pay the amount $x(z)$ in consumption units in order to become entrepreneur, with $x'(z) > 0$. The agents' types are distributed according to a continuous probability distribution with cumulative distribution function $G(z)$ on $[0,1]$. One interpretation of the start-up cost heterogeneity is that agents differ in their talent and/or cost function. Alternatively, one may think that some agents are favored in the process of establishing a business. For example, z could indicate the location of the agent. One may argue that some locations are better than others : it could be easier to establish a business in the city compared to the countryside. Yet another interpretation could be in terms of connections to the "right" people in the administration. It could be that some agents must pay additional bribes when they want to establish a business. These interpretations are relevant for developing countries with bad infrastructure or countries with a high level of corruption.

The consumption good is produced by a competitive firm according to a standard neoclassical technology, $F(K,L)$, combining capital and labor with constant returns to scale. I assume that $F(K,L)$ is strictly increasing in both arguments, strictly concave, and satisfies the Inada conditions. For simplicity I also assume that capital fully depreciates in one period. The capital good is produced by the agents who choose to become entrepreneurs. The capital production technology is described as follows. Each agent can put up one entrepreneurial project at the end of the first period of his life. If he is able to gather funds to cover his project's start-up cost, he becomes an entrepreneur and the project is implemented. Each project's return is stochastic, independently and identically distributed across projects. With probability π the outcome is "low" and the project generates an amount κ_L of capital good, with complementary probability $(1-\pi)$ the project's outcome is "high" and it generates an amount $\kappa_H > \kappa_L$ of capital good. The expected output of a project is denoted by $\kappa \equiv \pi\kappa_L + (1-\pi)\kappa_H$. The return of the entrepreneurial project, or the return on investment in the international financial market, is collected (and consumed) in the next period when agents are old. Figure 1.1 summarizes the timing.

1.2.2 Financial Intermediation and Occupational Choice

The agents who do not have sufficient funds to cover their business start-up cost and wish to become entrepreneurs borrow from a financial intermediary. The financial contract cannot be made fully contingent on the actual production outcome, because the realization of the idiosyncratic production shock is private information to the entrepre-

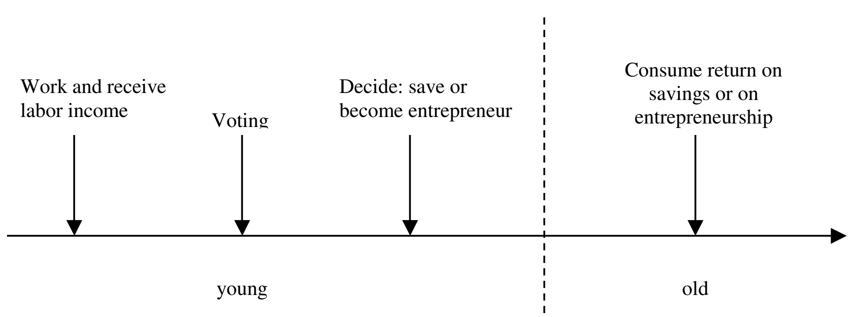


Figure 1.1 – Timing

neur. Instead, the entrepreneur announces to the intermediary how much was produced and the contract specifies the amount of loan repayment conditional on this report. The intermediary can decide to verify the entrepreneur's report by ordering an audit of the project which makes the output publicly observable. An audit costs an amount $q_{t+1}\gamma_t$ of consumption good.[2] I view the auditing cost γ_t as a proxy for investor protection. Lower auditing costs imply better monitoring and better protection of outside investors from expropriation by the entrepreneur. Conversely, higher auditing costs are associated with lower investor protection. This approach allows us to think about investor protection as a broad concept that embodies a large number of regulations, laws, and their enforcement. For example, when the standards of financial reporting and transparency requirements are low, investors must pay additional costs for obtaining the financial information necessary to exercise some control over the company. The auditing cost may also be thought of as a cost of liquidating the company in case of failure, which will depend on toughness and enforcement of bankruptcy law. If the law is tough and strictly enforced, the proceeds from liquidation will be higher than under a poor law enforcement, as less effort and lower costs must be incurred in order to retrieve the proceeds. I restrict the policy space to the interval $\left[0,\gamma^H\right]$, where $\gamma^H \equiv \left(\frac{1-\pi}{\pi}\right)(\kappa_H - \kappa_L)$. This is without loss of generality because the equilibrium allocation under any policy $\gamma_t \geq \gamma^H$ will be identical.[3] The actual level of investor protection is assumed to be known before financial contracts are signed, and thus the contracts take the investor protection as given. I allow for random auditing : the intermediary can choose the probability with which a project will be audited contingent on the entrepreneur's announcement. More formally, a financial contract for an entrepreneur of type z with labor income w_t is a seven-tuple

[2]The fact that the auditing costs are assumed to be paid in consumption good is not essential for my results. In fact, if the auditing costs were paid in capital good, the general equilibrium effect of investor protection on the relative price of the capital good would be stronger which would only reinforce my results.

[3]This will be explained in more detail in Section 1.2.3. Intuitively, if the auditing cost is above γ^H, only the entrepreneurs that can fully repay the intermediary even in the "low" production realization obtain external financing. For those agents the optimal contract will not depend on γ_t. Therefore, their financial contract will not change by further increasing the auditing cost beyond γ^H.

$\left\{a_t(z), \left\{p_{it}(z), c^a_{it}(z), c_{it}(z)\right\}_{i=L,H}\right\}$, where $a_t(z)$ is the investment advance, $p_{it}(z)$ is the probability of auditing when the entrepreneur reports that his output is equal to κ_i, with $i = L, H$, and $c^a_{it}(z)$, $c_{it}(z)$ are the consumption levels for the entrepreneur for each possible report in case, respectively, of auditing and non-auditing. I assume that financial intermediation is a competitive sector with free entry. The optimal contract maximizes the entrepreneur's expected consumption subject to an incentive compatibility constraint in case of high output realization, a financial intermediary's break-even constraint, and feasibility constraints on auditing probabilities.[4] Denoting $V^E_t(z)$ the value for type z of initiating a project, the contracting problem can be written as follows.

$$V^E_t(z) = \max_{a_t(z), \left\{p_{it}(z), c^a_{it}(z), c_{it}(z)\right\}_{i=L,H}} \{\pi\left[p_{Lt}(z)\,c^a_{Lt}(z) + (1 - p_{Lt}(z))\,c_{Lt}(z)\right] + (1-\pi)\left[p_{Ht}(z)\,c^a_{Ht}(z) + (1 - p_{Ht}(z))\,c_{Ht}(z)\right]\} \quad (1.1)$$

subject to

$$p_{Ht}(z)\,c^a_{Ht}(z) + \left[1 - p_{Ht}(z)\right]c_{Ht}(z) \geq \left[1 - p_{Lt}(z)\right]\left[c_{Lt}(z) + q_{t+1}(\kappa_H - \kappa_L)\right], \quad (1.2)$$

$$\pi\left\{p_{Lt}(z)\left[q_{t+1}(\kappa_L - \gamma_t) - c^a_{Lt}(z)\right] + \left[1 - p_{Lt}(z)\right]\left[q_{t+1}\kappa_L - c_{Lt}(z)\right]\right\} + (1-\pi)\left\{p_{Ht}(z)\left[q_{t+1}(\kappa_H - \gamma_t) - c^a_{Ht}(z)\right] + \left[1 - p_{Ht}(z)\right]\left[q_{t+1}\kappa_H - c_{Ht}(z)\right]\right\} = a_t(z)\,r, \quad (1.3)$$

$$a_t(z) = x(z) - w_t, \quad (1.4)$$

[4] If the output realization is "low", entrepreneurs never misreport, because, as it will be shown later, this would imply a higher repayment.

$$\left.\begin{array}{c} 0 \leq p_{it}(z) \leq 1 \\ c_{it}^{a}(z), c_{it}(z) \geq 0 \end{array}\right\} \text{for } i = L, H. \tag{1.5}$$

Constraint (1.2) is the incentive compatibility constraint. It states that the expected consumption level when "high" output is truthfully reported must be higher than the expected consumption level resulting from misreporting. Constraint (1.3) states that the intermediary must break even. Constraint (1.4) requires that the investment advance from the intermediary must cover the need for external funding of the entrepreneur. Notice that, because of constraint (1.4), when the labor income w_t changes over time, the severity of the agency problem and the whole contracting problem changes as well. Finally, inequalities (1.5) are the feasibility constraints on the probabilities of auditing and the non-negativity constraints on consumption levels.

An alternative to initiating an entrepreneurial project is to save in the international financial market. This generates a value

$$V_t^I = rw_t.$$

An agent of type z will become entrepreneur at date t if and only if $V_t^E(z) \geq V_t^I$. This condition defines the set of entrepreneurs in period t, which I denote by $\Omega_t = \left\{z : V_t^E(z) \geq V_t^I\right\}$.

1.2.3 Economic Equilibrium

In this section, I define and characterize the economic equilibrium for a given sequence of investor protection policies $\{\gamma_t\}_{t=0}^{\infty}$. The study of policy determination is postponed to Section 1.2.5.

Definition 1. Given an initial aggregate capital stock $K_0 > 0$ and a sequence of investor protection policies $\{\gamma_t\}_{t=0}^{\infty}$, an economic equilibrium is a non-negative consumption level for the initial old c_0^o, sets of entrepreneurs $\{\Omega_t\}_{t=0}^{\infty}$, optimal financial contracts

$k \equiv \left\{a_t(z), \{p_{it}(z), c_{it}^a(z), \quad c_{it}(z)\}_{i=L,H}, \text{ for all } z \text{ in } \Omega_t\right\}_{t=0}^{\infty}$, an allocation for the firm producing the consumption good $c \equiv \{K_t, L_t\}_{t=0}^{\infty}$, and prices $e \equiv \{w_t, q_t\}_{t=0}^{\infty}$ such that :

- $c_0^o = q_0 K_0$, and for all $t \geq 0$:
- given e, the firm in the consumption good sector maximizes profits,
- given e, contracts k solve problem (1.1) for all types z in Ω_t,
- given e, the occupational choice is optimal for all z, that is :

$$\Omega_t = \left\{z : V_t^E(z) \geq V_t^I\right\},$$

- the market for capital good and the labor market clear :

$$\int_{\Omega_t} \kappa dG(z) = K_{t+1},$$

$$L_t = 1.$$

The characterization of the economic equilibrium follows. The optimal contract depends on the agent's type z because the distortion due to the information asymmetry is more severe for the agents with higher start-up cost (higher z). The low cost types (those with very low z) need so little external funds that they are able to repay the required return to the intermediary even in case of "low" output realization. Indeed, we can see that if $a_t(z) \leq \frac{q_{t+1}}{r}\kappa_L$, then the optimal contract sets all auditing probabilities to zero and lets $c_{it}(z) = q_{t+1}\kappa_i - a_t(z) r$ for $i = L, H$. Using constraint (1.4), I introduce the threshold $\underline{z}_t$, which is implicitly defined by $x(\underline{z}_t) = w_t + \frac{q_{t+1}}{r}\kappa_L$. It follows that for all types $z \leq \underline{z}_t$ the optimal contract is the one described above.

For types $z > \underline{z}_t$ the optimal contract specifies positive auditing probabilities if the "low" realization is announced. To see this, note that constraint (1.2) binds for these types. From (1.3) we can deduce that the optimal auditing probability when the "high" realization is announced is always zero to minimize expected auditing costs. Also, to make constraint (1.2) easier to satisfy, it is optimal to set $c^a_{Lt}(z)$ and c_{Lt} to zero. Then, by (1.3) and (1.4) the optimal auditing probability $p_{Lt}(z)$ must satisfy :

$$p_{Lt}(z) = \frac{[x(z) - w_t]\, r - q_{t+1}\kappa_L}{(1-\pi)\, q_{t+1}(\kappa_H - \kappa_L) - \pi q_{t+1}\gamma_t}. \tag{1.6}$$

However, not all agents may obtain external funding. For high cost types, when γ_t is large, it may be impossible to satisfy (1.6) together with the constraints $0 \leq p_{Lt}(z) \leq 1$. Of course, the financial intermediary will not sign any contract in which the break-even constraint cannot be satisfied. Particularly, when $\gamma_t \geq \gamma^H = \frac{1-\pi}{\pi}(\kappa_H - \kappa_L)$ only the types $z \leq \underline{z}_t$ obtain external financing. Note that their contracts will not depend on γ_t. In fact, the resulting equilibrium allocation when $\gamma_t \geq \gamma^H$ is identical to that which prevails under $\gamma_t = \gamma^H$. This is why constraining the policy space to $\gamma_t \in [0, \gamma^H]$ is without loss of generality. For the formal proof of this claim see Appendix I.1, Lemma 7. The next proposition summarizes the characterization of the optimal contract for all types that obtain external funding.

Proposition 2. *Given prices q_{t+1}, w_t, and a level of investor protection $\gamma_t \in [0, \gamma^H]$, the optimal contracts for types z that have access to external financing are characterized by the investment advances, the auditing probabilities and the consumption plans for entrepreneurs,*
$\left\{a_t(z), \{p_{it}(z), c^a_{it}(z), c_{it}(z)\}_{i=L,H}\right\}$*, such that :*

- $a_t(z) = x(z) - w_t$,
- $p_{Ht}(z) = 0$,
- $p_{Lt}(z) = \max\left\{0, \frac{[x(z)-w_t]r - q_{t+1}\kappa_L}{(1-\pi)q_{t+1}(\kappa_H - \kappa_L) - \pi q_{t+1}\gamma_t}\right\}$,
- $c^a_{Lt}(z) = c_{Lt}(z) = \max\{q_{t+1}\kappa_L - [x(z) - w_t]\, r, 0\}$,
- $c_{Ht}(z) = \max\{q_{t+1}\kappa_H - [x(z) - w_t]\, r, [1 - p_{Lt}(z)]\, q_{t+1}(\kappa_H - \kappa_L)\}$.

Using Proposition 2 to substitute for $\{p_{it}(z), c_{it}^{a}(z), c_{it}(z)\}_{i=L,H}$, the expected value of being an entrepreneur is given by

$$V_t^E(z) = \begin{cases} q_{t+1}\kappa - [x(z) - w_t]\, r & \text{for } z \leq \underline{z}_t, \\ \\ (1-\pi)[1-p_{Lt}(z)]\, q_{t+1}(\kappa_H - \kappa_L) = & \\ \phi(\gamma_t)\{q_{t+1}(\kappa - \pi\gamma_t) - [x(z) - w_t]\, r\} & \text{for } z \geq \underline{z}_t, \end{cases}$$

where $\kappa \equiv \pi\kappa_L + (1-\pi)\kappa_H$ and $\phi(\gamma_t) \equiv \frac{(1-\pi)(\kappa_H-\kappa_L)}{(1-\pi)(\kappa_H-\kappa_L)-\pi\gamma_t}$. In equilibrium the expected value of being entrepreneur is affected by the level of investor protection γ_t via two effects. First, investor protection affects $V_t^E(z)$ indirectly through the price of capital q_{t+1}. This general equilibrium effect is present for all entrepreneurs independently on their cost type. Second, for all types $z > \underline{z}_t$, the value $V_t^E(z)$ is directly affected through the probability of auditing. Understanding the interplay between the general equilibrium effect and the direct effect of investor protection on the expected value of being an entrepreneur will be key for understanding political preferences.

It is easy to verify that for given prices q_{t+1} and w_t, the value of entrepreneurship $V_t^E(z)$ is continuous and strictly decreasing in z. On the other hand, the value of saving in the international financial market, V_t^I, is constant. It follows that there exists a unique value $z_t^\star$ for which $V_t^E(z_t^\star) = V_t^I$. We can then characterize the set of entrepreneurs at date t as $\Omega_t = \{z \in [0,1] : z \leq z_t^\star\}$. The measure of this set is $G(z_t^\star)$ and the capital supply at date $t+1$ is given by $K_{t+1}^s = \kappa G(z_t^\star)$. Notice that if $0 \leq z_t^\star \leq 1$, then the number $z_t^\star$ identifies the type that is exactly indifferent between initiating an entrepreneurial project and saving in the international market. Not surprisingly, the measure of entrepreneurs and, consequently, the capital supply are increasing in the price of capital good q_{t+1}. This is formally established in Appendix I.1 as Lemma 8. An economic equilibrium for a given policy $\{\gamma_t\}_{t=0}^{\infty}$ is thus completely characterized by four equations for all $t \geq 0$:

$$V_t^I = V_t^E(z_t^\star), \tag{1.7}$$

$$q_t = F_1(K_t, 1), \tag{1.8}$$

$$w_t = F_2(K_t, 1), \tag{1.9}$$

$$K_{t+1} = \kappa G(z_t^\star). \tag{1.10}$$

Next, I provide some intuition on how q_{t+1} is determined. Refer to Figure 1.2.[5] The figure is drawn for a given w_t. In fact, notice that by equation (1.9), w_t is predetermined by the current aggregate stock of capital K_t. The D curve depicts the demand for capital in period $t+1$ as a function of the relative price of capital q_{t+1}. It corresponds to equation (1.8). From the strict concavity of the consumption good production function it follows that D is strictly decreasing. The capital supply in period $t+1$ is given by equation (1.10). The S curve depicts the capital supply in period $t+1$ under perfect investor protection $\gamma_t = 0$. It is increasing in q_{t+1}. This is intuitive since higher q_{t+1} induces more agents to become entrepreneurs. Notice that for low and high level of q_{t+1} the capital supply is inelastic : for very low level of q_{t+1} nobody wants to be entrepreneur and $K_{t+1}^s = 0$; if q_{t+1} is high all agents will become entrepreneurs and capital supply attains its maximum $K_{t+1}^s = \kappa G(1) = \kappa$. The equilibrium price of capital, and hence the measure of entrepreneurs at date t, are pinned down by the capital market clearing condition at date $t+1$.

1.2.4 Comparative Statics

This section shows how the equilibrium on the capital market at date $t+1$ changes when γ_t and w_t change. This will be useful for understanding agents' policy preferences.

[5]The figure was constructed using the functional forms and parametrization as presented further in a numerical example.

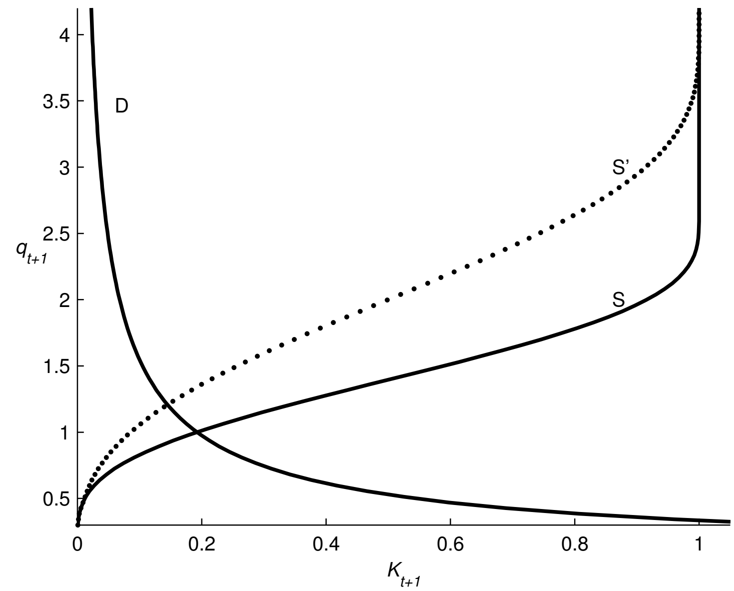


Figure 1.2 – Capital market with perfect (solid) and imperfect (dotted) investor protection

First, consider what happens when investor protection falls (γ_t increases). The capital demand curve does not move since the marginal product of capital is independent of γ_t. On the other hand, the capital supply curve shifts up and to the left, from S to S' in Figure 1.2. The intuition is that the rise in agency costs associated with a deterioration of investor protection induces some of the higher cost types not to start an entrepreneurial project. Hence, the capital supply curve shifts up and to the left. However, notice that the capital supply remains unchanged at high and low prices. At low prices, under a threshold $\underline{q}_t$, only the low cost types who are able to repay the intermediary even in case of "low" project's outcome decide to initiate a project. Because these agents are not concerned by the agency problem, a deterioration of investor protection does not have any effect on their occupational choice and hence on capital supply. At high prices, above a threshold $\overline{q}_t(\gamma)$, the capital supply curve does not change with worsening of investor protection because every agent becomes entrepreneur. Under the restriction that the the start-up cost of the highest cost type is high enough, $\overline{q}_t(\gamma)$ is increasing in γ

and $\overline{q}_t(\gamma) > \underline{q}_t$ for any γ. The following lemma summarizes how the supply of capital varies when investor protection changes. The formal proof and the details can be found in Appendix I.1.

Lemma 3. *Assume $x(1) > \frac{\kappa F_2(\kappa,1)}{(1-\pi)(\kappa_H-\kappa_L)}$. A deterioration of investor protection from γ' to γ'', with $\gamma' < \gamma''$, results in the following changes in the capital supply $K^s_{t+1}(q_{t+1})$:*

$$K^s_{t+1}(q_{t+1};\gamma') > K^s_{t+1}(q_{t+1};\gamma''),\ \forall q_{t+1} \in \left(\underline{q}_t, \overline{q}_t(\gamma'')\right),$$

$$K^s_{t+1}(q_{t+1};\gamma') = K^s_{t+1}(q_{t+1};\gamma''),\ \forall q_{t+1} \in \left[0, \underline{q}_t\right] \cup \left[\overline{q}_t(\gamma''), \infty\right),$$

with $\underline{q}_t \equiv \frac{w_t r}{(1-\pi)(\kappa_H-\kappa_L)}$ *and* $\overline{q}_t(\gamma'') \equiv \frac{r}{\kappa-\pi\gamma''}\left\{x(1) - \left[1 - \frac{1}{\phi(\gamma'')}\right] w_t\right\}$.

It follows that an economy with better investor protection γ' will experience a lower equilibrium price of the capital good than an economy with poorer investor protection $\gamma'' > \gamma'$, provided that the equilibrium prices in the first economy are in the interval $\left(\underline{q}_t, \overline{q}_t(\gamma'')\right)$.[6] Figure 1.2 gives an illustration of capital good market equilibria under two policies $\gamma' = 0$ (solid line) and $\gamma'' = 0.8$ (dotted line). Notice that the period $t+1$ equilibrium price of capital determined on the figure can be regarded as the general equilibrium price of capital since the wages w_t are predetermined by the actual stock of capital K_t.

In the remainder of this section, I discuss the implications on the number of entrepreneurs and the price of capital when wages increase.[7] The capital demand does not depend on w_t. This follows from the fact that the marginal product of capital is independent of wages because of the inelastic supply of labor. On the other hand, the effect of wages on the supply of capital depends on the level of investor protection. First, notice that under perfect investor protection (i.e. $\gamma_t = 0$) wages do not matter. In that case every project's outcome is verifiable at no cost and there are no agency problems

[6] If this condition is not verified for the economy with higher investor protection then a decrease in investor protection has no effects on equilibrium allocation and prices.

[7] This effect is akin to the financial accelerator mechanism of Bernanke and Gertler (1989).

between the intermediary and the entrepreneurs. Entrepreneurship is profitable for all types whose start-up cost is lower than the project's expected output actualized with the international gross interest rate. The set of entrepreneurs under perfect investor protection is $\Omega^{\star 0} = \left\{z \in [0,1] : z \leq z^{\star 0}\right\}$ with measure $G\left(z^{\star 0}\right)$. The cut-off $z^{\star 0}$ is given by $x\left(z^{\star 0}\right) = \frac{q^0 \kappa}{r}$, where q^0 is the equilibrium price of capital under perfect investor protection. Notice that there is no subscript t under $z^{\star 0}$ or $\Omega^{\star 0}$ in order to emphasize that they do not depend on the period t wages or capital stock. In what follows I assume that the parameters are such that in equilibrium $z^{\star 0} < 1$ that is, not all agents choose to become entrepreneurs in equilibrium under perfect investor protection. This simplifies the analysis because the equilibrium price q_{t+1} will always be below $\overline{q}_t\left(\gamma_t\right)$.

With imperfect investor protection (i.e. $\gamma_t > 0$), the number of entrepreneurs is lower than under perfect investor protection and it is increasing in the current wage level. To see this, note that with imperfect investor protection the agency problem distorts the financial contract for higher cost types (types $z > \underline{z}_t$) and makes external funding more expensive. Particularly, the term $\phi\left(\gamma_t\right)$ in the value function of an entrepreneur, $V_t^E\left(z\right)$, is greater than one which implies that for all types $z > \underline{z}_t$ investing one unit of external funds into the project costs $\phi\left(\gamma_t\right) r$, whereas investing one unit of their own wealth costs only r. The agent's net worth matters because when wages are high, the entrepreneur needs to borrow less and he can save the agency costs. This is why entrepreneurship becomes profitable for higher cost types only when they are sufficiently wealthy. It follows that the capital supply is higher and the equilibrium price of capital good is lower when wages are high. Eventually, for sufficiently high wages, all agents that would become entrepreneurs with perfect investor protection start a project also when $\gamma_t > 0$. In other words, when wages are sufficiently high, agency problems are not binding and the equilibrium allocations with $\gamma_t = 0$ and $\gamma_t > 0$ are identical.

I conclude this section by summarizing the relevant cut-offs :

1. $z_t^\star$ is the least efficient (in terms of the start-up cost) entrepreneur when investor protection is γ_t.

2. $z^{\star 0}$ is the least efficient entrepreneur when $\gamma_t = 0$. This threshold characterizes the measure of entrepreneurs and the capital supply in the first-best situation.

3. $\underline{z}_t$ is the least efficient unconstrained type. For all $z < \underline{z}_t$ the optimal contract does not depend on γ_t. This does not mean that they do not care about γ_t, because they are still affected by the general equilibrium effect on the price of capital.

1.2.5 Political Equilibrium

In this section, I add politics to the model. I assume that agents vote in each period on the current level of investor protection γ_t and the equilibrium policy is selected under simple majority rule. Voting occurs after receiving labor income but before the occupational choice (see Figure 1.1). When casting their vote, agents are fully rational and forward-looking. I assume that the old generation and the young types $z > z^{\star 0}$ do not bother to vote.[8] This is a plausible assumption since investor protection has no effect on the utility of these agents. In fact, old agents' consumption is predetermined by the previous period election outcome and previous period wages. The future consumption of the currently young types $z > z^{\star 0}$, who would not become entrepreneurs even under perfect investor protection, is equal to rw_t. This does not depend on γ_t since wages are related to K_t, which is predetermined, and r is exogenous. The voters are then the young types $z \leq z^{\star 0}$.

Notice that if $\underline{z}_t \geq z^{\star 0}$, which may happen if the wages are sufficiently high, all entrepreneurs are unconstrained, the agency problems disappear and the investor protection policy has no effect on the equilibrium allocation. In that case the voters are indifferent

[8] An alternative assumption would be that they select a policy randomly. Under uniform randomization, this would not change the results.

among all policies and the status-quo policy prevails. On the other hand, if $\underline{z}_t < z^{\star 0}$, then the policy affects the economic equilibrium and there is a disagreement among the potential entrepreneurs over the level of investor protection. This is the interesting case on which I will concentrate in what follows.

1.2.5.1 Median Voter Theorem

Each voter compares his expected utility under different policies. He votes for the policy that maximizes his indirect expected utility. However, deriving the indirect utility is not straightforward because of the general equilibrium effects. Despite the fact that the indirect utilities are not in general single-peaked in γ_t, I show that individual preferences can be ordered according to the type z. Roberts (1977) establishes that this guarantees that the median voter theorem applies.

Proposition 4. *The policy preferred by the median voter cannot be beaten by any other feasible policy in a pair-wise vote under simple majority rule.*

Proof. Note that the expected utility of each voter depends on γ_t and q_{t+1}. The price q_{t+1} itself depends on γ_t through equilibrium conditions (1.7), (1.8), and (1.10). The equilibrium price q_{t+1} is strictly increasing in γ_t. This follows from comparative statics with respect to γ_t and because $F_{11}(\cdot,1) < 0$. Applying Theorem 1 of Milgrom (1994), the preferences over pairs (q_{t+1}, γ_t) are single crossing in (γ_t, z) if and only if the expected utility function satisfies the Spence-Mirrlees condition that the agents' marginal rates of substitution between γ_t and q_{t+1} can be ordered according to z. The marginal rate of substitution for a constrained type $z > \underline{z}_t$ is :

$$\frac{\frac{\partial V_t^E(z)}{\partial \gamma_t}}{\frac{\partial V_t^E(z)}{\partial q_{t+1}}} = \frac{\phi'(\gamma_t)\{q_{t+1}(\kappa - \pi\gamma_t) - [x(z) - w_t]\,r\} - \phi(\gamma_t)\,\pi q_{t+1}}{\phi(\gamma_t)(\kappa - \pi\gamma_t)},$$

which is negative and strictly decreasing in z at any γ_t. On the other hand, unconstrained agents (types $z \leq \underline{z}_t$) are not directly affected by γ_t since their financial contract does not depend on γ_t. The marginal rate of substitution is then equal to zero. Thus, the policy preferences over the pairs (q_{t+1}, γ_t) are single-crossing and can be ordered according to the agents' types. This ensures that the median voter theorem obtains. □

Since the set of voters is equal to all types in the interval $\left[0, z^{\star 0}\right]$, the median voter is the type z^M for which $G\left(z^M\right) = {}^{G(z^{\star 0})}/_{2}$. The median voter does not change with the aggregate stock of capital because $z^{\star 0}$ does not depend on wages. The political outcome in each period is given by the solution to the median voter's trade-off between higher agency costs and higher price of capital good. The trade-off fundamentally hinges on two things. On the one hand, the marginal cost of decreasing investor protection is determined by the degree of dependence on external finance of the median voter. On the other hand, the marginal benefit of decreasing investor protection is determined by the elasticity of the capital supply with respect to γ_t. The determinants of both marginal cost and benefit of decreasing investor protection are intimately linked to features of the distribution of financial dependence among potential entrepreneurs.

The distribution of financial dependence inherits the shape of the distribution of start-up costs but its support is shifted to the left depending on the current wages (which are determined by the current stock of capital). The shape of the distribution of start-up costs pins down the identity of the decisive voter and it also affects the marginal benefit of increasing γ_t, since it determines how many agents it is possible to discourage from entrepreneurship.[9] This affects both the steady-state and the transition path of the politico-economic equilibrium. On the other hand, for a given distribution $G(z)$, the current stock of capital does not affect the identity of the decisive voter but it changes the decisive voter's preferred policy since higher wages make the agency problem under imperfect investor protection less severe. Therefore, the stock of capital in each period influences the transition path of the politico-economic equilibrium but not the features

[9] In the remainder of the paper I use the term "decisive voter" to refer to the median voter in order to avoid confusion with the median of the type distribution.

of the steady-state. In the next section I parametrize the model and solve it numerically in order to examine more in detail each of these effects.

1.3 Numerical Examples

For the production function and the cost function I choose, respectively, $F(K,L) = K^{\nu}L^{1-\nu}$ and $x(z) = \zeta + \theta z$. The distribution of types is assumed to be a Beta distribution with parameters α and β. When changing α and β, the Beta distribution can take a wide range of shapes on $[0,1]$ and therefore this specification is quite general.

The parameter values for the benchmark parametrization are listed in Table 1.I. The share of capital good in the final good sector production function is consistent with the evidence on factor income shares. I choose a positive value for ζ to ensure that the project requires a positive amount of investment even for the lowest cost type. The other cost parameter θ is then chosen so that, under perfect investor protection, the equilibrium price of capital good is equal to unity. This is simply a convenient normalization. The values of κ_L, κ_H and π are chosen so that the ex-ante expected production of an entrepreneurial project is one unit of capital good. I pick a symmetric distribution of start-up costs as a benchmark. With values of α and β as specified in the table the variance is $1/36$.

As in Bernanke and Gertler (1989) the "generations" in the model should be thought of as representing the entry and exit of firms from the credit market rather than literal generations. Consequently, I fix a period in the model to three years, which also determines the length of a financial contract and r is chosen so that the interest rate is five percent per year. Finally, in order to study dynamics of the political equilibria I fix the initial stock of capital to a relatively low value.

Table 1.I – Benchmark parametrization

ν	ζ	θ	κ_L	κ_H	π	α	β	r	K_0
0.33	0.1	2.211	0.1	1.9	0.5	4	4	1.1576	0.1

1.3.1 The Dynamics of Investor Protection

Let us first examine the dynamics of the politico-economic equilibrium under the benchmark parametrization. Figure 1.3 depicts the equilibrium path. There are two important observations. First, the model is able to generate imperfect investor protection in the long run as an equilibrium outcome. Second, in contrast to a model without investor protection endogeneity, the convergence to the steady state is non-monotone.

When investor protection is chosen in a politico-economic equilibrium, we have that at the beginning, when the capital stock is low, wages are low and the decisive voter needs more external funding to cover his business start-up cost. This is why he prefers high investor protection in order to mitigate the agency problem between him and the financial intermediary and reduce the cost of external funds. In the next period, as the capital stock increases, wages increase as well. The decisive voter becomes wealthier, which reduces the severity of the agency problem. He then chooses low investor protection in order to exclude high cost types from entrepreneurship and boost the price of the capital good. That depresses capital and wages and makes the agency problem more relevant again. This mechanism suggests a specific timing of investor protection reforms. Improvements in investor protection occur in periods of low growth, when entrepreneurs rely more on external finance, whereas in periods of high growth entrepreneurs tend to be wealthier and investor protection deteriorates.

Notice how both the capital stock fluctuation and its effect on other variables are created by politics. Absent politics, the dynamics would depend on the (exogenously fixed) level of investor protection in a simple way. Under perfect investor protection (that is $\gamma_t = 0$ for all t) there would be no transition dynamics - the economy would attain its first-best level of capital accumulation in one period. By contrast, under imperfect investor protection ($\gamma_t = \gamma > 0$ for all t) convergence to the steady state would be always monotone. The dependence of the financial contract on entrepreneur's net worth would introduce persistence in capital accumulation in spite of free capital mobility. The

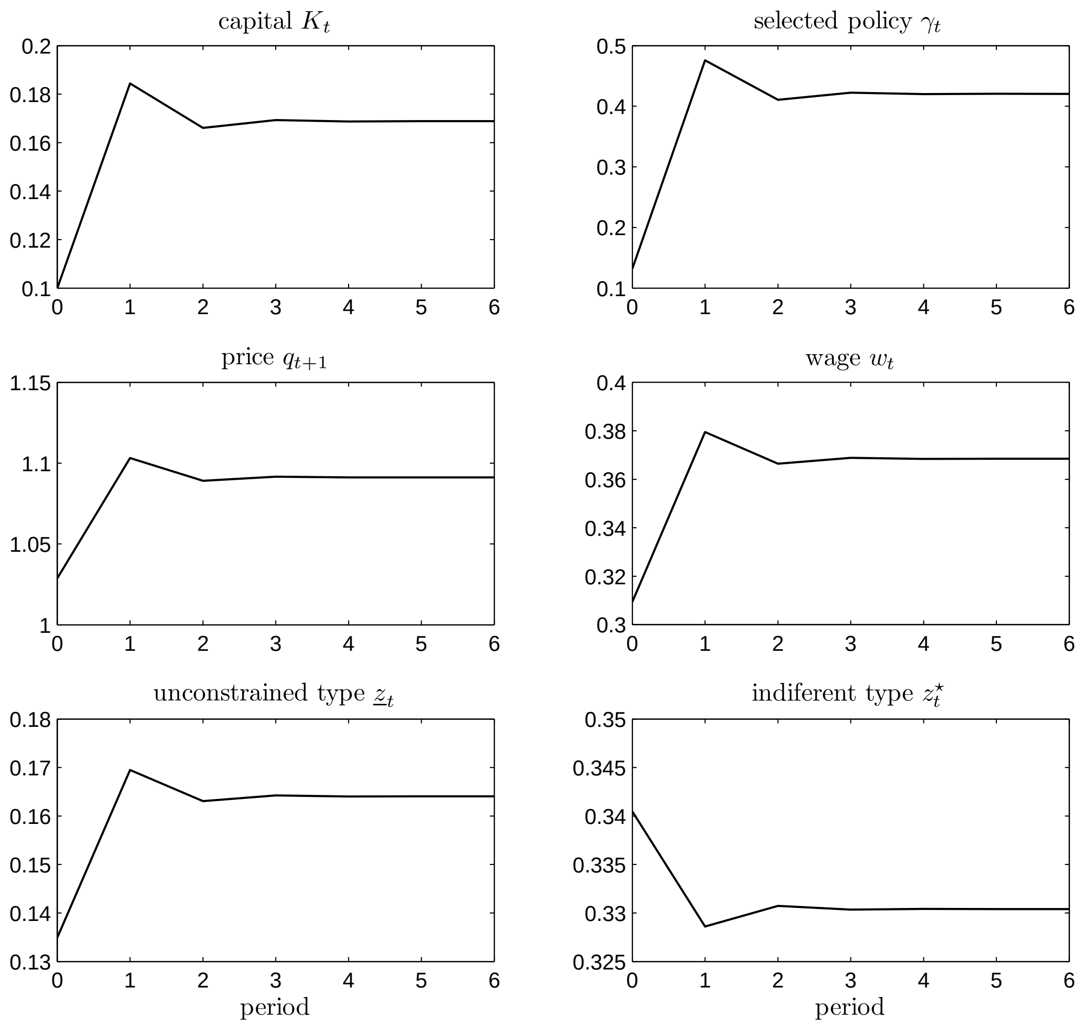


Figure 1.3 – Politico-economic equilibrium - benchmark parametrization

economy would converge gradually, as the stock of capital and the wages would grow over time, to a steady state.

1.3.2 Role of the Shape of the Start-up Cost Distribution

The shape of the start-up cost distribution is the main determinant of the long run equilibrium outcome. With different distributions of start-up costs the model is able to generate dynamics that converge to different equilibrium policies in the long run and therefore could help us understand persistent cross-country differences in levels of investor protection. Particularly, the model shows that higher inequality in financial dependence leads to political outcomes with lower levels of investor protection sustained in the long run.

To keep the analysis tractable I restrict myself to the study of distributions in the Beta family. Notice that the Beta family encompasses a wide range of shapes for continuous distributions on $[0,1]$. The two key moments that affect inequality are the skewness and the variance. To isolate the effects of inequality on the political outcome, I consider first distributional changes that are neutral under perfect investor protection. In other words, I compare economies that have the same first-best steady-state level of capital but differ in the start-up cost inequality as measured by Gini coefficient of the type distribution. Then, in section 1.3.2.2, I discuss some changes in skewness and variance that imply also a change in the economy's first-best level of capital accumulation.

1.3.2.1 Inequality in Financial Dependence and the Equilibrium Level of Investor Protection

It is convenient to use the Gini coefficient of the type distribution for measuring the inequality in financial dependence because for $Beta(\alpha,\beta)$ distributions it can be expressed directly as a function of parameters α and β. Therefore, to obtain a parametrization for the start-up cost distribution with a desired value for the Gini coefficient, we only need to impose the condition that under perfect investor protection the level of capital accumulation is the same as in the benchmark parametrization and solve for the values of α and β.[10] By varying a the values of the Gini coefficient we obtain distributions featuring different shapes, which can be ordered in terms of the thickness of tails according to the following definition.[11]

Definition 5. Let $G(z)$ and $H(z)$ be cumulative distribution functions of two Beta probability measures Γ and Λ on $[0,1]$. Γ has thicker tails than Λ if there exists x and y in $(0,1)$ such that for all $z \in [0,x]$ $G(z) \geq H(z)$, for all $z \in [x,y]$ $G(z) - G(x) \leq H(z) - H(x)$, and for all $z \in (y,1]$ $G(z) - G(y) > H(z) - H(y)$.

More inequality (higher Gini coefficient) is generated by type distributions with thicker tails, where the mass is less concentrated around the median. Given an initial stock of capital K_0, thicker tails imply two changes that directly affect the political equilibrium. First, as can be seen in the upper left panel in Figure 1.4, the decisive voter is a relatively lower cost type. Consequently, he relies less on external finance and his marginal cost of selecting more distortionary policy is lower. Second, at any given level of investor protection, the mass of agents that could be excluded from entrepreneurship by an additional marginal deterioration in investor protection is lower. Therefore, the increase in price that could be obtained by the general equilibrium effect is lower, which means lower marginal gain from selecting more distortionary policy. The upper right panel in Figure 1.4 displays this general equilibrium effect by plotting $\frac{dq}{d\gamma}$ at $\gamma = 0$ against the Gini coefficient of the start-up cost distribution. $\frac{dq}{d\gamma}$ is also decreasing in the Gini coefficient at any other $\gamma > 0$. Appendix I.2 provides some analytical results and more formal discussion of these two changes.

Although the changes resulting from increases in start-up cost inequality affect the decisive voter policy preferences in opposite directions, numerical experiments show

[10]The Gini coefficient can be expressed as $Gini(\alpha,\beta) = \frac{\alpha+\beta}{\alpha}\int_0^1 G(t;\alpha,\beta)[1-G(t;\alpha,\beta)]\,dt$. An alternative parametrization with Gini coefficient equal to a desired value χ can obtained by solving a system of two equations in α and β : $Gini(\alpha,\beta) = \chi$ and $\kappa G(z^{\star 0};\alpha,\beta) = \kappa G(z^{\star 0};4,4)$. Notice that the system may not have solution for some values of χ. Particularly, numerical simulations indicate that it is impossible to satisfy both equations for values $\chi > 0.25$.

[11]Definition 5 is a variant of Definition 6 in Rossi-Hansberg and Wright (2007).

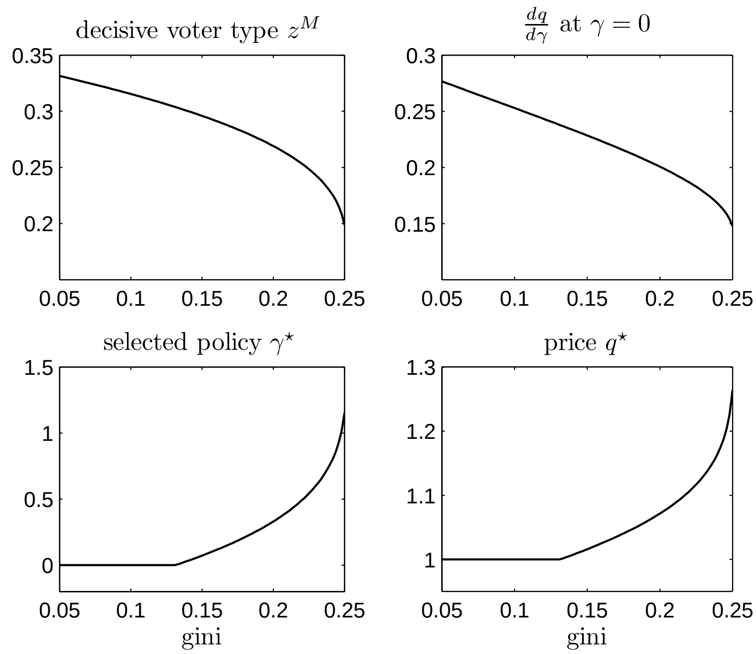


Figure 1.4 – Comparative statics with respect to start-up cost inequality, $K_0 = 0.13$

that the decrease in the marginal cost of worsening investor protection is stronger than the decrease in the marginal benefit associated with weaker general equilibrium effect. Therefore, as can be seen in the lower left panel in Figure 1.4, in all my simulations more inequality leads to a (weakly) lower investor protection (higher γ_t) being selected in the politico-economic equilibrium.

Given that we now understand how the start-up cost inequality affects the politico-economic equilibrium within a given period with a given stock of capital, we can study how its influence is propagated through the dynamic evolution of the economy. In Figure 1.5 I draw comparative dynamics for four start-up cost distributions with Gini coefficient ranging form 0.05 to 0.25. We observe that economies with higher inequality in start-up costs experience larger fluctuations in stock of capital and its price along the transition path. Furthermore, the differences in the selected equilibrium policy that we examined in the initial period, appear to be amplified in subsequent periods. This leads to larger differentiation in terms of levels of investor protection in the steady state across

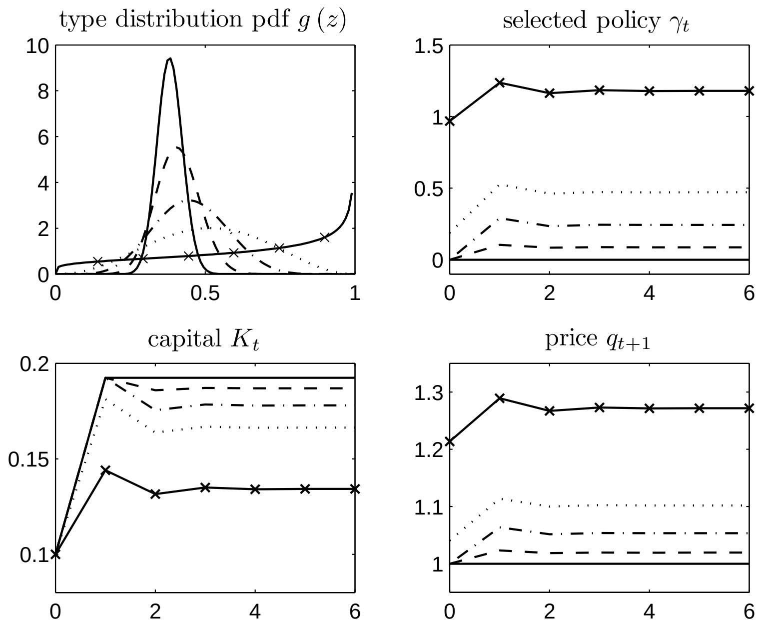


Figure 1.5 – Comparative dynamics

economies.

Figure 1.6 complements the picture by providing comparative statics across long run steady-states on a much finer grid of Gini coefficients in the same range.[12] Comparing the lower left panel in Figure 1.4 to that in Figure 1.6 we notice that that once the economies reach their steady-states the range of values of the Gini coefficient for which the political equilibrium features perfect investor protection $\gamma^{\star} = 0$ is much narrower. This can be explained by the fact that in Figure 1.4 we considered a relatively low initial stock of capital, therefore wages were low and the average dependence on external finance higher, which altered the policy preferences towards less distortionary policies. As the stock of capital and wages grew over time, the policy preferences of the decisive voter became more pro-distortionary leading to a larger policy differentiation among economies with different degrees of start-up cost inequality.

[12]To generate Figures 1.4 and 1.6 I use one hundred different parametrizations for the start-up cost Beta distribution. In Figure 1.5 only four of those parametrizations are displayed for readability.

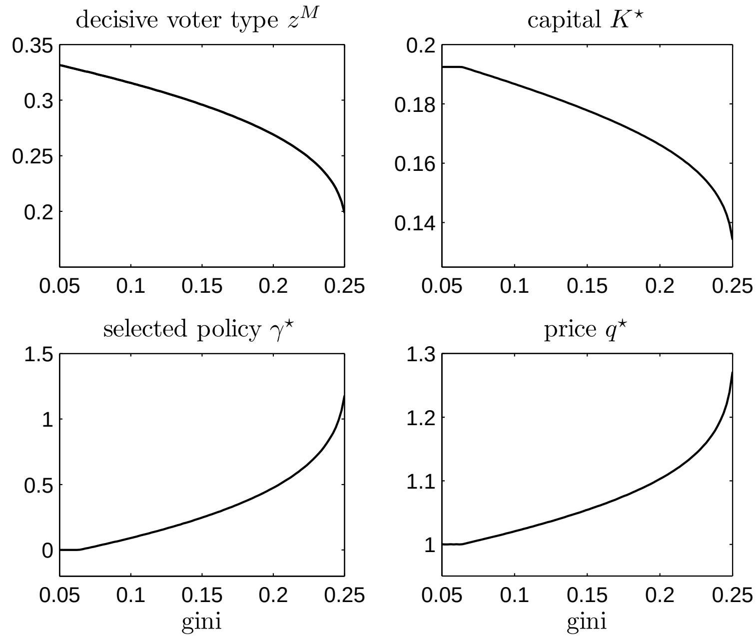


Figure 1.6 – Comparative statics with respect to start-up cost inequality, steady-states

1.3.2.2 Uncompensated Changes in Skewness and Variance

In this section I study directly changes in the moments of the start-up cost distribution without compensating for their effects on the first-best allocation. I focus on the variance and the skewness. With either higher dispersion or higher skewness towards low cost types the economy's first-best level of capital accumulation rises because more agents can produce the capital good at lower costs. It now becomes hard to make comparisons between economies since it is not possible to rank them solely on the basis of a simple measure of start-up cost inequality. However, it turns out that the effects of increases in the variance or in the skewness on the politico-economic equilibrium are very similar to those of increases in inequality when holding the first-best level of capital constant. To understand this we first need to realize that Beta distributions with the same skewness but different variance can be ranked in terms of the thickness of tails - higher variance implies thicker tails. Moreover, Beta distributions with the same variance but different skewness can be ranked in terms of the first order stochastic dominance - a distribution with a lower skewness first order stochastically dominates a distribution with a higher skewness. In Appendix I.2 I explain that with these alternative rankings the analysis of the preceding section to goes through.

It is interesting to look at some examples in Figure 1.7, which compares the dynamics of three economies : the benchmark economy (solid lines), one with higher variance in the distribution of start-up costs (dotted lines), and one with higher skewness (dashed lines). Looking at the upper right and at the lower left panels we can see that the economy with a more skewed distribution converges to a steady state with *lower* investor protection but *higher* capital accumulation. The reason is that the first-best level of capital is higher with a more skewed distribution. For the parametrization in Figure 1.7, this effect is so strong that even when the decisive voter chooses the lowest investor protection, $\gamma^H = 1.8$, the capital accumulation is larger than in the benchmark economy. Although this result is in odds with the usual negative correlation between investor protection and economic development, it is appealing since it could explain numerous observed exceptions from this relation.

Indeed, the investor protection literature may struggle with cases such that of France, Belgium, and several other countries. In spite of bad institutions, these countries are remarkably rich (La Porta et al., 1997, Levine et al., 2000).[13] An interesting feature of my model is that it is capable of delivering outcomes that mimic the experience of these countries. When a large fraction of entrepreneurs faces relatively low up-front costs, the capital good is produced more efficiently, which guarantees a larger first-best output. At the same time, the decisive voter is less dependent on external finance and he prefers a low level of investor protection. The combination of these two forces may give rise to an equilibrium path in which a high level of aggregate output and a low level of investor

[13]According to World Bank's Doing Business indicators, in 2006 France ranked 62 in protecting investors ; it shared this rank with several middle-income and low-income countries such as Algeria, Brazil, Guyana, Jamaica, Malawi, Namibia, Oman, Sri Lanka and Turkey. It actually lagged a number of middle-income countries, particularly in the Eastern Europe and South America, and even some low-income countries such as Ghana, India, Madagascar and Nigeria. France also ranks badly in La Porta et al.'s (1997) rating.

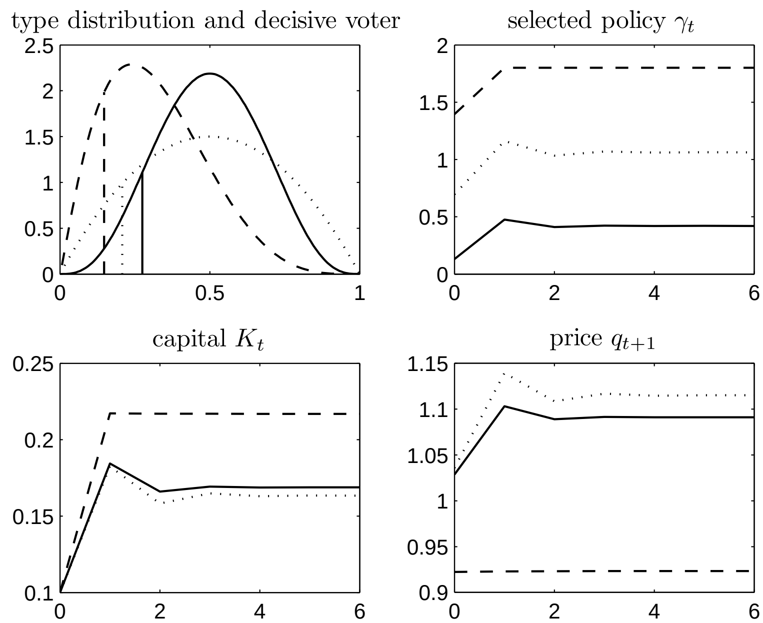


Figure 1.7 – Comparative dynamics - benchmark (solid), high variance (dotted), and high skewness (dashed)

protection occur at the same time and are sustained in the steady state.

At this point I would like to note that what essentially matters for the determination of the level of investor protection is the distribution of dependence on external finance. In my stylized model I have assumed that agents differ in business start-up costs and the distribution of dependence on external finance has inherited the characteristics of the type distribution. In reality there are also other variables that are likely to influence the shape of the distribution of financial dependence among agents. For example, the distribution is likely to be skewed towards high dependence in countries with high business start-up costs, high regulation of entry (government licenses, fees, capital requirements etc.), and generally poor population. Factors implying higher variance are high wealth inequality among potential entrepreneurs, high prevalence of corruption, presence of politically connected firms or groups with access to internal capital markets.[14] To sum-

[14]Svensson (2003)presents evidence from micro-level data on Ugandian firms that there is considerable

marize, heterogeneity in entry barriers and financial dependence determines the support for investor protection reforms.[15] There is a large literature emphasizing the negative effect of entry barriers on entrepreneurship (Desai et al., 2003, Klapper et al., 2006). This paper shows how heterogeneity in entry barriers and in access to finance may also hurt entrepreneurship.[16]

1.4 Empirical Implications

Previous sections have highlighted two key implication of my model : (i) improvements in investor protection should follow periods of low growth, and conversely for worsening of investor protection ; (ii) poorer investor protection should arise in economies with large heterogeneity in entry barriers or external financing needs. I now look at some data to test the qualitative significance of these implications.

1.4.1 Timing of Reforms in Creditor Rights

Testing the first implication is difficult because of the lack of comprehensive time series data on investor protection. A rare exception is the creditor rights index, constructed by Djankov et al. (2007) for the whole interval 1978-2003 and for 129 countries. There were 28 changes in the creditor rights index in 23 countries during the period 1978-2003. Fourteen of these changes correspond to an improvement in creditor rights and fourteen to a worsening. I rely on these data even if the creditor rights index is only a very partial measure for effective investor protection. While recognizing the shortcomings, I examine the relation between the changes in investor protection and the average

cross-firm variation in bribes that firms facing similar institutions need to pay. Faccio (2006) studies political connections of firms in a cross-section of countries. She concludes that strong connections between managers and politicians give the firm non-negligible advantage that is valued by shareholders.

[15] This suggests a link between political feasibility of an investor protection reform (financial law reform) and a barrier to entry reform (deregulation). Such an interaction is studied by Caselli and Gennaioli (2008).

[16] A recent paper by Claessens and Perotti (2007) presents a review of empirical evidence that also indicates that inequality in access to finance has negative effects on financial development and firm growth.

annual growth of GDP per capita in the years preceding the reform.

For each observed change in creditor rights I compute the average annual growth rate of GDP per capita, $\overline{g}_i$, over the $i = 4,5,6$ years preceding the reform. Then I consider an ordered probit regression of changes in creditor rights on the average annual growth rate. The use of the ordered probit method is justified by the fact that the changes in creditor rights index correspond to additions or deletions of specific clauses protecting creditors in the country's law. Consequently, changes in the creditor rights score correspond to categorical improvements (deteriorations) of investor protection rather than numerical measures of how much the investor protection was changed. In the data there are two categories of worsening in the creditor rights score, -1 and -2, and one category of improvements in the creditor rights score, $+1$. In Table 1.II the coefficients in all regressions are negative as predicted by the theory. However, only the coefficients of $\overline{g_4}$ and $\overline{g_6}$ are significant at the ten per cent level. Overall, I conclude that there is some evidence that goes in the direction of the model. Limitations of the data available do not allow to make the analysis more conclusive.

1.4.2 Inequality in Financial Dependence and Investor Protection

I now turn to the implication that poor investor protection should be observed in countries with high inequality in financial dependence among entrepreneurs. To test this implication, the most obvious approach would be to look at the correlation between various measures of investor protection and measures of inequality in financial dependence. Unfortunately, one cannot easily obtain appropriate measures of financial dependence inequality for any single country, much less for a broad cross-section of countries.[17]

An alternative approach is to realize that, although my model abstracts from wealth inequality, if agents were heterogeneous in initial wealth, this would have exactly the

[17] A measure of financial dependence could be in principle constructed using firm-level data (similarly to Rajan and Zingales, 1998), but it would not correspond well to the model. The reason is that it would include only the actual entrepreneurs and not those who decided not to start a business because of being financially constrained.

Table 1.II – Creditor rights reforms and growth - Ordered Probit Regression

Dependent var.	Change in creditor rights[a]		
$\overline{g_4}^b$	$-7.032^\star$ (3.837)		
$\overline{g_5}^b$		-5.725 (3.800)	
$\overline{g_6}^b$			$-7.704^\star$ (4.702)
Estimated thresholds			
α_1	-1.418 (0.379)	-1.404 (0.382)	-1.381 (0.394)
α_2	0.205 (0.249)	0.270 (0.252)	0.248 (0.254)
Pseudo R^2	0.05	0.032	0.048
Log-likelihood	-24.05	-22.84	-21.79
N. observations	28	26	25

All regressions include a constant. Robust standard errors in parenthesis. * significant at the ten per cent level.

Data sources : [a] Djankov et al. (2007), [b] computed from World Development Indicators Online, World Bank, accessed on August 20, 2009.

same effect as heterogeneity in start-up costs since it would generate heterogeneity in financial dependence. I use estimates of wealth inequality in each country, which are available from Davies et al. (2007), as a proxy for financial dependence inequality among potential entrepreneurs. Obviously, the approximation is imperfect because not everyone in the data is a potential entrepreneur.

Yet another approach is to focus on proxies for the heterogeneity in start-up costs. Particularly, I view the level of the costs to satisfy the entry regulation (including monetized time of the entrepreneur), compiled by the World Bank according to the methodology of Djankov et al. (2002), as the median start-up cost in the country. This start-up cost is then interacted with factors that are likely to induce dispersion and inequality in treatment. Particularly, I consider the interaction term with a corruption index as a (crude) measure of inequality in start-up costs in a country.

I use the following measures of investor protection. Formal investor protection (fip) is the sum of the anti-director and the creditor rights indices. These indices, which were first constructed by La Porta et al. (1998), reflect presence of particular clauses protecting investors in the commercial and bankruptcy law. I also construct two additional measures of effective investor protection : $eip(1)$ and $eip(2)$. Besides the anti-director and the creditor rights indices, these additional measures include the rule of law index of Kaufmann et al. (2008), which captures the quality of contract and law enforcement, as well as the likelihood of crime and violence. $Eip(1)$ is based on multiplication of the formal investor protection with the rule of law index as in Perotti and Volpin (2007), whereas $eip(2)$ is based on adding the rule of law index to the indices of formal investor protection.[18] Finally, I also consider the anti-self-dealing (*asd*) index of Djankov et al. (2008b) that focuses on private enforcement mechanisms, and the efficiency of debt enforcement (*ede*) index of Djankov et al. (2008a). I believe it is interesting to consider these measures because they are based on the study of a standardized case by law experts in different countries. They may then reflect the effective investor protection more accurately. I normalize all measures of investor protection to the interval $[0,1]$. I try to maintain as much as possible a direct time series correspondence between my measures of investor protection and proxies for inequality in financial dependence. However, data for some variables are not available for the years needed. In those cases I use the data for the closest preceding or following year available. A detailed description of variables and data sources can be found in Appendix I.3.

Figure 1.8 plots the measures of investor protection to the Gini coefficient of the wealth distribution. In simple linear regressions the coefficients are negative and significant at the five percent level, except in the regressions involving fip and asd.[19]

It is interesting to check whether wealth inequality is still significant when controlling for the English common law legal origin - a well-known determinant of investor protection. The results of regressions that include the common law dummy are reported

[18] I have verified that the results are robust to use of other constructions with different weightings of the components of the effective investor protection measure. $Eip(1)$ and $eip(2)$ are representatives of two basic groups of measures : one based on multiplication the other on addition of the rule of law index.

[19] I do not tabulate the results of the univariate regressions. The t-statistics used in the tests were calculated using robust standard errors.

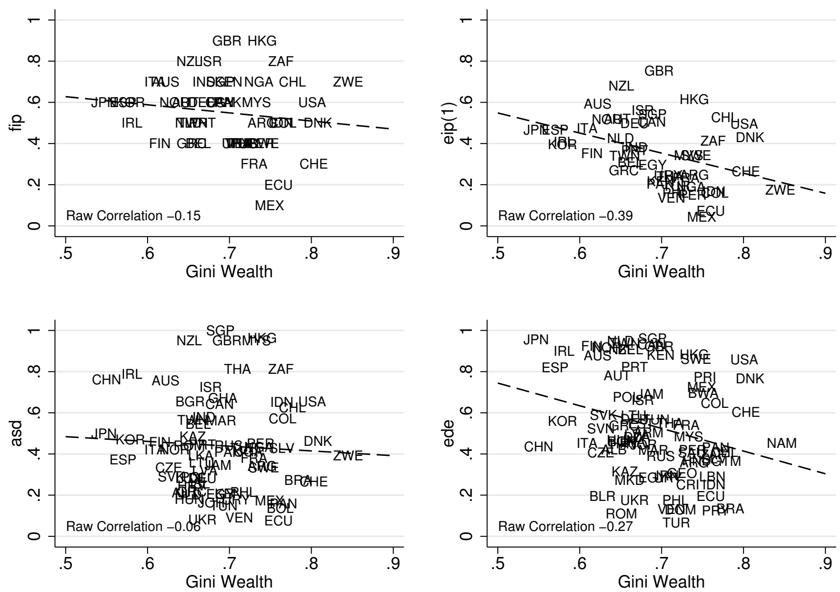


Figure 1.8 – Investor protection and wealth inequality

in Table 1.III. The relation with wealth inequality is significant at the one percent level for all measures of investor protection, except in the regression involving fip (significant at the ten percent level) and *asd* (not significant).

In the remainder of this section I validate the results with the alternative approach. I use the interaction between entry costs and corruption as the independent variable. Figure 1.9 shows the correlations between investor protection and the interaction of entry costs and corruption.[20] The coefficients in the simple regressions are all negative and significant at the five percent level except in the regression involving fip and *asd* (both significant at the ten percent level). Table 1.IV checks the results while controlling for the common law legal origin. The negative relation between investor protection and the interaction term is significant at the one percent level in the regressions involving $eip(1)$, $eip(2)$ and *ede* and at the ten percent level in the regression involving *asd*.

While recognizing possible weaknesses of my proxy variables I conclude that the

[20] In all these regressions two countries - Zimbabwe and Angola - were discarded as outlayers due to unusually high entry cost. The regression results were heavily affected by this outlayer.

Table 1.III – Regressions of investor protection

Dependent var.	$fip^{d,g}$	$eip\,(1)^{d,f,g}$	$eip\,(2)^{d,f,g}$	asd^{c}	ede^{b}
Gini wealth[a]	$-0.559^{\star}$	$-1.071^{\star\star\star}$	$-0.788^{\star\star\star}$	-0.543	$-1.305^{\star\star\star}$
	(0.307)	(0.298)	(0.247)	(0.341)	(0.413)
English legal origin dummy[e]	$0.227^{\star\star\star}$	$0.132^{\star\star\star}$	$0.148^{\star\star\star}$	$0.319^{\star\star\star}$	$0.237^{\star\star\star}$
	(0.043)	(0.049)	(0.037)	(0.057)	(0.055)
R^2	0.433	0.300	0.362	0.381	0.227
F stat	13.89	7.79	8.98	16.03	13.10
F stat p-value	0.0	0.001	0.001	0.0	0.0
N. observations	46	46	46	72	82

All regressions include a constant. Robust standard errors in parentheses. ***, **,* significant at 1, 5, and 10 per cent level.

Data sources : [a] Davies et al. (2007), [b] Djankov et al. (2008a), [c] Djankov et al. (2008b), [d] Djankov et al. (2007), [e] La Porta et al. (1998), [f] Kaufmann et al. (2008), [g] Pagano and Volpin (2005).

Table 1.IV – Regressions of investor protection

Dependent var.	$fip^{d,g}$	$eip\,(1)^{d,f,g}$	$eip\,(2)^{d,f,g}$	asd^{c}	ede^{b}
Cost of entry[a]	-0.008	$-0.0255^{\star\star\star}$	$-0.018^{\star\star\star}$	$-0.0164^{\star}$	$-0.046^{\star\star\star}$
$\times$ corruption[h]	(0.005)	(0.006)	(0.005)	(0.010)	(0.008)
Common law dummy[e]	$0.188^{\star\star\star}$	$0.116^{\star\star\star}$	$0.128^{\star\star\star}$	$0.315^{\star\star\star}$	$0.147^{\star\star}$
	(0.037)	(0.037)	(0.029)	(0.052)	(0.057)
R^2	0.298	0.397	0.373	0.430	0.346
F stat	13.43	11.51	13.82	18.48	27.44
F stat p-value	0.0	0.0	0.0	0.0	0.0
N. observations	69	69	69	69	85

All regressions include a constant. Robust standard errors in parentheses. ***, **,* significant at 1, 5, and 10 per cent level.

Data sources : [a] Davies et al. (2007), [b] Djankov et al. (2008a), [c] Djankov et al. (2008b), [d] Djankov et al. (2007), [e] La Porta et al. (1998), [f] Kaufmann et al. (2008), [g] Pagano and Volpin (2005), [h]Transparency International (2009).

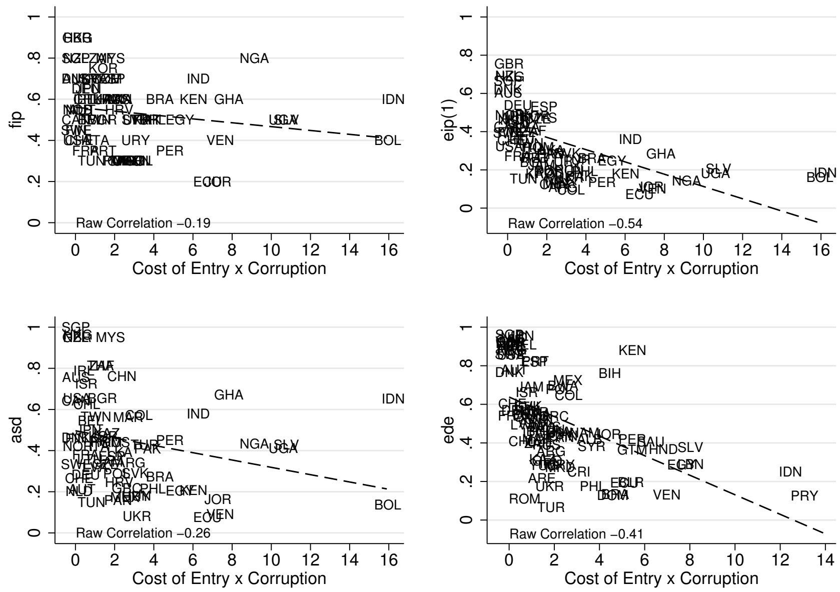


Figure 1.9 – Investor protection and Entry cost × Corruption interaction

evidence goes in the direction of the model's prediction. The regressions reveal a statistically significant relationship between most measures of investor protection and the proxies for the inequality in external finance dependence.

1.5 Concluding Remarks

In this paper, I analyze how investor protection is determined in a capital-accumulation model with optimal financial contracts. The central idea is that imperfect investor protection acts as a barrier to entry into entrepreneurship for agents with high external finance needs. Entrepreneurs that are less financially dependent favor imperfect investor protection because it increases the price of the entrepreneurially produced good, thereby raising their profits. The level of investor protection selected in the political equilibrium is inversely related to the inequality in external finance dependence among potential entrepreneurs. This result may explain why we observe low investor protection in countries with high wealth inequality or in countries where high corruption induces unequal treatment of entrepreneurs. The political support for imperfect investor protection is also related to the state of the economy. Imperfect investor protection is likely to emerge when entrepreneurs are wealthy and rely less on external finance. An interesting extension of the present work that I leave to future research would be adding voluntary bequests between generations. This would allow to endogeneize the evolution of the distribution of wealth over time and generate a role for long-term contracts between financial intermediaries and multiple generations of an entrepreneurial family.

CHAPITRE 2

FINANCIAL FRICTIONS, INTERNAL CAPITAL MARKETS, AND THE ORGANIZATION OF PRODUCTION

2.1 Introduction

Conglomerates (firms under common ownership that operate in multiple industries) and business groups (groups of legally independent firms that are linked together by strong equity or family ties) account for a large fraction of corporate assets and business activity in many countries. For example, Claessens et al. (2000) find that in five East Asian countries (Hong Kong, Indonesia, South Korea, The Philippines, and Thailand) the largest 15 business family groups control over 30 percent of listed corporate assets. Conglomerates and business groups are, in general, more important in East Asia compared to Europe and the United States. However, several empirical studies indicate that they are important in the latter countries as well. For example, in a study on European countries Faccio and Lang (2002) document that the top 15 family groups control more than 30 percent of listed corporate assets in Belgium, France, Portugal, and Switzerland. In the US and Canada conglomerates are not numerous, but they tend to be very large. Using detailed plant-level data, Maksimovic and Phillips (2002) find that 12 percent of firms in US manufacturing industries were conglomerates and that they accounted for around 75 percent of the total value of shipments in the 1980s. Similarly, in the third chapter of this thesis, I document that in Canadian manufacturing over the period 1997-2006 conglomerates accounted for around 19 percent of plants, 8 percent of firms, 75 percent of the total value of shipments, and 71 percent of the total value added.

Given the economic weight of these diversified entities, it seems important to understand their role in the cross-firm allocation of inputs and production outcomes, the determination of the aggregate share of entrepreneurship, the average size and productivity of plants, as well as their implications for aggregate macroeconomic variables. Why does business conglomeration emerge ? Why are diversified groups predominant in some countries and not in others ? What are the consequences of business groups for resource allocation ? What is the impact on economic development ?

In order to address these questions I examine the view that business groups substitute for missing or imperfect markets. More specifically, I develop a model in which conglomeration allows firms to partially avoid external credit market imperfections, and evaluate its capacity to generate quantitative implications that are consistent with empirical stylized facts on on the organization of production and cross-country differences in the presence of business groups. My model embeds business group formation into an otherwise standard heterogeneous agent model of entrepreneurship with credit constraints such as Cagetti and De Nardi (2006). Agents of differing abilities and wealth decide whether to be workers or become entrepreneurs. Entrepreneurs choose whether to operate a stand-alone (single-segment) business firm, or to become part of a diversified business group (conglomerate). 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 credit market, reducing their reliance on external funds. Internal capital markets also allow entrepreneurs to reallocate the available capital across group firms more efficiently.

I calibrate the model to match some key observations regarding the importance of entrepreneurship, and overall wealth and earnings inequality. The model performs relatively well in reproducing some of the salient features of the cross-sectional distribution of production size. Particularly, through internal reallocation of capital, conglomeration can generate concentration of the affiliated projects in large size categories. The model is also able to reconcile a seemingly contradictory finding in empirical corporate finance literature that plants in conglomerates tend to be on average more productive than those in stand-alone firms (Schoar, 2002), but this relation is inversed if we control for production size (Maksimovic and Phillips, 2002). The model shows that highly productive plants are more likely to select into conglomerates, hence the positive unconditional relation between conglomeration and productivity. On the other hand, because conglomeration relaxes credit constraints, a mass of highly productive plants that are constrained to operate on any given sub-optimal size is lower among conglomerates than among stand-alone firms. Therefore, conditional on most production sizes, except very high ones, the average productivity of plants in conglomerates is lower than in stand-alone firms. These results are in line with new detailed empirical evidence on size and productivity of diversified and focused firms presented in the third chapter of this thesis.

In quantitative experiments I show that more severe credit market frictions lead to a higher degree of conglomeration in the economy. The reason is that internal markets are more profitable in environments with higher frictions in the external markets. Varying the credit frictions can generate differences in the presence of business groups that are broadly consistent with the cross-country empirical evidence. Another experiment studies the effects of conglomeration on economic development. Conglomeration leads to better allocation of capital but also, via general equilibrium effects, makes external finance and labor more expensive. Almeida and Wolfenzon (2006a) argue that business groups improve aggregate capital allocation and lead to a higher equilibrium level of aggregate output when external capital market frictions are severe, but worsen the aggregate capital allocation and lead to a lower aggregate output when capital market frictions are moderate. However, their three-period model is very stylized and does not allow any quantitative conclusions. I revisit their question and find that the negative general equilibrium effects tend to be quantitatively small and, compared to a model without business groups, endogenous conglomeration leads to higher steady state levels of entrepreneurship, aggregate capital, and aggregate output per capita for realistic parametrizations of my model.

2.1.1 Related Literature

Business groups, conglomerates, and corporate diversification have received some attention in the corporate finance and industrial organization literature. Existing theoretical papers provide essentially three different explanations for business conglomeration. First, several papers argue that business groups emerge as a way to enhance control rights of group insiders and expropriate outside investors.[1] In these studies conglomeration creates additional layers of agency problems between the headquarters and divisional managers that lead to divisional rent-seeking and inefficient investment. Other papers view diversification as an optimal response of firms to industry or technological shocks.[2] Here firms diversify to take advantage of economies of scale and to explore new productive opportunities. Finally, a third group of papers argues, like my paper, that business groups arise as a way to substitute for missing or imperfect external markets. According to these studies conglomeration creates an internal market that allocates efficiently resources across diversified divisions (Almeida and Wolfenzon, 2006a, Stein, 1997). Discrimination between the alternative theories is difficult since the stylized theoretical models cannot be easily taken to the data. The empirical papers, on the other hand, mostly focus on differences in the market valuation of conglomerates and stand-alone firms but are silent about the underlying mechanisms that lead to business conglomeration.[3]

A rare exception that tries to close the gap between the theoretical and the empirical literature is Gomes and Livdan (2004). They construct a model of corporate diversification that is suitable for calibration and show that a theory in which firms diversify to explore new productive opportunities generates some implications that are quantitatively consistent with the empirical evidence. My paper follows this quantitative approach but it differs from Gomes and Livdan (2004) in at least three important aspects. First, I examine a different theory of conglomeration in which credit market frictions play a crucial

[1] Almeida and Wolfenzon (2006b), Rajan et al. (2000), Scharfstein and Stein (2000)

[2] Gomes and Livdan (2004), Maksimovic and Phillips (2002)

[3] Berger and Ofek (1995), Khanna and Palepu (2000), Lang and Stulz (1994), Santalo and Becerra (2008), Schoar (2002), Villalonga (2004)

role. In my model businesses conglomerate to create internal capital markets and avoid frictions on the external credit market through internal reallocation of capital. This idea was first proposed by Stein (1997) and my paper puts it into a full-fledged dynamic general equilibrium model. Second, in Gomes and Livdan (2004) "diversification" means that a single firm (entrepreneur) simply initiates a new technology, whereas in my paper "conglomeration" means that several previously stand-alone firms (entrepreneurs) create a new entity, which pools their technologies *and* their internal finance. This is particularly important in presence of credit constraints because when raising external finance as a group the net worth of rich and less productive entrepreneurs can be used to collateralize credit for more productive affiliated projects. While their approach corresponds to a particular form of diversification by building a new project "on the green field", mine can be thought of as diversification by acquisition or merger.[4] Looking at US diversified companies we can find ample examples of diversification of both types, and we should think of the two modelling approaches as complementary.[5] Third, I introduce the occupational choice decision into the model. This links endogenously the share of entrepreneurship, business conglomeration, and credit market imperfections and allows me to explore the implications of business groups from more macroeconomic perspective.

My work is also close to Basaluzzo (2006), who studies formation of entrepreneurial teams in a heterogeneous-agent general equilibrium model in which entrepreneurs face financial constraints. Similarly to a business group my paper, a team of two entrepreneurs in that paper pools partners' financial resources to achieve better financing of a productive project. However, in contrast to my paper, Basaluzzo (2006) makes an as-

[4]Although in the model I cannot clearly identify an acquirer and a seller, each party receives a remuneration for its project's technology as well as for its net worth. One can think of group formation as one party "purchasing" an ongoing project of the other party a price that is bargained.

[5]The empirical study of Hubbard and Palia (1999) shows that the acquisition-merger view is particularly relevant for the 1960s conglomerate merger wave in the US, and it may also be more suitable for diversified business groups in emerging markets. Japanese *keiretsus*, Korean *chaebols* as well as Indian industrial business groups tend to be collections of firms each with its own separate net worth and management. For more detailed description of business groups in these countries see Hoshi et al. (1991), Khanna and Palepu (2000), Shin and Park (1999).

sumption that an entrepreneurial team is able to operate only one productive project with a technology given by an ad hoc aggregation of the patners' productive opportunities. In consequence, the role of a team is reduced to ownership and profit sharing and his paper cannot talk about diversification of firm's productive activities. My work unifies what I see as two crucial aspects of conglomerates and business groups. In my model, formation of business groups gives rise to diversification of firm's operations across several productive projects, which can be interpreted as firm's expansion to other industries as in Gomes and Livdan (2004). At the same time, projects in business groups benefit from reallocation of financial resources via efficient internal capital markets, similarly to the internal finance pooling in Basaluzzo (2006). There are at least two other differences between my paper and Basaluzzo's. The timing and the search for partners are different. In Basaluzzo (2006) the decisions on the occupational choice and costly search for a partner are irreversibly made before the resolution of uncertainty concerning returns to entrepreneurial and working activities, while in my paper the occupational choice comes only after this uncertainty is resolved and instead of costly search I assume that partners are matched randomly. In consequence, in my paper there is not scope for risk sharing through conglomeration. I abstract from the risk-sharing and costly search issues for two reasons. First, it makes the model more transparent and allows to highlight the importance of internal capital markets for allocative efficiency. Second, empirical studies found no evidence that risk-sharing would be an important attribute of internal markets in business groups (Khanna and Yafeh, 2005). Lastly, Basaluzzo's study focuses on small businesses and features a competitive non-entrepreneurial sector to proxy for large firms. While this substantially facilitates numerical solving of the model, it leads to the counter-factual implication that the number of small entrepreneurial businesses increases with economic development (see Gollin, 2008, Tybout, 2000). Without a recourse to this simplification, my model is able to generate the fact that the number of establishments is inversely related to the economic development, whereas their size is positively related to economic development.

My paper can be related to papers that study the role of mergers and acquisitions in reallocation of resources. Particularly, Jovanovic and Rousseau (2002) propose a theory of mergers as waves of reallocation across plants. In their theory, mergers are a channel through which capital flows to better projects and better management. Jovanovic and Braguinsky (2004) study the selection of acquirers into the takeover pool. In contrast to my paper, both of these works feature a competitive market for acquisition targets without any matching frictions. This seems particularly suitable for studying mergers of publicly listed companies and enables the authors to explain empirical regularities concerning firm's Tobin's Q and the behavior of stock prices before and after acquisitions. While I recognize that these mergers and acquisitions are an important part of activities that lead to resource reallocation, I adopt a broader perspective of merger activity, which includes sales of smaller private companies, divisions of enterprises, entrepreneurial projects, and even sales of individual plants. In accord, I tie the implications of my model to the empirical evidence from studies using plant-level data, and I focus on implications on plant size and plant-level productivity instead of stock prices. I believe that my approach with random matching of partners instead of competitive market for targets is well adapted for thinking about such merger transactions for which there is not necessarily a well organized public market. Moreover, both Jovanovic and Braguinsky (2004) and Jovanovic and Rousseau (2002) assume a linear technology with respect to capital, therefore only the most productive project in the merged enterprise is operated and the merger does not lead to diversification in firm's production activities.

Finally, recent macroeconomic and economic development literature has devoted considerable attention to studying the effects of misallocation of resources across firms and productive plants and its effects on aggregate economic outcomes (Alfaro et al., 2008, Banerjee et al., 2003, Buera et al., 2009, Hsieh and Klenow, 2009, Restuccia and Rogerson, 2008). While internal reallocation of resources inside conglomerate firms or business groups is likely to play an important role in the determination of the extent and the effects of misallocation, it turns out that it has not received any specific attention in that literature. In this paper I make a contribution by incorporating some insights on business conglomeration from the corporate finance literature to a well-articulated macroeconomic model similar to those used for studying the effects of misallocation on economic development.

2.2 Empirical Evidence

This section summarizes several stylized facts found in the empirical literature against which my model will be evaluated. These stylized facts come essentially from two types of empirical studies. First, studies on US and Canadian conglomerates using high-quality plant-level data provide evidence on relative production size and productivity of firms. Second, studies from other countries provide evidence on cross-country differences in the importance of business groups and its link to financial development. Unfortunately, the latter studies are constrained to use substantially lower-quality and coarser firm-level data.

2.2.1 Evidence from the US and Canada

2.2.1.1 Distribution of Production Size

The facts on the distribution of relative production size in the US are taken from Maksimovic and Phillips (1998) and Maksimovic and Phillips (2002). They use detailed plant-level data on manufacturing sector producers contained in the Longitudinal Research Database (LRD) maintained by the US Bureau of Census. Their unit of analysis is a *firm-segment*. A firm-segment is constructed by aggregating the firm's plant-level data at the three-digit SIC code, therefore representing a firm's operations in a given industry. In their analysis Maksimovic and Phillips (2002) exclude all firm-segments with a value of shipments lower than one million of real dollars. Firms are then classified as single-segment or multiple-segment. A firm is classified as multiple-segment (conglomerate) if it produces more than ten percent of its sales outside its main three-digit SIC code. The relative production size of a firm-segment is measured by the ratio of the firm-segment's total value of shipments to the industry median value of shipments.

In Table 2.I I also report distribution of relative production size of *plants* in Canadian manufacturing. I constructed these statistics from plant-level data set from the Annual Survey of Manufacturers (ASM) of Statistics Canada, which provides similar information and data quality as the LRD database in the US. There are three differences with respect to the statistics of Maksimovic and Phillips (2002). First, I report relative production size of plants instead of firm-segments. Second, I impose a minimum value of shipments requirement of 50,000 dollars instead of one million. In consequence, my sample contains much more small-size plants and represents better the actual size distribution of plants in manufacturing. Third, I use slightly different definition of a conglomerate. I do not impose a minimum percentage of sales outside firm's main industry requirement, but I simply classify a firm as a conglomerate if it operates in more than one 4-digit NAICS industry.[6] For more details on the Canadian data, empirical facts on plant size distribution and plant productivity see the third chapter of this thesis.

Table 2.I reveals several interesting facts about the distribution of relative production size of plants and firm-segments. First, in both Maksimovic and Phillips's sample and in the Canadian ASM, the proportion of conglomerate *firm-segments* or *plants* is more than two and half times higher than the proportion of conglomerate *firms*.[7] This, together with the fact that conglomerates account for around 75 percent of the total value of shipments, points to the importance of multi-segment firms despite their relatively low number. Second, conglomerate firm-segments and plants tend to be much larger than those in stand-alone firms. The size distribution is skewed towards large sizes for the

[6] Another difference is that the Annual Survey of Manufacturers in Canada uses NAICS industry classification as opposed to SIC classification. However, save for few exceptions, 4-digit NAICS industries concorde to 3-digit SIC industries.

[7] The proportion of conglomerate firm-segments in Maksimovic and Phillips's sample is much higher than the proportion of conglomerate plants in my Canadian sample. This is largely due to different sample selection criteria. Particularly, Maksimovic and Phillips (2002) exclude from the sample large number of smaller plants that have value of shipments lower than one million dollars, which tend to be plants in stand-alone firms.

Table 2.I – Distribution of relative production size

	US firm-segments[a]			Canadian plants[b]		
	Conglomerate	Stand-alone	All	Conglomerate	Stand-alone	All
Relative size	Fraction of firm-segments %			Fraction of plants %		
<0.5	3.1	29.8	18.3	9.8	35.5	30.8
0.5-1.0	6.2	30.0	19.7	9.46	21.53	19.31
1.0-2.0	8.4	20.4	15.2	13.5	19.4	17.5
2.0-5.0	15.4	12.1	13.5	20.1	14.7	15.7
>5.0	66.9	7.7	33.3	47.1	9.9	17.7
All sizes	43.3	56.7	100	18.5	81.5	100
Nbr. of observations	13,817	18,122	31,939	45,828	202,491	248,319
Nbr. of firms	2,143	15,309	17,452	15,308	193,863	209,171
Proportion of firms %	12.2	87.8	100	7.3	92.7	100
Proportion of value of shipments %	75.8	24.2	100	75.0	25.0	100

[a] Statistics are computed from Maksimovic and Phillips (1998) and Maksimovic and Phillips (2002). Statistics on the firm-segment level are averages over the periods 1976-1978, 1981-1982, 1984-1988 and 1990-1991. For the firm-level statistics the information is available only at the beginning of the decade (year 1980) and the end of the decade (year 1990). The numbers reported are averages over these two years. Therefore, they need not directly correspond with the firm-segment-level statistics above.[b] Statistics computed by the author from Canadian Annual Survey of Manufacturers. The sample spans period 1997-2006 with a minimum of 17,606 plants per year. For more information on the data and sample selection procedure see the third chapter of this thesis.

firm-segments and plants in conglomerates, but it is skewed towards rather small sizes in the stand-alone firms. In the third chapter of this thesis, I establish that this observation is robust to using different measures of size such as value added or employment and controlling for plant age, as well as for industry and year fixed effects. In that paper I also show that the firm-segment size differences come mostly from the intensive margin (larger plants) rather than from the extensive margin (more plants).

2.2.1.2 Differences in Total Factor Productivity

Three recent papers study empirically the productivity differences between conglomerates and stand-alone firms. On the plant level, Schoar (2002) reports that plants in stand-alone firms have on average lower total factor productivity (TFP) than plants in conglomerates. This fact contrasts with the findings of Maksimovic and Phillips (2002), who study firm-segment-level TFP. They find that, conditional on size, firm-segments in stand-alone firms are on average more productive than those in conglomerates, except for the lowest size class. It may seem surprising that the two studies find qualitatively such different results. One might suspect that there might be serious problems with the comparability of the results since the two studies use slightly different methodologies and a different unit of observation.[8] In the third chapter of this thesis we use a unifying and coherent econometric framework to show that the reversion of the relationship between conglomeration and productivity when controlling for production size can be robustly found in the Canadian data. My model presented in this paper will provide a way to reconcile both findings, however, the detailed discussion is postponed to Section 2.7.

2.2.2 Evidence from Other Countries

2.2.2.1 Sensitivity of Investment to Internal Finance

The investment of the firms affiliated with business groups is less sensitive to the firm's internal funds than the investment of stand-alone firms. This stylized fact is documented by Hoshi et al. (1991) for the firms affiliated with Japanese *keiretsu* groups, by Shin and Park (1999) for the Korean conglomerates - *chaebols*, and by Perotti and Gelfer (2001) for the Russian financial-industrial groups. This has been interpreted as supporting evidence for the existence of financial constrains, and for the fact that business groups can help the affiliated firms to overcome these constraints. This interpretation will be consistent with my model.

2.2.2.2 Presence of Business Groups and Investor Protection

If business groups are a way to address external capital market imperfections, they should be prevalent in environments where these imperfections are high. One way to measure these imperfections is to look at indicators of investor protection. Figure 2.1 plots the proportion of group-affiliated firms and effective investor protection index in a

[8] In Schoar (2002) the unit of observation is a plant, whereas in Maksimovic and Phillips (2002) it is a firm-segment.

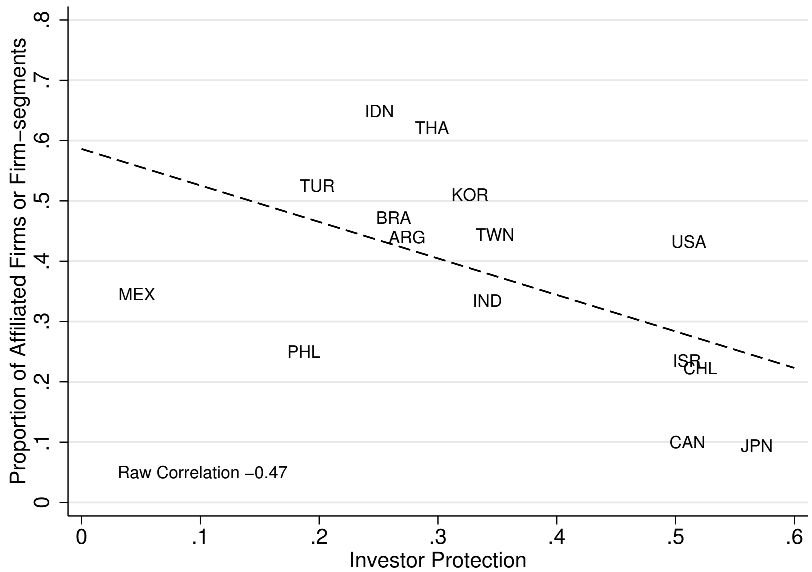


Figure 2.1 – Conglomeration and investor protection

cross-section of countries. The data on group affiliation in other countries than US and Canada are from Khanna and Yafeh (2005). For US and Canada the data points show the proportion of affiliated firm-segments from Maksimovic and Phillips (2002) and from our work presented in the third chapter of this thesis. It should be kept in mind that authors use several country-specific definitions of group affiliation since it is hard to find a unique definition that can be applied in different countries. The effective investor protection index is constructed by multiplying the sum of the shareholder protection index and creditors' right index (La Porta et al., 1998) by the rule of law index (Kaufmann et al., 2008). Although the number of data points is limited, the figure suggests that groups tend to be more present in the countries with lower investor protection ; the negative relation is statistically significant at the ten percent level.

2.2.2.3 Development, Entrepreneurship, and Size of Establishments

Tybout (2000) and Gollin (2008) show evidence that in less developed countries more people are entrepreneurs, and that they manage firms of a smaller size than in the developed countries. That is, the number of establishments is inversely related to the economic development, whereas the size of these establishments is positively related to the economic development. Simple models of entrepreneurship such as Cagetti and De Nardi (2006) fail to generate this stylized fact. Particularly, they imply entrepreneurship to be increasing with the level of financial and economic development. While there are other papers that concentrate on this issue (see Gollin (2008) for a model specifically designed to account for self-employment), my model's implications are consistent with the stylized fact.

2.2.3 Summary of Evidence

For convenience, this section summarizes the evidence presented above.

1. The distribution of relative production size of firm-segments and plants is skewed to large sizes in conglomerates. It is skewed to small sizes in stand-alone (single-segment) firms. Unconditional on firm type, the distribution of relative production size of firm-segments is bi-modal with concentration of mass in both tails.

2. Unconditionally on plant size, plants in stand-alone firms have lower TFP than plants in conglomerates. Conditionally on production size, plants in stand-alone firms have higher TFP than plants in conglomerates.

3. The investment of the firms affiliated with business groups is less sensitive to the firm's internal funds than the investment of stand-alone firms.

4. The degree of conglomeration seems to be on average higher in countries with lower investor protection.

5. The number of establishments is inversely related to the economic development, whereas the size of these establishments is positively related to the economic development.

2.3 The Model

The economy is populated with a continuum of measure one of infinitely-lived risk-averse agents. The consumption streams are valued according to

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

where the period utility function $u(c)$ is strictly increasing, strictly concave and satisfies the usual Inada conditions. Every period each agent is endowed with one unit of time that he can either supply on the labor market or use to manage his own entrepreneurial project. Leisure is not valued. The return to each occupational activity depends on the agent's working or managerial talent. The working and managerial abilities are denoted by ζ and θ, respectively, and their logarithms are assumed to follow exogenous AR(1) processes that are uncorrelated with each other.[9] In each period the agents choose whether they will work for a wage or become entrepreneurs after observing their individual ability shocks.

Production is carried out by entrepreneurs. As in Lucas (1978), an entrepreneurial project necessitates three inputs in order to be productive : entrepreneur-managerial time, capital k, and labor l. Entrepreneur i combines these inputs according to a decreasing returns to scale technology $y_{it} = \theta_{it}\left(k_{it}^{\alpha} l_{it}^{1-\alpha}\right)^{\nu}$, where θ_{it} is the managerial ability. The share parameters α and ν have values between zero and one. $(1-\nu)$ can be interpreted as the span of control of the entrepreneur-manager. During production, capital depreciates at rate δ.

The sole asset in the economy is productive capital. Consumers can save by accumulating capital, which is then lent to the entrepreneurs at the interest rate r. Borrowing to finance consumption is not allowed.[10] Contracts between entrepreneurs and lenders

[9] I have also computed a version of the model with positive correlation between the ability processes. The results stay qualitatively unchanged.

[10] Huggett (1997)makes a similar set of assumptions.

suffer from imperfect enforceability, which limits the external financing of entrepreneurial projects. Specifically, I assume that lender repayment can be enforced only up to a fraction η of entrepreneur's net worth a.

Besides accessing external funds in the credit market, entrepreneurs have the option to create internal capital markets by forming business groups. A business group allows the affiliated entrepreneurs to allocate capital among their projects internally, without being subject to enforcement problems. For simplicity, and to keep the model computationally manageable, I consider business groups with only two members. The creation of business groups occurs in the following fashion. After the occupational choice decision, the agents who have chosen to become entrepreneurs meet randomly in pairs and observe each other's managerial abilities and net worth. If two agents i and j meet, they may form a business group. A business group consists of a headquarters and the projects of the affiliated entrepreneurs. The headquarters pools the internal assets of the partners and, eventually, raises additional funds on the external credit market. Then it reallocates the total available capital between the affiliated projects as to maximize the group profit, avoiding any enforcement frictions.[11] I assume that conglomeration entails a fixed cost γ. This reflects two things : first it is more costly to manage a business group because of a complicated organizational structure. The simplest interpretation is to say that there is a cost of creating and operating the headquarters. Eventually, there may arise additional agency problems between the headquarters and project managers (Rajan et al., 2000, Scharfstein and Stein, 2000, and others). Although I do not model these agency problems explicitly, γ can be thought of as a reduced form of the cost implied by these additional agency problems. Yet another interpretation that may be advanced is the cost of reallocating capital that is already installed in each project. Second, imposing a cost of conglomeration may also be motivated by policy-related issues. For example, it may be costly to establish a business group due to regulation of mergers, anti-trust laws, and

[11] The assumption is that the headquarters has the power to reallocate the total capital available as opposed to only its part that has been raised on the external market. By forming a business group the entrepreneurs agree to pass the control over their internal assets to the headquarters.

policies imposing restrictions on the size of large firms.

I assume that the group profit is shared by the affiliated entrepreneurs according to the Shapley value solution. Thus, each partner is rewarded according to his contribution to the creation of group profits. Particularly, capital provision and managerial talent (or technology) provision are both accounted for in the remuneration. In this aspect a business group acts as an internal capital market, but it also acts as an imperfect substitute for market for ideas and entrepreneurial assets.

The timing of events within each period is given by the following sequence.

1. Individual exogenous states (ζ_i, θ_i) of each agent are realized.

2. Agents choose their occupation. They cannot change the occupation in the subsequent stages of the current period.

3. Entrepreneurs meet in pairs and observe their managerial abilities and net worth. They choose whether to form a business group or not. Conglomeration necessitates consent of both partners. At the end of this stage some entrepreneurs will be conglomerated in a group while others will run stand-alone projects.

4. Entrepreneurs and business groups search external finance on the capital market. Inside business groups the capital is allocated to the projects so as to maximize the group profit.

5. Production takes place, wages and interests are paid, external capital is returned to the lenders, profits are realized. In business groups the group profit is divided between the partners according to the Shapley value rule.

6. Agents choose how much to save for future periods.

There are two assumptions in the timing that need to be discussed. First, the assumption of within-period-irreversible occupational choice before business group formation takes place. This ensures that only the agents who have already engaged their net worth in entrepreneurship may affiliate business groups. This seems realistic, in order to aspire to merge with a strategic partner it is important that a project already has a label of an active business.[12] Second, I assume that business groups are dissolved at the end of each period and formed anew the next period. This is a strong assumption. In reality, business group affiliation is rather persistent. In my model, the high persistence of the managerial ability shocks ensures that certain types of entrepreneurs tend to nearly always participate in a business group. However, their business partners are constantly changing. The assumption is necessary to maintain the complexity of the model manageable. Were groups allowed to operate for several periods, both group formation (or dissolution) and the saving decisions of the partners would be the solution of a complex dynamic game. The dynamic strategic interactions would arise since each partner's decision rules would have to be a best response to the other partner's decision rules, together with the outside option of staying alone and searching for a new partner in the next period. While these matters are certainly interesting, they are very hard to deal with in a general equilibrium framework and are thus out of the scope of this paper.

2.4 Competitive Equilibrium

In this section I define the competitive equilibrium. I start with the consumption-saving problem and proceed to the occupational choice decision. Finally, I define the profit maximization problems of stand-alone firms and business groups.

In the maximization problems bellow, the joint distribution over the individual states Ψ is an aggregate state variable and in principle the agents need to know its law of motion in order to predict future prices and eventual business partner's type. However, in this paper I am going to focus on the stationary equilibria in which prices are constant and the distribution over individual states is invariant. All maximization problems can

[12] I have also solved the model with a modified timing in which the occupational choice occurs at the same time as group formation. That allows any agent (as opposed to only committed entrepreneurs) to enter into business groups. Results from that version are qualitatively similar, but the model is less successful from a quantitative perspective.

thus be written as being 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 in what follows.

2.4.1 Consumption-saving Decision

At the end of the period 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. Let also $W(\zeta_i, \theta_i, a_i)$ 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 value function $W(\zeta_i, \theta_i, a_i)$ already includes the occupational choice decision, which will be described in detail in the next section. The saving decision of agent i is then given by the following Bellman equation :

$$V(\zeta_i, \theta_i, \omega_i) = \max_{a_i' \geq 0} \left\{ u\left(\omega_i - a_i'\right) + \beta E_{\zeta_i', \theta_i',} W\left(\zeta_i', \theta_i', a_i'\right) \right\}. \tag{2.1}$$

2.4.2 Occupational Choice

At the beginning of the period, but after observing his working and managerial abilities, the agent can either become a worker and invest his net worth a_i in the credit market, which will yield at the end of the period assets

$$\omega_i^W \equiv \zeta_i w + (1+r) a_i,$$

or he can choose to become an entrepreneur and use a_i to finance his business activity. In this case the amount of assets that will be generated at the end of the period depends on whether the entrepreneur affiliates to a business group or not. Let $Z^{SA}(\theta_i, a_i)$ be the indirect profit function when entrepreneur i operates as a stand-alone firm, and $Z_i^G(\theta_i, a_i, \theta_j, a_j)$ the function that gives entrepreneur i's share of the group profit when i and j form a business group. These indirect profit functions come from static profit maximization problems that are described in the next section. The end-of-period assets of entrepreneur i can be written as

$$\omega_{ij}^{E} \equiv \max\left\{Z^{SA}\left(\theta_i, a_i\right), Z_i^{G}\left(\theta_i, a_i, \theta_j, a_j\right)\right\} + (1+r)\, a_i.$$

However, at the moment of deciding his occupation the agent does not know his potential business partner and has to make a conjecture on the partner's type. The expectation is taken over the set of entrepreneurs B with respect to the invariant measure Ψ. The occupational choice is then given by

$$W\left(\zeta_i, \theta_i, a_i\right) = \max\left\{V\left(\zeta_i, \theta_i, \omega_i^{W}\right), E_{\left(\zeta_j, \theta_j, a_j\right)\in B} V\left(\zeta_i, \theta_i, \omega_{ij}^{E}\right)\right\}. \tag{2.2}$$

Notice that due to the max operator, the value function $W\left(\zeta_i, \theta_i, a_i\right)$ need not be concave in the net worth a_i even if the value of working and the expected value of entrepreneurship are concave in ω.[13] Compared to a standard occupational choice problem without business groups, the value of entering into entrepreneurship becomes a stochastic variable depending on the random match with a partner. Agents consider the possibility of obtaining higher profits in a conglomerate if they meet a suitable partner, but also the possibility that their profits may be lower if they are credit constrained and have to operate their project as a stand-alone firm if the match is bad.

2.4.3 Profits and Factor Demands

Given prices, stand-alone firms and business groups decide how much of labor and capital they will contract to maximize their profits. Business groups also decide how to allocate capital to the affiliated projects. Entrepreneur i who meets entrepreneur j contracts $l\left(\theta_i, a_i, \theta_j, a_j\right)$ units of labor and $k\left(\theta_i, a_i, \theta_j, a_j\right)$ units of capital. These factor demands are the solution of profit maximization either for a stand-alone firm of entre-

[13] Dynamic models of occupational choice often feature such a non-convexity, see for example Bohacek (2006), Gomes et al. (2001), Vereshchagina and Hopenhayn (2009).

preneur i, or for a business group $\{i, j\}$. The profit maximization problems are static.

2.4.3.1 Stand-alone Entrepreneurs

A stand-alone project generates net profits according to :

$$Z^{SA}(\theta_i, a_i) = \max_{k_i, l_i} \left\{ \theta_i \left(k_i^{\alpha} l_i^{1-\alpha} \right)^{\nu} - (r+\delta) k_i - w l_i \right\} \tag{2.3}$$

subject to

$$(1+r)(k_i - a_i) \leq \eta a_i.$$

The borrowing constraint says that the repayment must be lower than a fraction η of the entrepreneur's net worth. The parameter η determines the tightness of the borrowing constraint. When η is low some entrepreneurs are constrained to implement their project in a sub-optimal size. The dependence of the credit contracts on the entrepreneurial net worth prevents the external capital to be allocated optimally among all productive projects.

2.4.3.2 Business Groups

In this paper I focus on the role of internal capital markets inside the business groups. To analyse the working of these internal markets as clearly as possible, I assume away economies of scale and ability spill-overs or other externalities created through joint group management. Each project is still attached to a particular entrepreneur-manager, only capital may be reallocated among the affiliated projects. A business group that disposes with managerial abilities θ_i and θ_j and total net worth a generates net profits according to :

$$\begin{aligned} Z^{G}\left(\theta_i, \theta_j, a\right) = \max_{k_i, l_i k_j, l_j} \Big\{ & \theta_i \left(k_i^{\alpha} l_i^{1-\alpha} \right)^{\nu} + \theta_j \left(k_j^{\alpha} l_j^{1-\alpha} \right)^{\nu} - \gamma \\ & - (r+\delta)\left(k_i + k_j\right) - w\left(l_i + l_j\right) \Big\} \end{aligned} \tag{2.4}$$

subject to

$$(1+r)\left(k_i+k_j-a\right) \leq \eta a.$$

γ is the (fixed) cost of conglomeration. A business group acts as a single entity when going to the external capital market and the credit constraint applies on the group level (total of external funds raised that depends on the total of internal finance available) and not on the each affiliated project level.

Group profit is shared according to the Shapley value solution. Each partner is paid the average of his marginal contributions to the creation of group profit.[14] Partner i obtains

$$Z_i^G\left(\theta_i,a_i,\theta_j,a_j\right)=\frac{1}{2}\left[Z^G\left(\theta_i,\theta_j,a_i+a_{j,}\right)-Z^{SA}\left(\theta_j,a_j\right)+Z^{SA}\left(\theta_i,a_i\right)\right]. \qquad (2.5)$$

A business group is feasible if the profit that each partner could obtain as a stand-alone entrepreneur is lower than his remuneration from the business group. This is guaranteed whenever

$$Z^G\left(\theta_i,\theta_j,a_i+a_j\right) \geq Z^{SA}\left(\theta_i,a_i\right)+Z^{SA}\left(\theta_j,a_j\right). \qquad (2.6)$$

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

Notice that because conglomeration is costly, efficiency dictates that there would be no business groups if the credit market was perfect. Without borrowing constraints, the external capital market would ensure equalization of marginal product of capital across stand-alone firms. However, in presence of borrowing constraints the production size of each project is linked to the amount of internal finance that acts as a collateral. Consequently, some very productive projects have to be operated on an sub-optimal scale if the entrepreneur is poor. In this environment, a possibility of forming a business group

[14]Because I allow only for two-member groups the Shapley value solution is particularly simple and identical to the generalized Nash bargaining solution with equal bargaining powers. I consider the Shapley value since it allows to think of business group formation as a cooperative game with a specific surplus-sharing rule. This interpretation seems to me better suited and more micro-founded.

and reallocating capital internally may generate large gains. Inside the business group the most productive project receives most of capital and its credit constraint is eased, possibly on expense of tightening it for the less productive project. This corresponds to "winner picking and looser sticking" (Stein, 1997) and leads to more efficient allocation of capital. Of course, it follows that a necessary condition for group formation is that at least one of the affiliated projects would be credit constrained were it operated as a stand-alone firm. The gain from conglomeration rises with the net worth - productivity mismatch of the affiliated entrepreneurs. It is highest when a poor high-productivity type meets a rich low-productivity type.

I now provide a formal definition of the equilibrium.

Definition 6. A stationary equilibrium is an invariant joint distribution of types over the individual states Ψ, prices r and w, set of entrepreneurs B, indirect profit functions $Z^{SA}(\theta,a)$, $Z^{G}(\theta_m,\theta_n,a)$, and $Z^{G}_{m}(\theta_m,a_m,\theta_n,a_n)$, and associated allocation functions $k(\theta_m,a_m,\theta_n,a_n)$, $l(\theta_m,a_m,\theta_n,a_n)$ for $m,n\in B$, and value functions $V(\zeta_i,\theta_i,\omega_i)$ and $W(\zeta_i,\theta_i,a_i)$ together with the associated saving decision rule $g(\zeta_i,\theta_i,\omega_i)$ such that :

- Given the distribution Ψ, and the prices r and w, the indirect profit functions and allocation functions solve (2.3), (2.4) and (2.5).

- Given the distribution Ψ, and the prices r and w, the value functions and the decision rule solve (2.1) and (2.2).

- Given the distribution Ψ, and the prices r and w, the set of entrepreneurs is $B=\left\{(\zeta_i,\theta_i,a_i):V\left(\zeta_i,\theta_i,\omega_i^{W}\right)\leq E_{(\zeta_j,\theta_j,a_j)\in B}V\left(\zeta_i,\theta_i,\omega_{ij}^{E}\right)\right\}$.

- Labor market clears

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

- Capital market clears

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

- Consumption good market clears

$$\int\left[\omega_i-g\left(\zeta_i,\theta_i,\omega_i\right)\right]d\Psi=\int_{m\in B}\int_{n\in B}y_m-\delta k\left(\theta_m,a_m,\theta_n,a_n\right)d\Psi d\Psi$$
$$-\int_{m\in B}\int_{n\in B}1_{[\{m,n\}]}\frac{\gamma}{2}d\Psi d\Psi,$$

where $1_{[\{m,n\}]}$ is an indicator function, which equals one if $\{m,n\}$ form a business group and zero otherwise.

- The invariant distribution Ψ is generated by the exogenous ability processes together with the agents decision rules.

2.5 Analysis

2.5.1 Occupational Choice

Given working and managerial abilities, the expected value of each occupation depends on the agent's net worth a_i. The occupational choice decision can then be characterized by a simple cut-off rule : an agent becomes an entrepreneur if his net worth is higher than a threshold $\bar{a}\left(\zeta_i,\theta_i\right)$, which is the solution of

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

Figure 2.2 illustrates the threshold $\bar{a}\left(\zeta_i,\theta_i\right)$ for two values of ζ_i and ten values of θ_i.[15] For some combinations of abilities such a threshold may not exist. Particularly, for some

[15]Figure 2.2 is constructed using the benchmark calibration that is detailed in Section 6. Qualitative conclusions are unchanged for alternative calibrations.

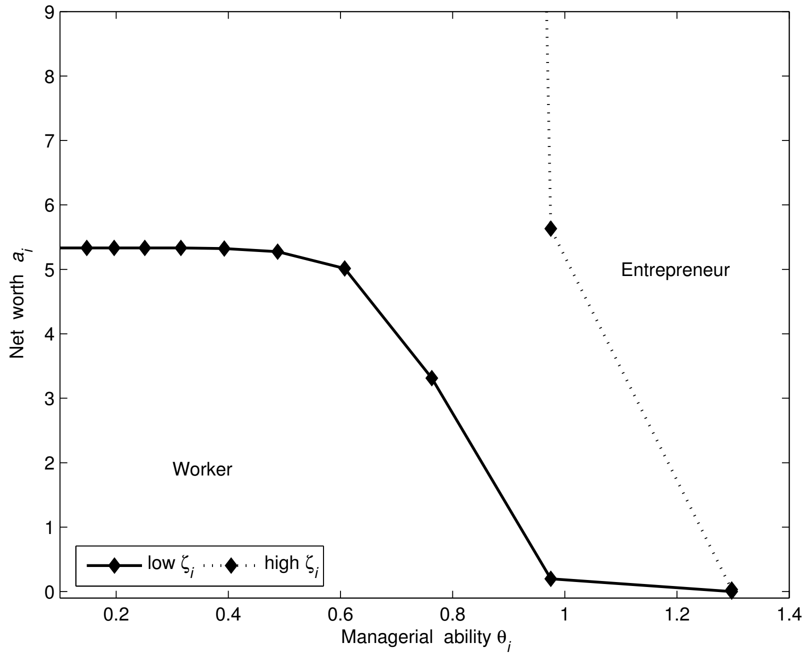


Figure 2.2 – Occupational choice

agents, becoming entrepreneur is never profitable enough to guarantee them an expected value of entrepreneurship higher than the value of working for wage. The threshold $\bar{a}(\zeta_i, \theta_i)$ is increasing in the working ability ζ_i, and decreasing in the managerial ability θ_i. This follows directly from monotonicity of $V(\zeta_i, \theta_i, \omega_i)$ in ω_i, which is guaranteed by the assumption of strictly increasing utility function. Intuitively, for any given net worth, higher ζ_i increases the value of working for wage. On the other hand, higher θ_i makes entrepreneurship profitable even on a smaller scale.

2.5.2 Conglomeration

To gain more intuition on the selection of entrepreneurs into business groups I would like to represent the conglomeration decision in the space of state variables. Given prices, four individual state variables are relevant for the decision : each partner's managerial ability, θ_i and θ_j, and each partner's net worth, a_i and a_j, respectively. Since the gain from conglomeration depends crucially on the net worth-productivity mismatch between the two partners, let us first fix the total amount of net worth available to the group at a. Now 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 a given ϕ and a, I can plot curves in the (θ_i, θ_j) space along which the joint group profit equals the sum of profits if the two projects were operated as stand-alone firms. More formally, I draw the set of couples (θ_i, θ_j) satisfying the following equation

$$Z^G(\theta_i, \theta_j, a) = Z^{SA}(\theta_i, \phi a) + Z^{SA}(\theta_j, (1-\phi)a).$$

Refer to Figure 2.3. Each panel depicts such curves for $\phi = 0.3$, 0.5 and 0.9, respectively, and a 45-degree dotted line. The curves represent matches in which both entrepreneurs are indifferent between operating in a business group or as stand-alone firms. The curves divide the space into three regions. Regions labeled with C represent the set of matches that lead to conglomeration. The points in the SA region correspond to matches that will be operated as two stand-alone firms. The shape of the curves is related to the fixed cost of conglomeration. Particularly, if both partners have managerial ability lower than some threshold, no internal reallocation will make enough gains to compensate for the fixed cost γ, and entrepreneurs will operate stand-alone firms.

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 the 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 the opposing corners, where the partners are heterogeneous enough in managerial abilities. Because capital is reallocated efficiently inside a business group, the more productive entrepreneur will operate his project on a larger scale. From this fact we can identify the internal flows of capital. In the upper left C-region capital is reallocated from entrepreneur i to entrepreneur j, and in the lower right C-region

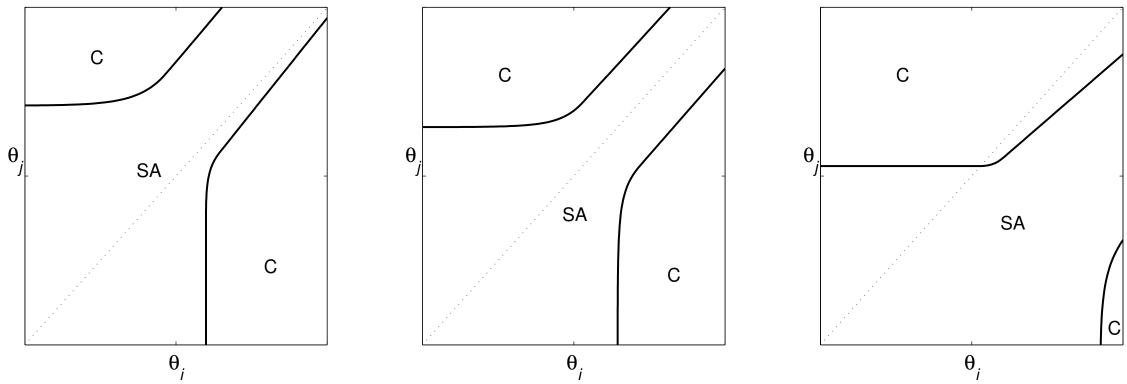


Figure 2.3 – Conglomeration decision : left $\phi = 0.3$, middle $\phi = 0.5$, right $\phi = 0.9$

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 among the partners (further ϕ is 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 C-regions as in the right panel ($\phi = 0.9$) in Figure 2.3. The points in the upper left C-region that are below the dotted line are the matches in which a relatively wealthy entrepreneur i conglomerates with a relatively poor entrepreneur j, who also has lower managerial ability. However, the conglomeration is profitable, because the difference in marginal products of capital is high enough, and the internal flow of capital goes from i to j so that the marginal products are equalized. In conclusion, matches that lead to conglomeration must feature either high enough differences in managerial abilities of the partners or high enough differences in the partners' net worth. The analysis stays qualitatively the same for different values of the total assets available to the group a, only the indifference curves shift closer to each other as a increases.

A direct implication of the efficient internal capital reallocation is that the model is consistent with the stylized fact number three : the investment of the projects in business groups is less sensitive to the entrepreneur's internal finance, because the partner's net worth can make up for the missing collateral.

2.6 Calibration

2.6.1 Functional Forms

For the period utility function I choose the constant elasticity of substitution form

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}.$$

Logarithms of the working and managerial abilities are assumed to follow independent exogenous stochastic AR(1) processes with persistence ρ_ζ and ρ_θ, and variance σ_ζ and σ_θ, respectively. I approximate the AR(1) processes with first order Markov chains using two states for the working ability and ten states for the managerial ability. The approximation is computed using the technique of Tauchen and Hussey (1991). The mean of the working ability is normalized to one, whereas the mean of the managerial ability μ is calibrated jointly with other parameters to match selected moments in the US data.

2.6.2 Parametrization

A set of parameters is calibrated using standard practice in the macroeconomic literature and evidence from independent studies. The inverse of intertemporal elasticity of substitution σ is set to 1.5, the time preference parameter β to 0.87, and capital depreciation δ to 0.08 in line with the standard practice in the macroeconomic calibration literature. Decreasing returns to scale parameter, ν, is set to 0.88. This is well within the range of values used by recent studies on entrepreneurship (Burnside (1996) estimates it to 0.92, Gomes and Livdan (2004) implicitly use a value of 0.95, Cagetti and De Nardi (2006) calibrate it to 0.88, Amaral and Quintin (forthcoming) use 0.85, Gollin (2008) sets it at 0.9, and Buera and Shin (2008) calibrate it to 0.82). Parameter α is chosen to match the aggregate capital income share by imposing $\alpha\nu = 0.33$.

The remaining seven parameters, the persistence and variance of the ability processes ρ_ζ, ρ_θ, σ_ζ, and σ_θ, the mean of the managerial ability process μ, the fixed cost of conglomeration γ, and the credit enforcement parameter η, are jointly calibrated so that the model approximately matches seven moments in the US data. These moments are : the average Gini coefficient of the workers' earnings in the Panel Study of Income Dynamics (PSID), reported by Cagetti and De Nardi (2006) to be 0.38, the Gini coefficients of the workers' and entrepreneurs' wealth in the PSID of 0.73 and 0.69 as reported by Bohacek (2006), the average exit rate from entrepreneurship of 24.2% reported by Quadrini (2000), the proportion of entrepreneurs defined as active business owners in the Survey of Consumer Finances of 11.5% reported by Cagetti and De Nardi (2006), the average proportion of firm-segments affiliated with conglomerates of 0.43 from Maksimovic and Phillips (2002), and the average fraction of external financing of 0.54 obtained by dividing the sum of credit market liabilities of the private sector by the aggregate capital stock of this sector (this moment is taken from Buera and Shin (2008)). Tables 2.II and 2.III summarize the baseline calibration and the moments matched.

2.7 Results

I simulate the model and I use the artificial model-generated data to produce statistics that can be compared to the empirical evidence. In my model each project corresponds to one firm-segment but also to one plant. In other words, in the model all firm-segments have exactly one plant. In consequence, if the aggregation of plant-level observations to the firm-segment level in the real-world data is not affected by strong composition effects, the statistics from the model should be comparable to the empirical evidence on both firm-segment and plant level. In what follows I use a generic term "establishment" to refer to either a firm-segment or a plant and I compare the model to empirical facts for US firm-segments as well as Canadian plants.

Table 2.II – Baseline calibration

Parameter	Description	Value
σ	Inverse of intertemporal elasticity of substitution	1.5
β	Discount rate	0.87
δ	Depreciation rate	0.08
ν	Variable factors output share	0.88
α	Capital share in the output to variable factors	0.378
ρ_ζ	Persistence of the working ability process	0.98
ρ_θ	Persistence of the managerial ability process	0.92
σ_ζ	Variance of the working ability process	0.5
σ_θ	Variance of the managerial ability process	0.04
μ	Mean of the managerial ability process	0.5
γ	Fixed cost of conglomeration	0.5
η	Enforcement of credit contracts	3.0

Table 2.III – Moments matched

Moment	Data	Model
Gini workers' earnings	0.38	0.30
Gini workers' wealth	0.73	0.58
Gini entrepreneurs' wealth	0.69	0.51
Exit rate from entrepreneurship	0.24	0.23
Proportion of entrepreneurs	0.11	0.10
Proportion of conglomerate firm-segments	0.43	0.41
Proportion of external financing	0.54	0.52

2.7.1 Production Size Distribution

In this section I look at the equilibrium distribution of production size that is generated by the model and compare it to the stylized facts on this distribution mentioned in Section 2.2. The stylized facts are established using the relative production size defined as the value of shipments of an establishment divided by the median value of shipments in the establishment's industry. Since I do not model explicitly different industries, I define the relative production size in the model as the production of each project divided by the median production in the whole cross-section of active projects.

Table 2.IV shows that the success of the model in reproducing the features of the relative production size distribution is mixed. In line with the data, the model generates concentration of establishments in stand-alone firms in the low size categories and some concentration of the conglomerated establishments in the large size categories. The main discrepancy between the data and the model is that the model generates too much establishments in the lowest relative size category. This problem is quite severe for the conglomerated establishments.

The larger proportion of low size conglomerated establishments in the model can be explained by the internal capital reallocation combined with the selection of group-affiliated projects. Since inside a business group the capital is reallocated without any frictions, the most productive project will receive most of the capital and the less productive project will be operated at a smaller scale. Thus, one of the affiliated establishments will generally have a larger size than the other, but this still does not explain the large quantitative difference in their size. To understand this difference quantitatively, we must look at the selection of the projects that do conglomerate. Remember from Section 2.5 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 fixed cost of conglomeration, the entrepreneurs in the extremes of the distribution of net worth and abilities are most likely to conglomerate. From ef-

Table 2.IV – Distribution of relative production size

	Conglomerate			Stand-alone			All types		
	US	Canada		US	Canada		US	Canada	
Relative size	segments	plants	Model	segments	plants	Model	segments	plants	Model
<0.5	3.1	9.8	32.2	29.8	35.5	42.1	18.3	30.8	38.1
0.5-1.0	6.2	9.5	8.8	30.0	21.5	14.1	19.7	19.3	11.9
1.0-2.0	8.4	13.5	6.2	20.4	18.4	29.2	15.2	17.5	19.8
2.0-5.0	15.4	20.1	20.7	12.1	14.7	8.5	13.5	15.7	13.5
>5.0	66.9	47.1	32.2	7.7	9.9	6.0	33.3	16.7	16.7
All sizes	43.3	18.5	40.7	56.7	81.5	59.3	100	100	100

Relative Size in the data is segment's value of shipments divided by industry median value of shipments. Relative Size in the model is project's production divided by the median production in the cross-section of all active projects. US statistics in the data are computed from Maksimovic and Phillips (1998), and Maksimovic and Phillips (2002) over the periods 1976-1978, 1981-1982, 1984-1988 and 1990-1991. Canadian statistics are computed by the author from Canadian Annual Survey of Manufacturers over the year 1997-2006. Details about Canadian sample can be found in the third chapter of this thesis.

ficient internal capital reallocation then follows that inside groups the high-productivity entrepreneurs will operate their project on a very large scale and the low-productivity entrepreneurs will operate their project on a very small scale, leading to concentration of the mass of affiliated projects in both extremes of the size distribution. The data, on the other hand, exhibit concentration of the conglomerated establishments only in the large size category. This may point to existence of barriers to frictionless internal capital reallocation. As discussed in the introduction, I abstracted from the possible agency problems inside the business groups that affect the relations between headquarters and division managers. However, such agency issues may be relevant for explaining the discrepancy between the model and the data. Particularly, some frictions in the internal capital markets could limit free internal reallocation and impose minimum size requirements for each conglomerated project.

2.7.2 Productivity of Conglomerates and Stand-alone Firms

Here I relate the implications of my model to several recent papers that examine the relation between plant or firm-segment total factor productivity and diversification. All papers ((Maksimovic and Phillips, 2002, Schoar, 2002) measure plant-level TFP as a residual from a regression of the total value of plant's shipments on production inputs. Since in my model the factor shares are calibrated, I measure the project-level TFP using a standard accounting approach. Particularly, in the model the logarithm of project i's production can be decomposed as :

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

The measured TFP of project i is then equal to $\ln \theta_i$.

There are two remarks in order with respect to comparing the results on TFP in the model to the empirical evidence. First, because in the model all firm-segments comprise only a single plant, I cannot distinguish between plant-level and a firm-segment-level TFP. The measured TFP in the model is thus best compared to the plant-level TFP in the data, because there could be some composition effects in play while aggregating the plant-level TFP to the firm-segment level. Second, the model features a two-factor production function in which there is no place for intermediate inputs such as materials. In consequence, the measured TFP is best compared to the estimates of TFP obtained from a value-added production function.

Maksimovic and Phillips (2002) and Schoar (2002) estimate TFP from gross revenue production functions. While Schoar (2002) reports results directly on the plant-level, Maksimovic and Phillips (2002) construct firm-segment-level TFP as a weighted average of plant-level TFPs over the plants within the firm-segment. In the third chapter of this thesis, I estimate plant-level TFP from both gross revenue and value added production function, perform a similar analysis as in Schoar (2002) and Maksimovic and Phillips (2002), and check the robustness of results with respect to different levels of aggregation. Fortunately, the main stylized facts seem to be robust to the differences in the level of aggregation or in type of production function used to estimate TFP.

2.7.2.1 TFP Differences Unconditional on Size

To examine the relation between average productivity and firm diversification Schoar (2002) and our study presented in the third chapter of this thesis regress plant-level TFP on the number of firm-segments in which the firm operates. Both studies find a significant positive relationship, which means that the plants in the diversified firms are on average more productive than those in stand-alone firms.[16] Consistent with this evidence, I also find a positive relationship when running this regression on artificial data obtained by simulating my model. The positive relationship captures the selection of highly productive projects into conglomerates. A disproportionally large fraction of projects that end up in conglomerates have very high TFP, because the gain from internal reallocation of capital towards these projects is likely to be high. This selection can be nicely seen on Figure 2.4, which compares the distribution of TFP for the conglomerated and stand-alone projects.

2.7.2.2 TFP Difference Conditional on Size

Maksimovic and Phillips (2002) find that, conditional on production size, conglomerated firm-segments have on average lower TFP than the stand-alone firm-segments. This might seem in contradiction with the finding of Schoar (2002) and the results of the previous section. However, in the third chapter of this thesis I show that when running a regression of TFP on conglomeration dummy in the Canadian data set, we can find a positive coefficient unconditionally on production size, but a negative coefficient if we do condition on production size. Moreover, from the statistics reported in Maksimovic and Phillips (2002) one can actually infer, with a simple calculation, the unconditional means of TFP for the segments in conglomerates and single-segment firms. Interestingly, one then also finds that unconditional on size, the firm-segments in conglomerates

[16] In her alternative specifications, Schoar (2002) controls for the number of plants on the firm-segment and firm level. This actually makes her results even more suitable for comparison to my model since it compensates for the fact that I have only single-plant segments. However, she does not control for the plant production size. The results in these alternative specifications are qualitatively same.

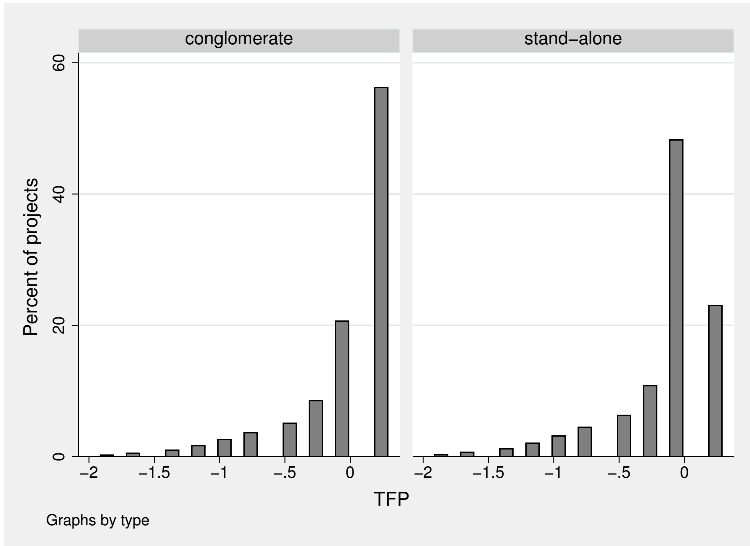


Figure 2.4 – TFP distribution by firm type

are more productive than the stand-alone firm-segments. Therefore, the two results are not incompatible. My model allows to understand some of the effects that can be in play.

If we run a regression of TFP on a conglomeration dummy and we control for the project's relative production size in the artificial data, we find, in line with Maksimovic and Phillips (2002), a negative relation between TFP and conglomeration. Examining more in detail the mechanisms of the model, we discover that the conglomerates are on average less productive when controlling for size because they allocate capital from less productive projects to more productive ones, eliminating the capital-productivity mismatch. Figure 2.5 visualizes this effect. It gives the distribution of TFP for projects of relative production size between 0.1 and 0.15 (left panel), and projects of relative production size between 1.35 and 1.4 (right panel). For smaller production sizes, there is less high-productivity projects constrained to operate at this size among conglomerated firm-segments than among stand-alone firms. Consequently, the average TFP in these size categories is lower among conglomerated firm-segments. For large sizes the composition effect goes in the opposite direction. However, it comes out that in the regression the former effect dominates. This is because TFP is bounded from above and all projects

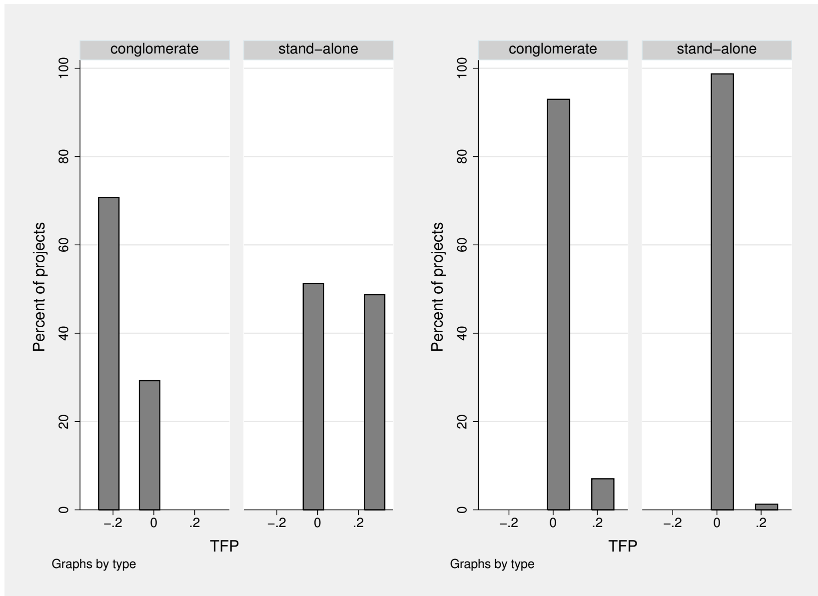


Figure 2.5 – TFP distribution in given production size classes ; small size in the left panel, large size in the right panel

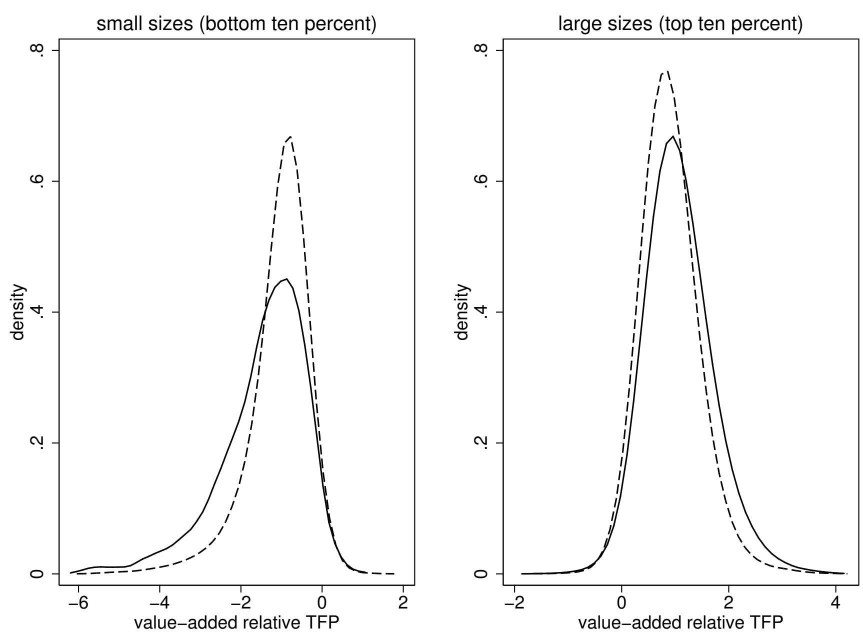


Figure 2.6 – Plant-level TFP distribution in Canadian Annual Survey of Manufacturers (conglomerates - solid line, stand-alone firms - dashed line)

larger than a certain threshold have the highest TFP whether they are in conglomerates or not. The model therefore suggests that the simple regression analysis hides important details about the two opposing effects of the selection mechanism. Interestingly, in the third chapter of this thesis, we look at the data more in detail and we find shifts in the TFP distribution of plants in conglomerates with respect to the TFP distribution of plants in stand-alone firms that are exactly in line with the predictions of the model. Figure 2.6 depicts smoothing kernel estimates of TFP distributions from the Canadian data. Effectively, among the plants in the first decile of the plant-size distribution, there is more low-TFP plants in conglomerates than in stand-alone firms. On the other hand, among the plants in the top 10% of the size distribution, there is more high-TFP plants in conglomerates than in stand-alone firms.

Maksimovic and Phillips (2002) and some other studies that cite their paper broadly interpret lower productivity of conglomerates conditional on size as evidence of their low performance compared to the specialized firms. However, my results indicate that one should be careful with making conclusions on performance of conglomerates based on this finding, especially in presence of frictions in the external capital market. When conditioning on size, the negative relation between TFP and conglomeration may actually stem from reallocation of capital towards highly productive projects inside conglomerates, which should have a positive impact on performance.

Another way to see the implications of internal reallocation on size and productivity is to look at average production size conditional on productivity. Since in the model TFP is discretized, we can easily plot the average relative production size and TFP for conglomerated firm-segments and stand-alone firms, what is done in Figure 2.7.[17] We see that, except in the highest productivity class, the average size of conglomerated firm-segments is lower. This suggests that conglomerates channel the capital more aggressively from low to the highest productivity projects than the external credit market.

One may be concerned with the fact that, due to selection, the underlying distribution

[17] In Figure 2.7 y-axis is scaled logarithmically.

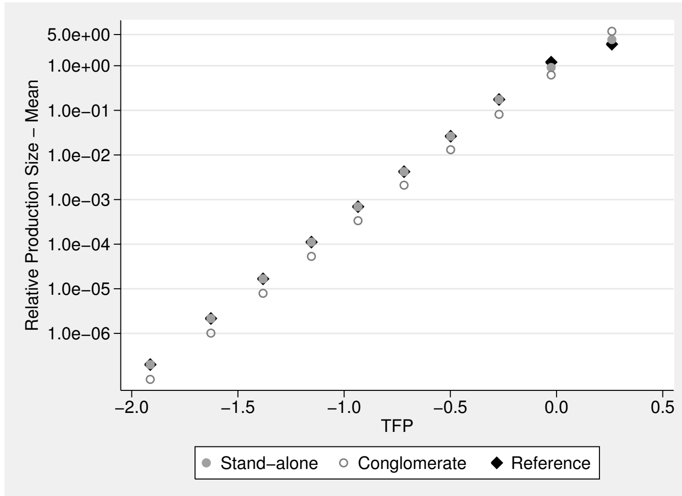


Figure 2.7 – Average production size and productivity

of internal funds is not the same for stand-alone and conglomerated projects. To address this issue, I plot the hypothetical average size of projects that select into conglomerates if they were forced to remain stand-alone. In that situation they would be constrained to use only the amount of capital that they were able to raise with their own internal funds. I call these averages "Reference" points, and they are depicted as black diamonds in Figure 2.7. The Reference points closely follow the average size of stand-alone firms except for the two most productive categories, where they actually emphasize even more the internal reallocation towards the highest productivity projects. Clearly, this confirms that conglomerates allocate capital more efficiently than stand-alone firms on average. Their average performance, measured by profit creation or capital allocation efficiency, should therefore be higher than that of single-segment firms in environments with frictions in external markets. This finding is consistent with Santalo and Becerra (2008), who find a conglomerate premium in industries in which information that is not verifiable by company outsiders is important, and a conglomerate discount in industries in which such "inside" information is not important.

2.8 Quantitative Experiments

2.8.1 Credit Frictions and the Degree of Conglomeration

This section examines how the degree of conglomeration in the economy changes with the severity of borrowing constraints. The implications of the model are then contrasted with the data. Specifically, I ask whether cross-country differences in the degree of conglomeration tend to be associated with measures of investor protection (my proxy for credit constraints) in the way predicted by the model.

Figure 2.8 depicts some comparative statics with respect to the enforcement parameter η. Lower enforcement, or, equivalently, more severe credit constraints, leads to higher levels of entrepreneurship, higher degree of conglomeration, lower prices, lower average output per firm-segment, and lower output per capita.[18] The proportion of entrepreneurs in the economy is higher with tighter credit constraints because lower wages and interest rates make the entrepreneurship profitable (compared to working for wage) for types with lower managerial abilities. Notice that this mechanism endogenously reproduces stylized fact number five - in economies with lower aggregate output there is a higher number of active entrepreneurs operating lower scale projects.

Due to lack of quality data on conglomeration and difficulty to measure credit constraints in a broad cross-section of countries, it is hard to quantitatively evaluate whether the model is able to generate differences in degree of conglomeration consistent with the data. However, Figure 2.9 aims to give an idea on this issue. It plots the degree of conglomeration and an investor protection index normalized by its the level in the US. The real-life data points are labeled by three letter country codes. The connected diamonds correspond to model equilibria in which the enforcement parameter, normalized by its level in the benchmark calibration, is equal to the relative investor protection on the x-axis. The abscissas for the simulation points were selected to be equal to quintiles of the distribution of relative investor protection. The model gets quite well the average degree

[18] Output is net of fixed costs of conglomeration.

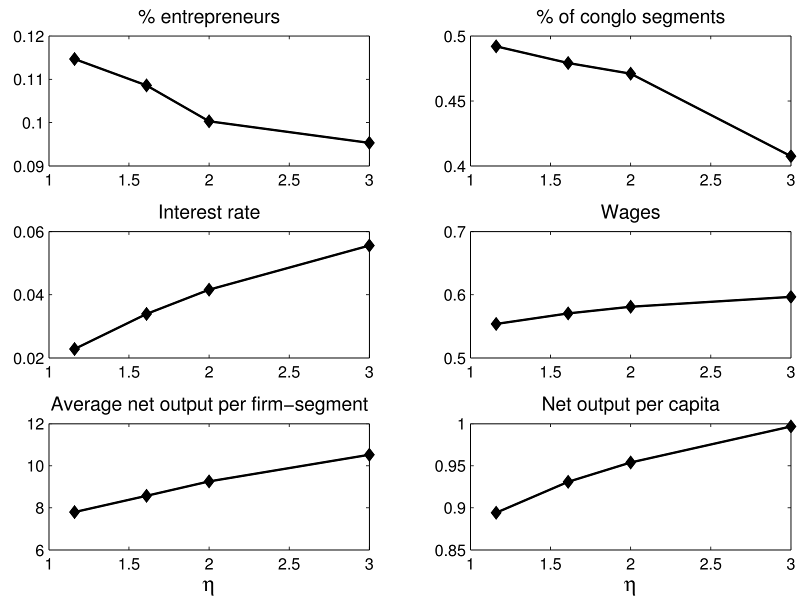


Figure 2.8 – Comparative statics with respect to credit constraint

of conglomeration of countries in the second, and third quintile of the distribution. The evaluation out of this range is difficult due to low number of data points.

In any case, the reader should take all comparisons based on Figure 2.9 only as a broad illustration. More precise conclusions are problematic since investor protection indices are ordinal variables that are not suitable for quantitative comparisons, whereas the enforcement parameter in the model has a precise quantitative meaning and implications.

2.8.2 Restrictions on Conglomeration

In this section I look at effects of policies that raise the cost of conglomeration. In my model conglomeration has two opposing effects on macroeconomic aggregates. First, for any given prices, the internal capital markets reduce the misallocation of capital over the productive projects. This allows highly productive entrepreneurs to operate their projects at sizes closer to their unconstrained levels and raises the level of entrepreneurship. Second, via general equilibrium restrictions, conglomeration implies higher prices of

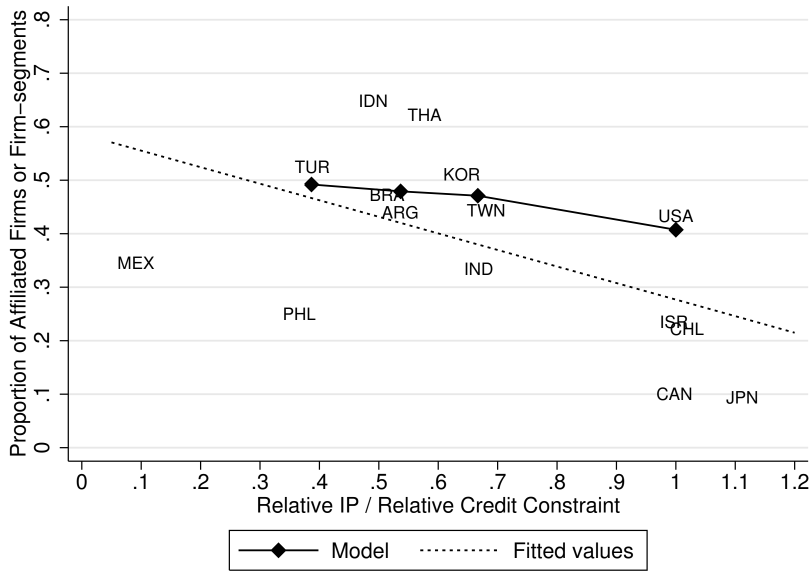


Figure 2.9 – Conglomeration and credit constraints

production factors, which tends to reduce production size of all projects and the level of entrepreneurship.

As mentioned in the introduction, my paper is not the first to study these effects. Indeed, Almeida and Wolfenzon (2006a) speculate that the negative general equilibrium effect may be dominant in environments with intermediate level of investor protection. This would have important implications in terms of policies restricting conglomeration such as merger and acquisition regulation. However, no work, in my best knowledge, attempts to measure these effects quantitatively. To do such quantitative comparisons in my model, I consider following three scenarios. A "No Groups" stationary equilibrium in which conglomeration is prohibitively costly and no business groups emerge, a "Groups Partial" perspective in which prices are held constant on their level in the "No Groups" scenario, but in which the cost of conglomeration is as in the benchmark calibration, and a "Group Benchmark" stationary equilibrium that corresponds to the benchmark calibration. The Groups Partial is an off-equilibrium scenario in which agents optimize, but they expect prices and the joint type distribution to be as in the stationary equilibrium without groups. Although in this situation markets are not cleared and the resulting distribution of wealth and production size is not invariant, this scenario can serve for evaluating the direct effect of conglomeration separately from the general equilibrium effect.

Refer to Table 2.V. Comparing the Groups Partial scenario to the No Groups scenario gives us some information on the direct effects of conglomeration. If the prices stayed at the No Groups level, possibility of forming groups would raise entrepreneurship by 37%. A possible match with a suitable partner makes entrepreneurship profitable for many agents that would choose to work if they were constrained to operate their project alone. The rise in entrepreneurship and the possibility to reallocate capital internally boosts the aggregate demand for capital by 110%, and the aggregate output by 189%. The average proportion of external financing decreases because internal capital reallocation allows to circumvent the external credit markets to some extent. The agents also tend to save more on average (increase by 6.5% in the saving rate) because of improved the prospects for investing the savings efficiently through a business group partnership.

Off course, the numbers cited above look quite spectacular, but they correspond to an off-equilibrium situation and illustrate only one part of the story. The second part are the general equilibrium effects of conglomeration, which can be illustrated by comparing the Groups Benchmark scenario to the Groups Partial scenario. In the former prices adjust so that all markets clear and the joint distribution of wealth and abilities is stationary. Higher prices of production factors (interest rate and wages go up by 51% and 7%, respectively) make entrepreneurship less profitable inducing a 47% decrease in the proportion of entrepreneurs. The same apply to aggregate demand for capital and aggregate output. Relative to the Groups Partial scenario, they are lower, respectively, by 66% and 67%. The average proportion of external financing continues to decrease by 16%, the reason being the higher price of external finance.

Put together, the direct and the general equilibrium effects compensate each other resulting in a much smaller, but still significant, variation across the stationary equilibria with and without groups. The equilibrium with business groups features a 25% higher

Table 2.V – Aggregate effects of conglomeration

Statistic	No groups	Groups partial	Groups benchmark
Cost of conglomeration	1000	0.5	0.5
Interest rate	3.67%	3.67%	5.56%
Wage rate	0.56	0.56	0.60
Proportion of entrepreneurs	0.08	0.19	0.10
Proportion on conglomerate firm-segments	0.00	0.57	0.41
Aggregate demand for capital	1.83	5.68	1.93
Net output per capita	0.95	2.70	1.00
Net output per unit of capital	0.52	0.48	0.52
Net output per efficiency unit of labor	1.02	3.19	1.07
Average proportion of external financing	0.71	0.62	0.52
Average saving rate	0.46	0.49	0.48

No Groups refers to stationary equilibrium with prohibitive cost of conglomeration, Groups Partial refers to off-equilibrium scenario in which prices are held constant at the No Groups level, Groups Benchmark refers to the stationary equilibrium under the benchmark calibration. Net output is output minus fixed costs of conglomeration.

level of entrepreneurship, higher levels of capital accumulation and aggregate output (by 5.4% and 6.3%), and a lower level of external financing than the equilibrium without conglomeration. This suggests that internal capital markets play quite important role in allocating resources to their more productive use and that this beneficial effect outweighs the negative general equilibrium effect. This result is in line with a recent study of broader size-restricting policies by Guner et al. (2008). My analysis focuses on a particular type of these policies that restrict conglomeration. However, an important caveat applies since my analysis assumes away any ties between governments and business groups. In several countries large diversified groups tend to be closely connected to the politicians, which may sometimes lead to inefficient outcomes such as corruption, over subsidizing of groups, or concentration of market power through state-granted monopoly rights.

2.9 Concluding Remarks

This paper contributes to the literature studying conglomerates, business groups, and allocation of resources in the economy. I consider the role of conglomeration in an economy with financial frictions. In my model conglomeration arises endogenously as a way for firms to partially avoid external credit market imperfections, and to reallocate the available capital across affiliated projects more efficiently. The quantitative analysis shows that this view of conglomeration is consistent with several observed stylized facts on how production is organized across firms, on productivity differences between conglomerates and stand-alone firms, and on cross-country differences in degree of conglomeration. The model suggests that conglomeration may have a positive effect on economic development through improving the allocation of capital to productive projects. Therefore, regulations restricting conglomeration may be potentially harmful.

I can think of at least three important points where my analysis may be improved. First, I have abstracted from potentially important agency issues that may arise inside business groups. Those are likely to limit the ability of the headquarters to efficiently reallocate capital across projects. Integrating explicitly such issues into my model may help to better reproduce the marked concentration of conglomerated firm-segments in the large size categories. Such an extension, however, would require thinking more deeply about detailed ownership and control structure of conglomerated firms and business groups, which varies considerably even within a given country. Second, I have abstracted from business groups dynamics. Allowing for long-lived business groups may help understand the observed persistence in group affiliation and the long-term interactions among the affiliated firms. Finally, I have not considered the market and political power that is often concentrated in the hands of large business groups. While the market power considerations could help better understand market structure and innovation and pricing behavior of firms, a political economy extension could shed some light on emergence of subsidy policies, barriers to entry, or barriers to financial development.

CHAPITRE 3

SIZE AND PRODUCTIVITY OF SINGLE-SEGMENT AND DIVERSIFIED FIRMS : EVIDENCE FROM CANADIAN MANUFACTURING

3.1 Introduction

Diversified business groups, conglomerates, and multi-industry enterprises are present in almost every country. Often they are among the largest and the most widely known firms in the economy - General Electric, Bombardier, Fiat Group, Mitsubishi, and Hyundai all are internationally renowned. Anecdotal evidence suggests that in many countries conglomerates account for a particularly large fraction of corporate assets and business activity. Given the economic weight of these diversified entities, it seems that understanding conglomerates should also be key for understanding several phenomena, which are of interest for micro as well as macro-economists, such as the organization of production, the cross-firm allocation of inputs and production outcomes, and the productivity of firms. In this paper, I make a step in this direction by establishing several key facts about size and productivity of plants in conglomerates and single-segment firms from Canadian Annual Survey of Manufacturers and Canadian Business Register.

I first document that although in Canada conglomerates are not numerous, they do play an important role in the Canadian economy. In fact, conglomerates represent about 18 percent of manufacturing plants but they account for around 70 percent of the overall manufacturing value added. This suggests that conglomerated plants are much larger than plants in single-segment firms. To show some more detail, I provide new evidence on establishment size distribution conditional on firms' organizational structure. Particularly, I separately estimate size distributions for establishments in conglomerates and in single-segment firms using non-parametric smoothing kernels. My results show that the size distribution for plants that are part of diversified firms is shifted towards larger sizes compared to the size distribution for plants in single-segment firms. The result is robust to different measures of plant size such as the value of shipments, value added, or employment, as well as to controlling for selection of conglomerates into some specific industries.

Is the larger size of plants in conglomerates justified by their productivity being higher than that of plants in single-segment firms or are they just overgrown and inefficient dinosaurs ? To shed some light on this question, I estimate plant level total factor productivity (TFP) using the estimation procedure of Levinsohn and Petrin (2003) to correct for the endogeneity of inputs bias. I compare the productivity of conglomerated plants to the productivity of plants in single-segment firms. I find that conglomerated plants are on average more productive than plants in single-segment firms, but this relationship is reversed when controlling for plant size. The reversion of the relationship between conglomeration and productivity when conditioning on size may seem puzzling. In order to understand the mechanism that may lead to this reversion result, I examine the empirical evidence in more detail. I show that in the data the reversion can be explained by a shift of the TFP distribution of large-size conglomerated plants towards higher productivity levels compared to the TFP distribution for single-segment firm plants of similar size and a shift of the TFP distribution of small-size conglomerated plants towards lower productivity levels compared to the TFP distribution for single-segment firm plants of similar size. I argue that this evidence supports the theory of efficient internal reallocation of resources inside conglomerates in presence of frictions on the external markets as proposed by Stein (1997) and taken to a general equilibrium framework in the second chapter of this thesis. An important implication of that theory is that a very productive plant should be operated on a larger size if it is a part of a conglomerate than if it is a part of a single-segment firm. The intuition is that in presence of frictions that limit the allocative efficiency of external markets, conglomerates have better ability to channel resources to their most productive use via internal reallocation among their divisions. This mechanism induces a higher selection of highly productive plants into large size categories in conglomerates than in single-segment firms. In line with my empirical finding, plants in conglomerates will then be on average less productive in small size categories, whereas in the large size categories they will be on average more productive than their single-segment firm counterparts.

My paper is most related to the industrial organization literature on firm and establishment size distribution and to the corporate finance literature on corporate diversification. Although the empirical literature concerning establishment size is abundant (Axtell, 2001, Dunne et al., 1989, Evans, 1987, Hall, 1987), the only existing study that allows to infer some information concerning the size distributions conditional on conglomeration is the paper by Maksimovic and Phillips (2002). Using data from Longitudinal Research Database (LRD) of the US Bureau of Census, they divide firm-segments[1] in conglomerates and single-segment firms into five coarse size categories. Their statistics suggest that there are important differences in the shape of the distribution of firm-segment size between conglomerates and stand-alone firms, but they do not examine the size distributions in detail nor do they provide any indication on where these differences come from. This is understandable, since their work does not explicitly focus on documenting facts about establishment size. Related, the particular measure of size used by Maksimovic and Phillips (2002) is practically non-comparable to any other standard ways of measuring establishment or firm size. Compared to Maksimovic and Phillips (2002), this paper provides much more detailed insights and it addresses some measurement and definition issues in their approach. It also ensures comparability to the firm size distribution literature by considering several standard measures of establishment size. More generally, several recent studies tried to provide and test empirically a theory that could explain salient features of the establishment size distribution. For example, Angelini and Generale (2008), Cabral and Mata (2003), and Desai et al. (2003) assess whether financial constraints play an important role in determining the features of the size distribution and explaining firm growth. Rossi-Hansberg and Wright (2007) pro-

[1] A firm-segment summarizes the activity of a firm on the industry level.

pose a theory that relates the shape of the size distribution to differences in the physical capital share across industries. My paper shows another dimension that might be important to understand the overall shape of the firm size distribution - the organisational structure of firms with respect to corporate diversification.

There is a large body of corporate finance literature devoted to the study of efficiency of corporate diversification. Since the seminal work of Berger and Ofek (1995), which found that publicly listed diversified conglomerates in the US trade on average at a discount relative to the focused firms, most of empirical literature concentrated on differences in stock valuation of diversified versus single-segment firms. The question in these papers is whether diversification creates value for the shareholders. The so-called diversification discount was often interpreted as evidence of inefficiency of conglomerates. However, more recent empirical papers cast some doubts on the robustness of the diversification discount finding (Khanna and Palepu, 2000, Santalo and Becerra, 2008, Villalonga, 2004)[2] as well as its power to indicate the inefficiency of conglomerates (Gomes and Livdan, 2004, Schoar, 2002). The approach in my paper is quite different. I contribute to the small group of works that rather than relying on stock market valuation look directly at the plant-level productivity in conglomerates (Maksimovic and Phillips, 2002, Schoar, 2002). The advantage of this approach is that it does not suffer from the sample selection bias related to the focus on publicly traded companies and it is able to provide information on the actual differences in the plant-level total factor productivity. This enables one to ask a different types of question such as do conglomerates channel resources to their best use more efficiently than external markets ? My finding of the reversion of relationship between conglomeration and productivity when controlling for plant size is in line with what suggests a comparison of the two previous studies

[2] The diversification discount is not found in other countries (Khanna and Palepu, 2000 find instead a diversification premium for firms affiliated with large industrial groups in India), when using more detailed establishment-level data (Villalonga, 2004 also finds a diversification premium instead of a discount in the BITS establishment-level data), or when controlling for industry heterogeneity (Santalo and Becerra, 2008 find a diversification discount in industries with a large number of stand-alone firms, but a diversification premium in industries in which stand-alone firms capture a small market share).

in corporate finance. Using the LRD data on American manufacturing plants, Schoar (2002) finds that plants in diversified firms have on average higher TFP than those in the single-segment firms. Maksimovic and Phillips (2002) find the exact opposite when looking at firm-segments and conditioning on a given size category.[3] However, the comparison of the results in those papers suffers from several problems. First, the authors use a different level of observation and slightly different form of the production function to estimate TFP, so the results are not exactly comparable.[4] Second, and more importantly, both studies use a simple regression-based approach to obtain TFP residuals. This approach is well known to suffer from the endogeneity of the input decisions problem. Third, none of these studies combine the size and productivity statistics to specifically test the efficiency of internal resource reallocation. In contrast, my paper examines the subtle relation between plant's productivity, firm's organizational structure, and plant's size in a unified econometric framework that corrects for the endogeneity bias and that is commonly used in the industrial organization literature (Levinsohn and Petrin, 2003, Olley and Pakes, 1996). My paper is also the first that studies size and productivity of conglomerates from Canadian plant-level data. I view this as a nice robustness test of facts suggested by previous studies that all worked with data on US manufacturing firms.

My paper can also be related to several papers that study the role of mergers in reallocation of capital and labor and the role of product switching in intra-firm allocation of resources. Jovanovic and Braguinsky (2004) and Jovanovic and Rousseau (2002) find that a theory of mergers as waves of reallocation of resources across plants can explain empirical regularities concerning firm's Tobin's Q and behavior of firm's stock prices before and after acquisitions. Bernard et al. (2010) model product switching in American manufacturing firms and conclude that it significantly contributes to better allocation of

[3] Surprisingly, each of these studies is silent about the finding of the other paper.

[4] In Schoar (2002) the unit of observation is a plant, whereas in Maksimovic and Phillips (2002) the unit of observation is a firm-segment. Schoar (2002) uses a standard Cobb-Douglas form of production function with labor, capital, and material inputs, while Maksimovic and Phillips (2002) augment it with a cross-product of any two inputs, squared terms of any inputs, and a plant-firm specific fixed effect.

resource. In contrast to my paper, these works do not estimate TFP and they do not consider the role of establishment size in comparing the firm's performance.

I think that the evidence presented in this paper could also be of interest to the industrial organization literature that tries to estimate and explain plant-level heterogeneity in productivity (Abrahám and White, 2008, Bartelsman and Doms, 2000, Jensen and McGuckin, 1996), as well as to the macroeconomic and economic development literature that recently became interested in the role of financial constraints and other firm-specific frictions for the efficiency of the aggregate resource allocation (Castro et al., 2009, Hsieh and Klenow, 2009, Restuccia and Rogerson, 2008).

3.2 Data

In this study, I use data on Canadian manufacturing establishments. Statistics Canada uses a four-level hierarchy of statistical entities for businesses : the Enterprise, the Company, the Establishment, and the Location. My sample is selected from Statistics Canada's records from the Annual Survey of Manufacturers (ASM hereafter), which collects financial and commodity data at the Establishment level. Establishment is the smallest level at which the data on principal inputs, revenues, salaries, and wages are available (Statistics Canada, 2010). In manufacturing industries this level usually represents a plant and I will use terms plant and establishment interchangeably. The Enterprise is defined as the organisational unit of a business that directs and controls the allocation of resources relating to its domestic operations (Statistics Canada, 2010). In what follows, I will use terms firm and enterprise interchangeably.

ASM gathers detailed information on production inputs, revenues, salaries and wages of manufacturing plants from three principal types of sources : questionnaires sent to survey participants,[5] administrative tax records, and imputation from aggregate or industry records. My sample covers the period from 1997 to 2006. From the initial 568,628 plant-

[5]Responding to ASM questionnaires is mandatory and firms can be fined for non-compliance.

year observations I exclude 137,274 observations that were imputed from aggregate or industry records. I further exclude from the sample observations for which the value of manufacturing shipments plus the difference in inventories of finished products and goods in progress is lower than CAD 50,000. This leaves me with a sample of 295,132 plant-year observations.

In order to classify firms as conglomerate or stand-alone, I construct so-called firm-segments. Particularly, I use the firm identifier to aggregate plant-level data at the 4-digit NAICS code for every firm. A firm-segment therefore represents a firm's operations in a given industry. I classify a firm as a conglomerate if it has more than one firm-segment. I will also use the number of firm-segments and herfindahl-based measures to measure the actual degree of diversification.

A limitation of the ASM data is its concentration on manufacturing industries. In consequence, if a firm is diversified outside manufacturing, the non-manufacturing operations are not recorded. This issue has been recurrent in all studies on conglomeration that used detailed plant-level manufacturing data. (Schoar, 2002) tries to address this problem by matching the observations from the Longitudinal Research Database of US Bureau of Census to the Compustat Segment data. While this may partially solve the difficulty of controlling for diversification outside manufacturing, it comes at a great cost of limiting the sample to firms included in the Compustat files. Given the known issues with the Compustat data, this sample selection could introduce serious bias to the analysis. One contribution of this study is that I was able to obtain the information on firms' activities outside manufacturing directly from the Business Register (BR hereafter) records.[6] This information is of substantially higher quality than the Compustat Segment files and, because BR represents the universe of Canadian enterprises, the sample selection issue is mitigated as well. BR is supposed to provide information on all activities of Canadian firms, particularly the NAICS industry codes in which a firm operates as

[6] I am indebted to Robert Gibson from Statistics Canada for recovering and cleaning the data on manufacturing firms from the Business Register.

well as sales and employment in each of these industries. However, BR was designed as a sampling framework for various business surveys and it is not a coherent research database. Therefore, not all records in BR are accurately up to date and suitable for research purposes. Using the firm identifier and the reporting year in the ASM as matching variables, I was able to obtain firm-level information from the BR records for 249,830 plant-year observations in the ASM. I had to further delete 1,511 observations associated to firms for which BR reports activities in manufacturing industries that are not reported in the ASM.[7] After this final cut I have a sample of 248,319 plant-year observations spanning the period 1997 to 2006 with at least 17,606 plant observations per year.

In some of my analysis I will divide the sample into two sub-sample periods, the first including all pre-2000 years and the second including years 2000 to 2006. The reason for this division is that in 2000 the ASM was redesigned as a part of the United Enterprise Survey program. One important consequence is that since 2000 the ASM moved to the Business Register as its frame for sampling, whereas it had its own specific sampling frame before 2000. There were also several other modifications in the survey design. Although the database variables were checked to insure compatibility over both sub-periods, repeating the analysis on each sub-period provides a nice opportunity to examine the robustness of some results.

3.2.1 Prevalence of conglomeration in Canadian manufacturing

The proportion of plants in the sample that operate under conglomerate firms ranges from 16 percent in 1997 to 24 percent in 2000. It tends to be slightly lower in the first sub-sample period with an average of 17 percent over the years 1997-1999 and 19 percent over the years 2000-2006. Table 3.I reveals that the proportion of firm-segments that operate under conglomerate firms is smaller than the proportion of conglomerated plants. At

[7]This is a consistency requirement. Since the ASM file is updated on a regular basis and provides much more accurate information on manufacturing industries than BR, I use the ASM data whenever BR records on manufacturing are not coherent with the ASM files. I make implicitly the assumption that ASM records truthfully all manufacturing activities of the firm.

Table 3.I – Proportion of conglomerates

year	% plants	% segments	% firms	% gross output	% value added	% employment
1997	16.3	8.7	6.1	77	73	55
1998	17.2	9.3	6.6	76	73	55
1999	18.1	9.7	7.0	77	74	55
2000	24.5	13.9	10.1	79	75	59
2001	19.0	10.0	7.2	77	72	56
2002	21.5	11.9	8.8	79	76	60
2003	22.1	12.5	9.1	79	74	60
2004	17.7	9.3	6.7	75	70	55
2005	16.2	8.8	6.4	72	66	51
2006	16.1	9.0	7.0	66	61	46
All years	18.5	10.0	7.3	75	71	55

the firm level the proportion of conglomerates is even lower. This points to the importance of the choice of the level of aggregation for conducting any analysis concerning multi-segment firms. In following sections I will generally report results at the plant level and at the firm-segment level.

To assess the part of production accounted for by conglomerates, I look at the gross manufacturing output defined as the value of shipments plus the variation in inventories of goods in progress and final goods. The proportion of gross manufacturing output produced in conglomerated plants ranges from 66 percent in 2006 to 79 percent in 2002, averaging around 75 percent for both sub-sample periods. These high numbers point to importance of conglomerates in the economy, or at least in manufacturing. The industries in which conglomerates account for the largest fraction of output appear to be NAICS 3365 Railroad Rolling Stock Manufacturing (1997), NAICS 3122 Tobacco Manufacturing (1998-2000), NAICS 3241 Petroleum and Coal Products Manufacturing (2001-2003 and 2006), and NAICS 3311 Iron and Steel Mills and Ferro-Alloy Manufacturing (2004-2005). In these industries the proportion of the gross output produced by conglomerates was above 98 percent. Over the two sample sub-periods, the largest fraction of the gross output was produced by conglomerates in NAICS 3122 for the pre-2000 period and in NAICS 3241 for the post-2000 period. The industries with the lowest concentration of production in conglomerates were NAICS 3159 Clothing Accessories and Other Clothing Manufacturing (1997, 2001-2004), NAICS 3169 Other Leather and Allied Product Manufacturing (1998-2000 and 2005), and NAICS 3161 Leather and Hide Tanning and Finishing (2006). The fraction of the gross output produced by conglomerates in these industries is generally lower than 10 percent. Over the two sample sub-periods, NAICS 3169 has the lowest concentration of output in conglomerates for the pre-2000 period and NAICS 3159 for the post-2000 period.

The numbers are similar if we look at the value added instead of gross output. The proportion of total manufacturing value added produced in conglomerated plants ranges from 61 percent in 2006 to 76 percent in 2002, averaging around 75 percent for both sub-sample periods. The industries in which conglomerates account for the largest and the lowest fraction of the value added appear to be the same as when looking on gross output, with addition of NAICS 3361 Motor Vehicle Manufacturing in the category of industries with production most concentrated in conglomerates.

3.3 Size distribution

Previous literature (Maksimovic and Phillips, 2002) suggests that there are important differences in the size distribution between plants and firm-segments operating under conglomerates and those in single-segment firms. In this section I provide new detailed evidence on the size distribution of plants and firm-segments according to their diversification status. In subsections 3.3.1 to 3.3.3, I rely on non-parametric kernel density estimation to compare the size distributions. This approach has the advantage of conveying information not only on few selected moments of the distribution, such as average size and its variance, but on the shape of the whole distribution. The non-parametric approach has also some limitations. Particularly, I cannot easily control for plant characteristics, such as age and industry, or for year effects. This might be important because, as is well known from firm-size literature, older plants and firms tend to be larger, the minimum scale of operation in some industries is larger than in other industries, and the production will be generally lower in recession years. Some of these issues can be addressed by carefully constructing the measures of plant size (I consider several of them) used for kernel density estimation. For other issues and as a robustness check, I include a regression analysis in subsection 3.3.4.

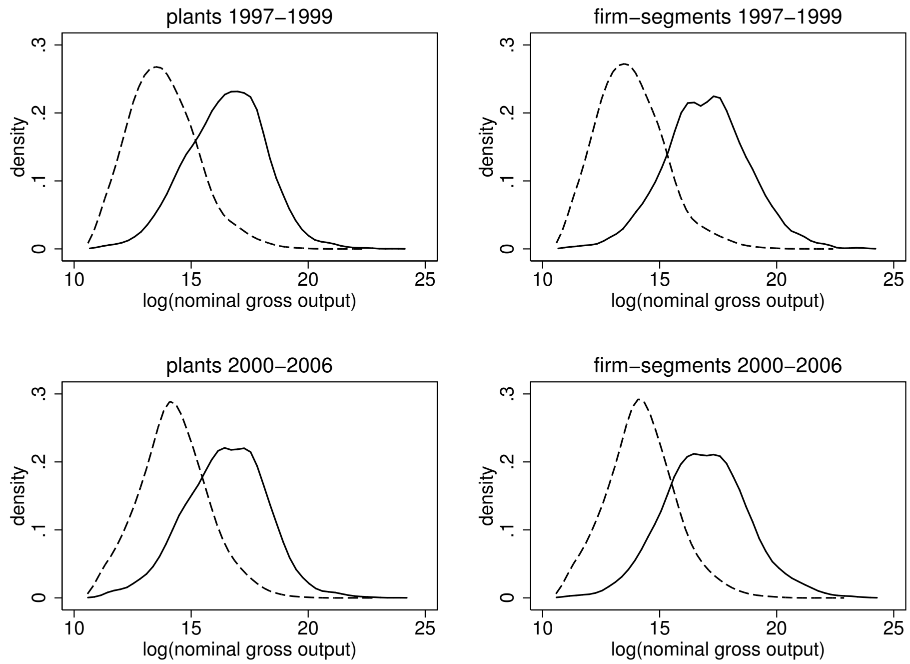
3.3.1 Nominal output size measure

First, following the standard approach in the literature on firm size distributions, I measure the plant size by the logarithm of the nominal gross output. Nominal gross output is defined as the total value of shipments plus changes in inventories of goods in progress and finished goods.[8]

Figure 3.1 provides kernel density estimates of the size distribution for conglomerates and single-segment firms. In the left panels I draw the non-parametric estimates for the size distribution of plants and in the right panels I draw the estimates of the firm-segment size distribution.

Kernel density estimates clearly indicate that plants and firm-segments in conglomerates tend to be larger than those in single-segment firms. We see that the mass of the size distribution of conglomerate plants and firm-segments is shifted towards larger sizes, but it also has thicker tails. The Kolmogorov-Smirnov test also strongly rejects (p-value=0.0) the hypothesis of equality of distribution function estimates for both sub-periods and at both plant and firm-segment levels. Notice that the finding that conglomerated plants and firm-segments have on average larger size compared to their single-segment firms' counterparts is not trivial because a priori there is no reason for size differences at the plant or firm-segment level (as opposed to size differences at the firm level, where one

[8]An alternative would be to use value added as a measure of output. The distinction is important when aggregating plant-level data for analysis on more macro level, because plant value added can be summed up and compared to the aggregate industry output in the national accounts. However, when comparing size and productivity on the disaggregated plant level it should not matter much whether one uses gross output or value added. Indeed, I have redone the analysis using value added for measuring size and the results (unreported) are qualitatively unchanged and quantitatively very close.



Kernel : Epanechnikov, bandwith : 0.25

Figure 3.1 – Nominal gross output size distributions ; conglomerates - solid line, single-segment firms - dashed line

would clearly expect conglomerate firms to be larger because they operate in several industries).

Comparison of nominal output size distributions is convenient but it is subject to two potential concerns stemming from possible concentration of conglomerates in specific industries. First, one might be worried about the effects of variation in output prices across industries. If conglomerates dominate industries with relatively higher output prices, then the difference in the average nominal output in conglomerates and the average nominal output in single-segment firms picks up these price differences. Consequently, some researchers might like better to compare distributions of size expressed in real terms. Second, one might be worried about higher selection of plants into conglomerates in industries with high minimal size requirements. It is easy to imagine that conglomerates are predominant in industries in which it is difficult or impossible to operate plants at a small scale (think for example of Motor Vehicle Manufacturing ; Pulp, Paper and Paperboard Mills ; Alumina and Aluminum Production and Processing ; Iron and Steel Mills and Ferro-Alloy Manufacturing ; or Railroad Rolling Stock Manufacturing). Then the difference between the size distribution of plants in conglomerates and the size distribution of plants in single-segment firms will reflect high prevalence of conglomerates in these industries with large minimum scale of operation. Next two subsections address these concerns.

3.3.2 Employment size measure

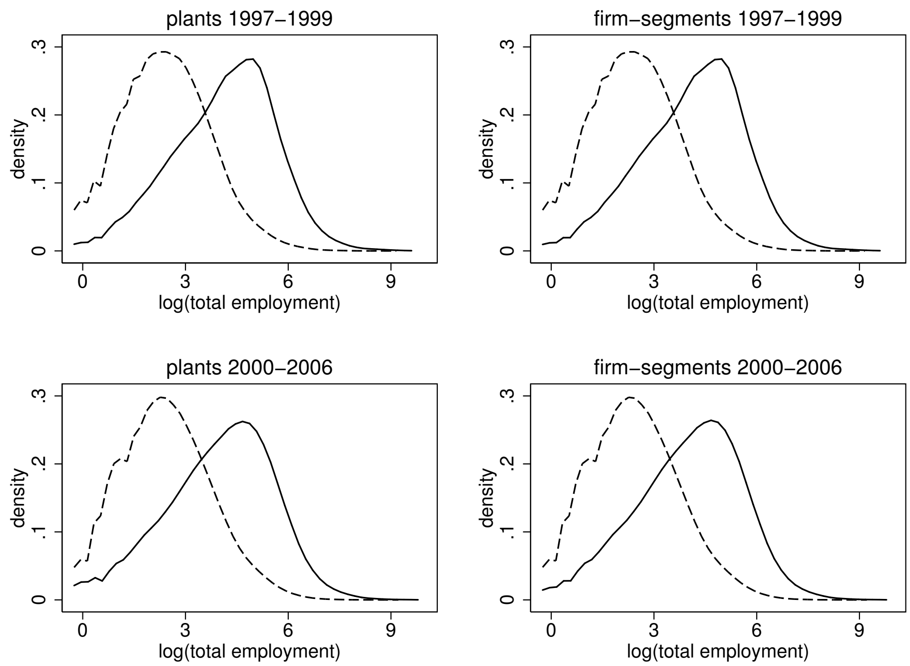
Using employment to measure establishment size has the advantage of not being subject to cross-industry variation of output prices. Moreover, it is interesting to see whether the evidence on size differences between conglomerate and single-segment plants obtained from measuring production output can be validated by looking at the input side of the production process.

Looking at Figure 3.2, we see that the difference in size of conglomerate and single-segment plants is even more marked when looking at employment. The shape of the estimated kernel densities differs substantially with the size distribution of single-segment plants (firm-segments) being skewed to the right and that of conglomerate plants (firm-segments) to the left.

3.3.3 Relative size measures

Conglomerates might be predominant in industries in which the minimum size of operation is high. If, on the other hand, single-segment firms are more concentrated in industries in which the minimum scale of operation is lower, and if we do not control for this selection, the difference between the size distributions of plants in conglomerates and in single-segment firms might arise solely because of this composition effect.[9] The

[9]Notice, however, that this does not mean that the evidence presented above is unimportant or uninteresting. For example, this evidence could help us understand mechanisms that lead to the selection of



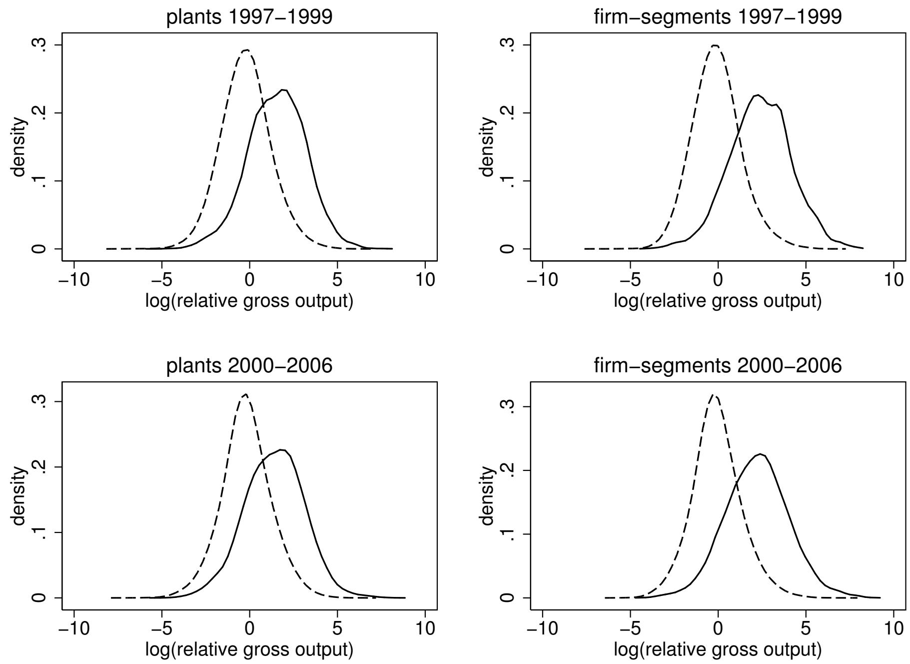
Kernel : Epanechnikov, bandwidth : 0.25

Figure 3.2 – Total employment size distributions ; conglomerates - solid line, single-segment firms - dashed line

problem is that when size is measured by nominal output or employment, we attempt to compare the "absolute" size of an airplane-assembly plant in a large conglomerate to the "absolute" size of a local leather manufacturer. This comparison across such different industries may seem inappropriate. It is therefore interesting to consider an approach that would control for industry-specific characteristics and allow us to compare the size of these establishments in more "relative" terms.

To do this, I consider relative size measures, defined as the ratio of plants size to the industry median size. Relative size measures have several advantages. Being a ratio they are unitless, which may address the problem of cross-industry heterogeneity in output prices. Moreover, they can be interpreted as the rank, in terms of a given size variable, of a plant within its own industry. Therefore, relative production size measures take in

conglomerates into high minimal-size industries, which is an interesting research topic on its own.



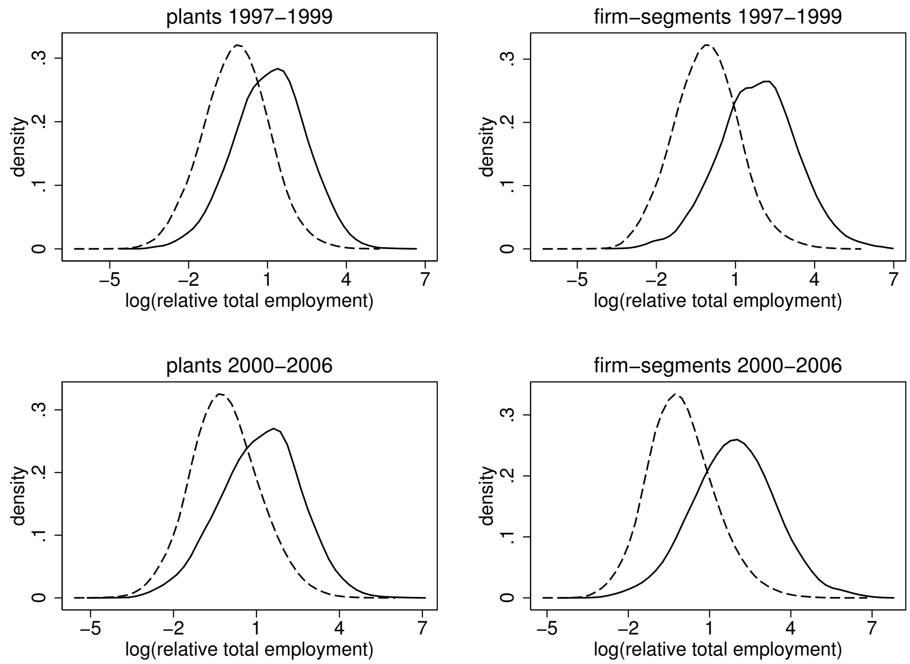
Kernel : Epanechnikov, bandwith : 0.25

Figure 3.3 – Relative gross output size distributions ; conglomerates - solid line, single-segment firms - dashed line

account the industry-specific characteristics such as the minimum scale of operation. This addresses the problem of possible selection of conglomerates into some specific industries, because now we can compare the size in different industries on a relative basis.[10]

Figure 3.3 presents kernel density estimates of the distribution of the logarithm of the relative gross output. The relative gross output is defined as the ratio of the nominal gross output to the industry median nominal gross output. Estimates of the relative gross output size distribution reveal once again sizable differences between the size distributions for conglomerates and the size distributions for single-segment firms. As was the case with nominal output and employment, the mass of the size distribution of conglomerate

[10]Maksimovic and Phillips (2002)used this the relative gross output size measure to compare growth of firm-segments in conglomerates to the growth of size of single-segment firms.



Kernel : Epanechnikov, bandwidth : 0.25

Figure 3.4 – Relative total employment size distributions ; conglomerates - solid line, single-segment firms - dashed line

plants and firm-segments is shifted towards larger sizes, but it has also thicker tails. The Kolmogorov-Smirnov test rejects the hypothesis of equality of the two distributions at the 5 percent level (p-value=0.0) for plants as well as firm-segments in all sub-sample periods. Figure 3.4 shows that the results are similar when looking at the relative total employment size, which is defined in analogous way.

On average plants and firm-segments in conglomerates have larger relative size than plants and firm-segments in single-segment firms. This finding is important. Because the relative size measures control for cross-industry variation in output prices as well as for cross-industry minimum scale of operation differences, the result tells us that conglomerates operate plants and firm-segments that are relatively larger even with respect to other plants *within their own industry*. For example, a plant of a conglomerate that produces household appliances is larger than a plant of a single-segment firms that is specialized in production of household appliances. Moreover, the comparison of relative production size makes sense even across industries : a conglomerated plant that produces locomotives has higher size rank among all plants in the Railroad Rolling Stock Manufacturing industry than the local leather manufacturer's plant size rank among all plants in the Leather Manufacturing industry.

These findings suggest that there are additional factors, other than higher selection of plants into conglomerates in specific industries, that explain the patterns in the size distributions of plants and firm-segments in conglomerates and single-segment firms. One such factor could be the internal reallocation of resources inside conglomerates. An interesting and long literature has asked whether the conglomerates allocate the resource efficiently among their divisions and what are the effects of this internal reallocation on firm valuation (Gomes and Livdan, 2004, Maksimovic and Phillips, 2002, Schoar, 2002) , conditions on the external markets, and more broadly the overall industry-wide or economy-wide allocative efficiency (Almeida and Wolfenzon, 2006a). In my view, the first and crucial element to answer these interesting questions is to examine carefully the relationship between plant size, productivity and the organizational structure of the firm. In section 3.4 I provide some new evidence on this relationship.

3.3.4 Average size differences - robustness checks and some details

In this section I check the robustness of my finding that plants and firm-segments in conglomerates are on average larger than plants in single-segment firms using a regression analysis. I also examine whether the differences in size of firm-segments come mostly from the extensive margin (more plants in each firm-segment in conglomerate firms) or from the intensive margin (plants that are larger in conglomerate firms).

As mentioned above, the limitation of the non-parametric kernel density estimation approach is the impossibility to control for a lot of year, industry, firm, and plant characteristics. Therefore, to check the robustness of my results I run regressions of plant size on measures of diversification and a set of controls.

Table 3.II – Regressions of plant size

	(1)	(2)	(3)	(4)
Diversification dummy	1.902*** (0.008)	1.931*** (0.009)	1.727*** (0.012)	1.756*** (0.017)
Nbr. segments			0.101*** (0.004)	
Employment Herfindahl				0.403*** (0.039)
Plant age	0.072*** (0.001)	0.065*** (0.001)	0.065*** (0.001)	0.062*** (0.001)
Industry dummies	yes	yes	yes	yes
Year dummies	no	yes	yes	yes
R^2	0.372	0.383	0.384	0.372
Nbr. observations	248,319	248,319	248,319	234,282

The dependent variable is logarithm of gross nominal output. Gross nominal output is the total value of shipments plus changes in inventories of goods in progress and finished goods measures at the plant level. Diversification dummy is equal to one if the firm has more than one 4-digit NAICS firm-segment. Nbr. segments is equal to the number of 4-digit NAICS firm-segments including those outside manufacturing industries. Employment Herfindahl is employment-weighted measure of diversification. Age is the number of years since the plant has been included in the ASM sample for the first time. Industry dummies are constructed on the 4-digit NAICS level. Robust standard errors are in parentheses. ⋆⋆⋆, ⋆⋆, and ⋆ indicates statistical significance at the 1, 5, and 10 percent level.

Columns (1) and (2) in Table 3.II show that the coefficient on diversification dummy is positive and statistically significant when controlling for plant age, which is proxied by the number of years since the plant has been included in the ASM sample, industry fixed effects, and year dummies. The results show that plants in conglomerates are on average almost twice as large as plants in single-segment firms and this even when comparing within a given age class, 4-digit NAICS industry, and year.

In columns (3) and (4) I follow Schoar (2002) and I include alternative measures of diversification, which allow to take in account not only classification of plants into single-segment and conglomerate firms but also the actual degree of diversification of the firms. These measures are the number of firm-segments on the 4-digit NAICS level and a Herfidahl-based measure of diversification, which is equal to one minus a Herfindahl index for the firm's segments employment. I still include the diversification dummy in the regression. This allows me to distinguish the impact on plant size of being in a single-segment firm or a conglomerate and the impact of increasing the diversification of an already conglomerate firm. The coefficients on the degree of diversification are much lower in magnitude that on the simple diversification dummy, but they are statistically and economically significant. Clearly, the largest part of differences in average plant size comes from differences between single-segment firms and diversified firms. On the other hand, a unit difference in the number of firm-segments among diversified firms is on average associated with a ten percent difference in the plant size.

I have repeated the analysis at the firm-segment level and the results are qualitatively unchanged. Particularly I find that firm-segments in conglomerates are on average twice as large as single-segment firms. The firm-segments in more diversified conglomerates also tend to be larger than those in less diversified conglomerates. I have also done robustness checks using alternative measures of size such as employment, value added, and relative size measures. The results are robust to these changes.

In Table 3.III I examine whether the difference in firm-segment size comes mostly from extensive margin (firm-segments in conglomerates having more plants than single-segment firms) or from intensive margin (plants in the conglomerate firm-segments are larger than plants in single-segment firms). This information is important when we want to compare the results from previous studies, because some of them were done at the firm-segment level (Maksimovic and Phillips, 2002) and others at the plant level (Schoar, 2002). One may be worried that a strong composition effect at the firm-segment level might make the results of these studies incomparable. We already know from previous paragraphs that there are differences in the plant size in conglomerates and single-segment firms. Therefore, the intensive margin seems to be important. Table 3.III shows that there are also differences along the extensive margin, although they seem to be less important than those along the intensive margin. Comparing an average single-segment firm to an average conglomerate, which in my sample has three firm-segments, implies roughly a factor 2.2 increase in the average number of plants per segment, but the difference in the average relative output per plant is of factor 7.7. Sure, the variance of the average output per plant is larger than that of average number of plants per firm-segment, but it still appears that the largest bulk of firm-segment size differences comes

Table 3.III – Extensive vs. intensive margin of firm-segment size differences

	all years (1997 - 2006)					
	Nbr. of plants per segment			Relative output per plant		
Total nbr. of segments in firm	mean	sd	nbr. obs.	mean	sd	nbr. obs
1	1.04	0.35	193,869	2.45	9.12	202,491
2	1.83	2.88	13,629	15.84	65.13	24,965
3	2.32	3.58	4,184	18.96	82.58	9,725
4	2.48	4.36	1,586	32.68	163.67	3,942
5	2.69	3.34	915	23.98	101.91	2,470
6	4.23	11.51	511	12.81	21.75	2,161
7 and more	3.37	8.49	761	16.07	31.78	2,565

Segments are defined at the 4-digit NAICS level. All statistics are computed from 1997-2006 pooled data. Mean relative output per plant is simple arithmetic average of relative output across plants in all firms with a given number or segments. Relative output is the ratio of plant's nominal output to the median nominal output in its industry.

from differences in the plant size and not from differences in the number of plants in each segment. Therefore, if we want to compare the relation between size and productivity across conglomerates and single-segment firms, the results should be qualitatively similar if we are doing the analysis at the plant level or at the firm-segment level, provided that the firm-segment aggregation reflects correctly productivity and size at the plant level.

3.4 Conglomeration and productivity

In this section I explore the relationship between size and productivity.

3.4.1 Productivity estimation

I estimate total factor productivity at the plant level using a Cobb-Douglas production functions. I use two alternative measures of output : gross output defined as deflated value of shipments plus changes in inventories of goods in process and final goods, and deflated value added. In case of gross output I assume the production function is

$$y_{ijt} = \alpha_j k_{ijt} + \beta_j l_{ijt} + \gamma_j m_{ijt} + \varepsilon_{ijt},$$

where y_{ijt} is the logarithm of gross output of plant i in industry j and year t, and k_{ijt}, l_{ijt}, and m_{ijt} are the logarithms of inputs of capital services, labor services, and materials of that plant in the given industry and year. Similarly, in case of value added I assume a production function of the form

$$y_{ijt} = \alpha_j k_{ijt} + \beta_j l_{ijt} + \varepsilon_{ijt},$$

where y_{ijt} now stands for the logarithm of deflated plant-level value added.

To correct for the simultaneity bias that arises from endogenous response of inputs to productivity changes I use the methodology first developed by Olley and Pakes (1996). The underlying idea is to use plant-level investment as a proxy for unobservable productivity shocks. Since I do not have information on plant-level investment in my data set, I use the extension of this method proposed by Levinsohn and Petrin (2003), who showed how to use intermediate inputs instead of investment for controlling for unobservable productivity shocks. The inputs are divided into freely variable (labor) and the state variable (capital). The error term ε_{ijt} is assumed to be additively separable in a transmitted productivity component ω_{ijt}, which impacts the plant's decision rules, and an i.i.d. component η_{ijt}. Levinsohn and Petrin (2003) assume that the demand for intermediate inputs m_{ijt} depends on the plant's state variable k_{ijt} and the transmitted productivity ω_{ijt}. Under the assumption that the intermediate inputs demand is monotone in ω_{ijt}, the intermediate inputs demand function can be inverted, which allows to write the transmitted productivity component as a function of k_{ijt} and m_{ijt} only : $\omega_{ijt} = \phi\left(k_{ijt}, m_{ijt}\right)$. In the first stage of the estimation procedure, the function $\phi\left(k_{ijt}, m_{ijt}\right)$ is approximated by a third-order polynomial in k_{ijt} and m_{ijt} and a consistent estimate $\hat{\beta}_j$ is obtained from regressing the output on l_{ijt} and the polynomial approximation of $\phi\left(k_{ijt}, m_{ijt}\right)$. In the second stage, the estimates of α_j and γ_j, are obtained by GMM.[11] Additional identifying assumptions that ω_{ijt} follows a first-order Markov process and that the state variable (capital) and the past intermediate input demand do not respond to innovations in productivity over the last period expectation are necessary. The first assumption allows to obtain a consistent estimate of $E\left[\omega_{ijt}|\omega_{ijt-1}\right]$ from the first-stage residuals and compute the residual for α_j, γ_j as

$$\widehat{\eta_{ijt}+\xi_{ijt}} = y_{ijt} - \hat{\beta}_l l_{ijt} - \alpha_j k_{ijt} - \gamma_j m_{ijt} - E\left[\widehat{\omega_{ijt}|\omega_{ijt-1}}\right],$$

where ξ_{ijt} denotes the innovations in productivity over the last period expectation. The second assumption defines two moment conditions $E\left[\eta_{ijt}+\xi_{ijt}|k_{ijt}\right] = 0$ and $E\left[\eta_{ijt}+\xi_{ijt}|m_{ijt-1}\right] = 0$, which allow to estimate $\hat{\alpha}_j$ and $\hat{\gamma}_j$ as the solution to :

$$\min_{\alpha_j,\gamma_j} \sum_h \left[\sum_t \sum_i \left(\widehat{\eta_{ijt}+\xi_{ijt}} \right) \mathbf{Z}_{hijt} \right],$$

where $\mathbf{Z}_{ijt} = \left(k_{ijt}, m_{ijt-1}\right)$ and h is indexing the elements of $\mathbf{Z}_{ijt}$. The method is implemented in the Stata command `lp` by Petrin et al. (2003). With the estimates of coefficients on inputs in hand, I calculate the plant-level total factor productivity as the residual from the corresponding log-linearized production function.

The measures of output and inputs are obtained directly from the ASM data. Gross nominal output and value added are deflated by the respective 4-digit NAICS industry price indices obtained from the Statistics Canada CANSIM database. The labor input is the total number of workers in the plant.[12] Unfortunately, ASM does not provide information on capital stocks or investment. To overcome this difficulty, I follow Burnside et al. (2005) and use data on energy expenditures to proxy for capital utilization. Particularly, I assume that capital services vary in proportion with energy use.[13] I therefore

[11] In case of estimating value-added production function the second-stage estimation step is modified accordingly.

[12] I re-estimated TFP using only the number of production workers as the labor input. I also re-estimated TFP using the total wage bill to proxy for possible differences in use of skilled labor across plants. All results are qualitatively robust to these changes.

[13] This imposes an assumption on the form of the production function. Particularly, the elasticity of

replace the input of capital services by energy expenditures deflated by industrial energy price index obtained from the CANSIM database. The materials input is given by the total material costs minus changes in inventories of materials deflated by the price index for materials.

3.4.2 Productivity differences across conglomerates and single-segment firms

My empirical strategy to examine productivity differences of plants across conglomerates and single-segment firms is to regress plant-level TFP on a measures of corporate diversification and a set of controls. Because the coefficients in the production function were estimated separately for each 4-digit NAICS industry, the estimated TFP includes industry-specific factors in addition to plant-specific differences. Since I want to compare the productivity of plants that operate in many different industries, I need to control for the variation of TFP that is due to these industry-specific factors. I therefore include industry dummies in all regressions of plant TFP.[14] I also control for plant age as well as for year-specific factors such as fluctuations in the aggregate level of productivity by including year dummies.

Table 3.IV presents the results using gross-output TFP as the dependent variable. The coefficient on the conglomeration dummy in column (1) shows that conglomerated plants are on average 15 percent more productive than plants in the single-segment firms. Columns (2) to (3) show that a large part (around nine percentage points) can be attributed just to the fact of being diversified. Subsequently, the differences in the degree of diversification have an additional positive impact on plants' measured TFP. However, based solely on these results, it is hard to conclude that diversification creates value, because we cannot distinguish whether diversification raises the productivity or whether more productive plants are simply more likely to select into conglomerates. Moreover,

capital services with respect to energy use has to be equal to unity.

[14] An alternative strategy would be to subtract industry average TFP from the plant-level TFP estimates and then use this relative TFP measure as dependent variable in my regressions. This approach is less flexible if one wants to include any additional control variables, and yields results that are qualitatively the same and quantitatively very close to those presented in the text.

Table 3.IV – TFP regressions - gross output productivity

	(1)	(2)	(3)	(4)	(5)	(6)
Diversification dummy	0.153*** (0.003)	0.087*** (0.004)	0.092*** (0.006)	−0.011*** (0.003)	−0.059*** (0.004)	−0.056*** (0.006)
Nbr. segments		0.032*** (0.001)			0.024*** (0.001)	
Employment Herfindahl			0.190*** (0.013)			0.156*** (0.013)
Log(relative gross output)				0.088*** (0.001)	0.088*** (0.001)	0.087*** (0.001)
Plant age	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	−0.002*** (0.000)	−0.002*** (0.000)	−0.002*** (0.000)
Industry dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
R^2	0.955	0.955	0.955	0.958	0.958	0.959
Nbr. observations	229,739	229,739	216,839	229,739	229,739	216,839

The dependent variable is the estimated gross-output TFP obtained as the residual from estimation of a Cobb-Douglas production function using the Levinsohn and Petrin (2003) procedure. Relative gross output the ratio of plant's total value of shipments plus changes in inventories of goods in progress and finished goods to the industry median total value of shipments plus changes in inventories of goods in progress and finished goods. Diversification dummy is equal to one if the firm has more than one 4-digit NAICS firm-segment. Nbr. segments is equal to the number of 4-digit NAICS firm-segments including those outside manufacturing industries. Employment Herfindahl is employment-weighted measure of diversification. Age is the number of years since the plant has been included in the ASM sample for the first time. Industry dummies are constructed on the 4-digit NAICS level. Robust standard errors are in parentheses. $\star\star\star$, $\star\star$, and $\star$ indicates statistical significance at the 1, 5, and 10 percent level.

these regressions on their own do not say anything about the efficiency of resource allocation inside conglomerates.

One might think that there may be a problem in the comparison of the productivity of plants across conglomerates and single-segment firms because, as shown in Section 3.3, plants in conglomerates tend to be larger. In columns (4) to (6) I repeat the analysis adding a control for relative production size of the plant. Interestingly, the coefficient on conglomeration dummy becomes negative and statistically significant. Plants that are in conglomerates are on average one percent less productive than plants of the same size in the single-segment firms. Columns (5) and (6) show that it is the fact of being diversified that has quantitatively significant negative effect (a productivity discount around six percent), but the actual degree of diversification still has a positive effect on TFP. This result may seem to justify the conglomeration discount often found in the stock market valuation data (Berger and Ofek, 1995), but we will later see that it is compatible with efficient allocation of resources among divisions of a conglomerate.

Table 3.V – TFP regressions - value added productivity

	(1)	(2)	(3)	(4)	(5)	(6)
Diversification dummy	0.618*** (0.004)	0.537*** (0.006)	0.524*** (0.009)	−0.026*** (0.004)	−0.044*** (0.005)	−0.061*** (0.006)
Nbr. segments		0.040*** (0.002)			0.009*** (0.002)	
Employment Herfindahl			0.263*** (0.021)			0.135*** (0.014)
Log(relative value added)				0.352*** (0.001)	0.351*** (0.001)	0.348*** (0.001)
Plant age	0.016*** (0.000)	0.016*** (0.000)	0.015*** (0.000)	−0.004*** (0.000)	−0.004*** (0.000)	−0.004*** (0.000)
Industry dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
R^2	0.572	0.572	0.573	0.807	0.807	0.807
Nbr. observations	226,435	226,435	213,836	226,435	226,435	213,836

The dependent variable is the estimated value-added TFP obtained as the residual from estimation of a Cobb-Douglas production function using the Levinsohn and Petrin (2003) procedure. Relative value added is the ratio of plant's value added to the industry median value added. Diversification dummy is equal to one if the firm has more than one 4-digit NAICS firm-segment. Nbr. segments is equal to the number of 4-digit NAICS firm-segments including those outside manufacturing industries. Employment Herfindahl is employment-weighted measure of diversification. Age is the number of years since the plant has been included in the ASM sample for the first time. Industry dummies are constructed on the 4-digit NAICS level. Robust standard errors are in parentheses. ⋆⋆⋆, ⋆⋆, and ⋆ indicates statistical significance at the 1, 5, and 10 percent level.

The results are robust to using TFP estimated from value added production function instead of gross output production function as the dependent variable. Actually, Table 3.V shows that in the value-added case the reversion of the relationship between conglomeration and productivity conditional on plant size becomes even more striking, going from a 61 percent productivity premium to a three percent productivity discount for the plants in conglomerates.

While the reversion of the relationship between productivity and conglomeration once we control for plant size may seem puzzling, the results are actually in line with what suggested some previous studies. Schoar (2002) looked at plants' gross-revenue productivity in US manufacturing controlling for the number of plants in the plant's firm-segment and firm, but not controlling for plant's size. She found a seven percent productivity premium for diversified firms. On the other hand, Maksimovic and Phillips (2002), working with a similar data set, found that conditional on being in a given size class, the firm-segments in conglomerates tend to be less productive than single-segment firms. However, none of previous studies compared these two findings and tried to reconcile them within a unified econometric framework and using the same observations.

3.4.3 Explaining the Productivity Differences

How could we explain the two seemingly contradictory findings, and how they relate to the corporate finance literature on conglomeration discount in stock valuation ? Could we say anything about the impact of conglomeration on aggregate efficiency ?

In the second chapter of this thesis, I showed that a simple theory of efficient internal reallocation of resources inside conglomerates that allows for endogenous selection of plants into conglomerates can reconcile the two findings. In presence of frictions that hinder efficient allocation of resources through external markets, conglomeration may serve as a device that helps achieve allocative efficiency through internal transfers inside conglomerates (Stein, 1997). In that case, conglomerates will channel resources towards most productive plants more aggressively than external markets. This has two testable implications that I will show to be consistent with my empirical findings. First, highly productive plants should be more likely to select into conglomerates, since the gain from internal reallocation of resources towards these plants is likely to be high. Hence, due to this selection, the average productivity of plants in conglomerates should be higher than that of plants in single-segment firms, which is consistent with the unconditional productivity premium for conglomerated plants. Second, a highly productive plant should be more likely operated on a large size if it is a part of a conglomerate than if it is a part of a single-segment firm. This is a simple consequence of the fact that the reallocation possibilities are larger in a diversified conglomerate than in a narrowly focused firm and therefore the amount of resources that could be transferred towards the highly productive plant is likely to be higher. Then, if we look at the cross-sectional distribution of TFP by given size classes, we should find the following. On one hand, in small-size classes, there should be a *lower* number of high-TFP plants in conglomerates than in single-segment firms. On the other hand, in large-size classes there should be a *higher* number of high-TFP plants in conglomerates than in single-segment firms. I now look at the relative TFP distribution in two representative size classes to verify whether the data support these predictions.

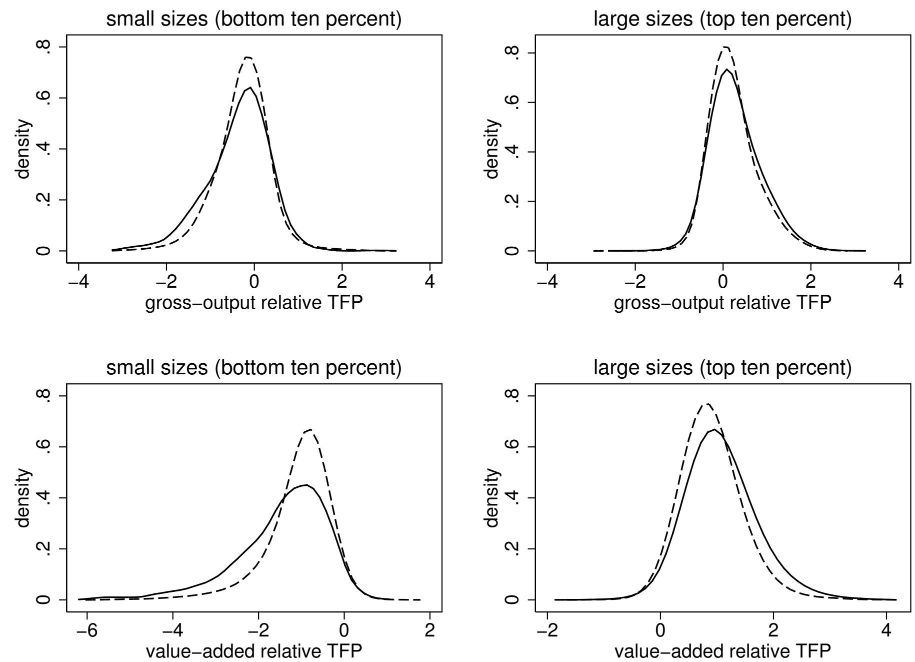
In order to allow a comparison of TFP across plants in different industries and years I construct the relative TFP measure as

$$RTFP_{ijt} = TFP_{ijt} - TFP_{ijt}^{pred},$$

where TFP_{ijt} is the TFP estimated from the production function and TFP_{ijt}^{pred} is the adjusted linear prediction of TFP from the regression of TFP on diversification dummy, relative plant size, plant age, and plant industry and year dummies. The prediction is adjusted by setting the values of the diversification dummy and of the relative plant size to the sample averages of these variables. The relative TFP measure can be interpreted as the rank of the plant in terms of TFP relative to the average TFP in its industry in a given year.

Figure 3.5 presents non-parametric kernel density estimates of the cross-sectional distribution of relative TFP in two representative size classes. The left panels correspond to a small-size class with plants whose relative gross output or relative value added is in the first decile of the relative size distribution. The right panels correspond to a large-size class in which plants have relative gross output or relative value added in the last decile of the relative size distribution. The estimation results show exactly what the theory of efficient internal reallocation suggested. In the small-size class, there is a larger mass of low-TFP plants in conglomerates than in single-segment firms. In the large-size class the relation goes the other way around. The support of theory's predictions is remarkably strong when looking at value-added TFP, however Kolmogorov-Smirnoff tests reject equality of distribution functions at the one percent level even for distributions of gross-output TFP.

To relate these results back to the productivity discount for conglomerated plants



Kernel : Epanechnikov, bandwidth : 0.25

Figure 3.5 – Relative TFP distributions conditional on plant size ; conglomerates - solid line, single-segment firms - dashed line

conditional on plant size, notice that the number of small-size plants is much higher than the number of large-size plants.[15] Due to the larger number of small-size plants, in the regression of the plant TFP the effect of conglomeration in small-size classes dominates, which leads to a negative coefficient on the conglomeration dummy and a finding of a productivity discount for conglomerated plants.

[15]This is true in general. In my sample, which I believe represents well the population of Canadian manufacturing plants, the size distribution is close to a log-normal distribution. However, other studies that used more complete samples encompassing also establishments in industries outside manufacturing showed that the size distribution tends to be close to a Pareto distribution (Axtell, 2001, Rossi-Hansberg and Wright, 2007). In that case the number of small-size establishments will also be higher than the number of large-size establishments.

3.5 Concluding Remarks

In this paper I provided a new empirical evidence on size and productivity of conglomerates and single-segment firms. The main findings are that (i) plants and firm-segments in conglomerates tend to be much larger than in single-segment firms, (ii) unconditionally on plant size, plants in conglomerates have on average higher TFP than plants in single-segment firms, and (iii) this relation is reversed if we control for plant size. Examining the data in more detail I argued that the empirical findings are compatible with more efficient allocation of resources inside conglomerates than on external markets with frictions.

There are several extensions to current work that are interesting and that I envisage to explore. First, an additional tests of the theory of efficient internal reallocation could be done by examining whether conglomerates tend to be more present in industries that are more financially dependent or in industries that are more contract-specific. Second, detailed Input-Output tables could be used to gauge vertical relatedness of industries in which a given conglomerate firm operates. Then, combining the data on size and productivity with the vertical relatedness measure would inform us on whether the internal reallocation tends to operate through production-chaining or whether most of it goes through simple transfers of resources across horizontally diversified divisions. Last, it would be interesting to examine dynamic implications of internal reallocation of resources for size and productivity for a given plant. Effectively, the paper by Schoar (2002) indicates that the dynamic effects of diversification can be quite different from implication in a cross-section of plants.

CONCLUSION GÉNÉRALE

La littérature macro-économique récente a reconnu l'importance des frictions financières qui interviennent au niveau micro-économique pour le comportement des variables macro-économiques. Cependant, il reste toujours un éventail de questions à répondre concernant les effets agrégés des frictions financières. Dans cette thèse, nous avons abordé deux thèmes. Qu'est-ce qui détermine la sévérité des frictions financières ? Comment les frictions financières influencent-elles l'organisation du secteur productif du pays ? Nous avons essayé de répondre à ces questions tout en suivant l'approche moderne en macro-économie, qui met l'accent sur les liens entre les décisions micro-économiques des agents et les implications pour les variables macro-économiques.

Dans le premier essai, nous avons présenté un modèle qui explique comment le niveau de protection des investisseurs est déterminé par un processus politique. L'idée principale est qu'une faible protection des investisseurs agit comme une barrière à l'entrée des agents avec des besoins de financement externe élevés dans l'entrepreneuriat. Les entrepreneurs avec des besoins de financement externe faibles favorisent un niveau faible de protection des investisseurs, car cela augmente le prix du bien produit par le secteur entrepreneurial et par le même biais leurs profits. Le niveau de protection des investisseurs sélectionné par un vote majoritaire est inversement relié à l'inégalité en besoins de financement externe parmi les entrepreneurs. Ce résultat peux expliquer pourquoi nous observons une faible protection des investisseurs dans des pays avec forte inégalité de richesse ou dans des pays où la corruption provoque un traitement inégal des entrepreneurs.

Le deuxième essai a considéré le rôle des conglomérats dans une économie avec frictions financières. Nous avons montré qu'un modèle où les conglomérats permettent d'éviter partiellement les frictions sur le marché du crédit, peut expliquer plusieurs faits stylisés concernant la taille et la productivité des établissement. Notre étude a suggéré que les conglomérats peuvent avoir des effets positifs sur le développement économique via une amélioration de l'allocation du capital vers les projets plus productifs.

Dans le troisième essai nous avons présenté une nouvelle évidence empirique concernant la distribution de la taille des établissements et leur productivité totale des facteurs. Nos estimations à partir des micro-données sur les établissements du secteur manufacturier canadien ont montré que les établissements qui font partie des conglomérats sont plus larges que ceux dans les firmes non-diversifiées. Concernant la productivité, les établissements dans les conglomérats semblent être en moyenne plus productifs que leurs contreparties dans les firmes non-diversifiées, mais cette relation est inversée si nous contrôlons pour la taille de l'établissement. En examinant les données plus en détail, nous avons avancé que ces résultas sont compatibles avec une meilleure allocation des ressources dans les conglomérats que dans les firmes non-diversifiées.

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Annexe I

Appendices to Chapter 1

I.1 Lemmas and Proofs

Lemma 7. *Under any policy* $\gamma_t \geq \gamma^H$*, with* $\gamma^H \equiv \frac{1-\pi}{\pi}(\kappa_H - \kappa_L)$*, only types* $z \leq \underline{z}_t$ *obtain external financing.*

Proof. Recall that from constraints (1.3) and (1.4) the auditing probability for any type $z \leq \underline{z}_t$ must satisfy $p_{Lt}(z) = \frac{[x(z)-w_t]r - q_{t+1}\kappa_L}{(1-\pi)q_{t+1}(\kappa_H-\kappa_L) - \pi q_{t+1}\gamma_t}$. Then as $\gamma_t \to \gamma^{H-}$ constraint (1.3) implies $p_{Lt}(z) \to \infty$, which contradicts the feasibility constraint $p_{Lt}(z) \leq 1$. On the other hand, if $\gamma_t > \gamma^H$ then constraint (1.3) implies $p_{Lt}(z) < 0$, which contradicts the feasibility constraint $p_{Lt}(z) \geq 0$. Thus, for any level of investor protection $\gamma_t \geq \gamma^H$ types $z > \underline{z}_t$ have no access to external finance. The set of entrepreneurs under any policy $\gamma_t \geq \gamma^H$ is therefore $\Omega_t = \left\{z \in [0,1] : z \leq \underline{z}_t\right\}$ leading to the same capital supply. As the capital demand is independent of γ_t, the equilibrium prices and allocations are the same under any $\gamma_t \geq \gamma^H$. □

Lemma 8. *For given* γ_t *and* w_t*, the measure of entrepreneurs and the capital supply are increasing in the price of capital* q_{t+1}*.*

Proof. Applying the implicit function theorem on equation (1.7), we find

$$\frac{dz_t^\star}{dq_{t+1}} = \begin{cases} \frac{\kappa}{x'(z)} & \text{if } z_t^\star \leq \underline{z}_t, \\ \frac{\kappa - \pi\gamma_t}{x'(z)} & \text{if } z_t^\star > \underline{z}_t, \end{cases}$$

which is always positive. Then differentiating the capital supply $K_{t+1}^S = \kappa G(z_t^\star)$ with respect to q_{t+1} we obtain $\frac{dK_t^s}{dq_{t+1}} = \kappa \frac{\partial G(z)}{\partial z} \frac{dz_t^\star}{dq_{t+1}}$, which is positive. □

Proof of Lemma 3. From definitions of q and $\overline{q}(\gamma)$ and because wages will never be higher than $F_2(\kappa,1)$, it follows that if $x(1) > \frac{\kappa F_2(\kappa,1)}{(1-\pi)(\kappa_H-\kappa_L)}$ then $\bar{q}(0) > \underline{q}$. The same lower bound on $x(1)$ also ensures that $\overline{q}'(.) > 0$ so that $\overline{q}(\gamma) > \underline{q}$ for any feasible policy γ. Define $\underline{z}_t\big|_q$ by the following equation $x\left(\underline{z}_t\big|_q\right) = w_t + \frac{q}{r}\kappa_L$. That is, $\underline{z}_t\big|_q$ is the least efficient financially unconstrained type when the price is equal to q. Also, let $z_t^{\star}|_q$ denote the type that is indifferent between becoming entrepreneur and investing on the international market when the price is equal to q. Formally, $z_t^{\star}|_q$ is the value at which, for a given price q, $V_t^E\left(z_t^{\star}|_q\right) = V_t^I$. Then the cut-off prices $\underline{q}$ and $\overline{q}(\gamma)$ are such that $z_t^{\star}|_{\underline{q}} = \underline{z}_t\big|_{\underline{q}}$ under any feasible policy, and $z_t^{\star}|_{\overline{q}(\gamma)} = 1$ under the policy γ.

Now I can show how the capital supply changes when the investor protection moves from γ' to γ'', with $\gamma' < \gamma''$. Consider first the range of prices $\left(\underline{q},\overline{q}(\gamma'')\right)$. For any price q in this range we have $z_t^{\star}|_q > \underline{z}_t\big|_q$ under any γ and $z_t^{\star}|_q < 1$ under γ''. The agency problem arises for the indifferent type and the highest-cost type chooses to be an investor under γ''. Moreover, given any price q, $\frac{\partial V_t^E(z)}{\partial \gamma_t} < 0$ for all types $z > \underline{z}_t\big|_q$. Therefore, when γ_t increases, $z_t^{\star}|_q$ has to decrease in order to preserve equality in equation (1.7). Less agents decide to become entrepreneurs and the effect on the aggregate capital supply curve is negative.

Second, consider the range of prices $\left[0,\underline{q}\right]$. Any price q in this range implies $z_t^{\star}|_q \leq \underline{z}_t\big|_q$ under any γ. The type that is indifferent between becoming entrepreneur and investing abroad experiences zero auditing probability and the effect of changes in investor protection on his expected utility and on the capital supply is nil.

Finally, consider the range of prices $[\overline{q}(\gamma''),\infty)$. Any price q in this range implies $z_t^{\star}|_q \geq 1$ under γ'' and the highest-cost type is willing to become an entrepreneur under γ''. Thus, under γ'', capital supply is at its maximum level equal to κ. Since $\overline{q}(.)$ is increasing, the capital supply at price q is also equal to κ under any policy $\gamma' < \gamma''$ and the effect of change in policy from γ' to γ'' on the capital supply is nil. $\square$

I.2 The Role of the Shape of the Distribution

In this appendix I establish some results concerning the effects of distributional changes analytically and I discuss the effects of distributional changes on political equilibrium in more detail.

Lemma 9. *Consider two economies with distinct Beta start-up cost type distributions g and h with cumulative distribution functions $G(z)$ and $H(z)$. If :*

1. *g has thicker tails than h and the economies have the same first-best level of capital stock, or,*

2. *g has thicker tails than h and they have the same skewness, or,*

3. *h first order stochastically dominates (FOSD hereafter) g,*

then in economic equilibrium for any given level of investor protection $\gamma_t \in \left[0, \gamma^H\right]$ we have : $q_{t+1,g} \leq q_{t+1,h}, G_1\left(z^\star_{t,g}\right) \geq G_2\left(z^\star_{t,h}\right)$, and $z^\star_{t,g} \leq z^\star_{t,h}$.

Proof. Consider the capital supply curve under any given policy γ : $K^S_{t+1,i}(q_{t+1}) = \kappa G_i\left(z^\star_{t,i}\Big|^{\gamma}_{q_{t+1}} \right)$, where the subscript $i = g, h$ denotes the situation under the different distributions. $z^\star_{t,i}\Big|^{\gamma}_{q_{t+1}}$ is determined by $V^E_t\left(z^\star_{t,i}\Big|^{\gamma}_{q_{t+1}} \right) = V^I_t$. Notice that for a given (γ, q_{t+1}), neither $V^E_t(.)$ nor V^I_t depend on the shape of the distribution of start-up costs. Therefore $z^\star_{t,i}\Big|^{\gamma}_{q_{t+1}} = z^\star_t|^{\gamma}_{q_{t+1}}$ under both g and h. Moreover, $z^\star_t|^{\gamma}_{q_{t+1}}$ is increasing in q_{t+1} and decreasing in γ.

Notice that the definition 5 implies that if g has thicker tails than h, then there is a unique number x such that $0 < G(x) = H(x) < 1$. For any $z < x$ we have $G(z) \geq H(z)$ and for any $z > x$ we have $G(z) \leq H(z)$. Define a price $\tilde{q}(\gamma)$ such that $z^\star_t|^{\gamma}_{\tilde{q}(\gamma)} = x$. It follows that if condition 1 or condition 2 holds, then for any price in the range $(0, \tilde{q}(\gamma)]$ the capital supply under the distribution g is larger than under the distribution h, $\kappa G\left(z^\star_t|^{\gamma}_{q_{t+1}} \right) \geq \kappa H\left(z^\star_t|^{\gamma}_{q_{t+1}} \right)$.

If condition 3 holds, then the capital supply under the distribution g_1 is larger than under the distribution g_2 for any price q_{t+1}, because $\kappa G\left(z_t^{\star}|_{q_{t+1}}^{\gamma}\right) \geq \kappa H\left(z_t^{\star}|_{q_{t+1}}^{\gamma}\right)$ is implied by the definition of FOSD.

Now consider the capital demand curve. Because it depends solely on the marginal product of capital, it is the same under both distributions and it is strictly decreasing in q_{t+1}. Therefore, the capital market clears at a lower price and a higher quantity under the distribution g than under the distribution h, provided that equilibrium prices are in the interval $(0, \tilde{q}(\gamma)]$ if condition 1 or condition 2 holds. Therefore, in the equilibrium we have $q_{t+1,g} \leq q_{t+1,h}$ and $\kappa G\left(z_{t,g}^{\star}\right) \geq \kappa H\left(z_{t,h}^{\star}\right)$. Moreover, from monotonicity of $z_t^{\star}|_{q_{t+1}}^{\gamma}$ in q_{t+1} it follows that in equilibrium we also have $z_{t,g}^{\star} \leq z_{t,h}^{\star}$.

To complete the proof we must verify that the equilibrium prices under any policy γ are always in $(0, \tilde{q}(\gamma)]$ if condition 1 or condition 2 holds. Under condition 1 the equilibrium stock of capital under perfect investor protection is the same in the two economies, $\kappa G\left(z_g^{\star 0}\right) = \kappa H\left(z_h^{\star 0}\right)$. Therefore $q_g^0 = q_h^0 = \tilde{q}(0)$ and the number x is $x = z_g^{\star 0} = z_h^{\star 0}$. Under condition 2 the equilibrium capital stock under perfect investor protection is larger under distribution g than under h since there is more entrepreneurs that can produce capital good at lower start-up costs, $\kappa G\left(z_g^{\star 0}\right) > \kappa H\left(z_h^{\star 0}\right)$. Therefore, in that situation the number x is such that $x \geq z_h^{\star 0}$ and $\tilde{q}(0) \geq q_h^0 \geq q_g^0$. Given this and the monotonicity of $z_t^{\star}|_{q_{t+1}}^{\gamma}$ in γ and in q_{t+1}, we deduce that $\tilde{q}(\gamma)$ is increasing and for all γ we have $\tilde{q}(\gamma) \geq q_h^0 \geq q_g^0$. Now, remember that the capital supply is the same under distributions g and h at price $\tilde{q}(\gamma)$. Moreover, for any γ and under any distribution the capital supply at price $\tilde{q}(\gamma)$ is higher or equal than the equilibrium stock of capital under perfect investor protection, $\kappa G\left(z_t^{\star}|_{\tilde{q}(\gamma)}^{\gamma}\right) \geq \kappa G\left(z_g^{\star 0}\right)$ and $\kappa H\left(z_t^{\star}|_{\tilde{q}(\gamma)}^{\gamma}\right) \geq \kappa H\left(z_h^{\star 0}\right)$. Because q_h^0 and q_g^0 are equilibrium prices and the capital demand curve is decreasing, we have that at price $\tilde{q}(\gamma) \geq q_h^0 \geq q_g^0$ capital demand is lower than capital supply under both distributions, and therefore the equilibrium prices must be in $(0, q(\gamma)]$. $\square$

Lemma 10. *Consider two economies with distinct Beta start-up cost type distributions g and h with cumulative distribution functions $G(z)$ and $H(z)$. Let denote z_g^M and z_h^M the* *decisive voter types in the two economies respectively. If g has thicker tails than h and the economies have the same first-best level of capital stock, then he decisive voter z_g^M is relatively lower cost type than z_h^M, $z_g^M \leq z_h^M$.*

Proof. The identity of the decisive voter in each case is given by $G\left(z_g^M\right) = G\left(z_g^{\star 0}\right)/2$, and $H\left(z_h^M\right) = H\left(z_h^{\star 0}\right)/2$. Because the economies have the same first-best level of capital stock we must have $\kappa G\left(z_g^{\star 0}\right) = \kappa H\left(z_h^{\star 0}\right)$ under perfect investor protection $\gamma = 0$ and it follows that $x = z_g^{\star 0} = z_h^{\star 0}$. But then $G\left(z_g^M\right) = H\left(z_h^M\right)$ and necessarily $z_g^M < z_h^M < x$. □

If the start-up cost distributions do not imply the same first-best level of capital accumulation but g has thicker tails than h or h first-order stochastically dominates g then from Lemma 9 we know that $z_g^{\star 0} \leq z_h^{\star 0}$ and $G\left(z_g^{\star 0}\right) \geq H\left(z_h^{\star 0}\right)$. This has two opposing effects on the identity of the decisive voter. One one hand, $z_g^{\star 0} \leq z_h^{\star 0}$ would imply $z_g^M \leq z_h^M$ if $G\left(z_g^{\star 0}\right) = H\left(z_h^{\star 0}\right)$. On the other hand, $G\left(z_g^{\star 0}\right) \geq H\left(z_h^{\star 0}\right)$ implies $G\left(z_g^M\right) \geq H\left(z_h^M\right)$, which may require $z_g^M \geq z_h^M$. This is why it is not possible to establish the more general version of Lemma 10 analytically. In order to obtain that $z_g^M \leq z_h^M$ the difference $z^{\star 0} - z^M$ has to be increasing with the variance and/or skewness of the type distribution. In all my numerical simulations this monotonicity is satisfied.

An immediate consequence of the shift in the identity of the decisive voter is that under distributions that have thicker tails or that are first order stochastically dominated, the marginal cost for the decisive voter of choosing more distortionary policy is relatively lower.

To shed some light to the way distributional changes affect the marginal benefit of choosing more distortionary policy I study how much the price q_{t+1} increases when the investor protection is deteriorated at the margin. From equilibrium conditions (1.8) and (1.10) we have :

$$\frac{dq_{t+1}}{d\gamma_t} = F_{11}\left(\kappa G\left(z_t^\star\right), L\right) \kappa g\left(z_t^\star\right) \left[\frac{\partial z_t^\star}{\partial \gamma_t} + \frac{\partial z_t^\star}{\partial q_{t+1}} \frac{dq_{t+1}}{d\gamma_t}\right],$$

therefore

$$\frac{dq_{t+1}}{d\gamma_t} = \frac{F_{11}\left(\kappa G\left(z_t^\star\right), L\right)\kappa g\left(z_t^\star\right)\frac{\partial z_t^\star}{\partial \gamma_t}}{1 - F_{11}\left(\kappa G\left(z_t^\star\right), L\right)\kappa g\left(z_t^\star\right)\frac{\partial z_t^\star}{\partial q_{t+1}}} > 0,$$

where $g(z)$ denotes the probability density function and $\frac{\partial z_t^\star}{\partial \gamma_t} = \frac{\pi q_{t+1}[\kappa_L - (x(z_t^\star) - w_t)r]}{x'(z_t^\star)r[(1-\pi)(\kappa_H - \kappa_L) - \pi\gamma_t]} < 0$ and $\frac{\partial z_t^\star}{\partial q_{t+1}} = \frac{\kappa - \pi\gamma_t}{x'(z_t^\star)r} > 0$. Although it is not always possible to compare $\frac{dq_{t+1}}{d\gamma_t}$ under different distributions analytically, it can be done at $\gamma_t = 0$ in the particular case of distributions that differ in inequality but share the same first-best level of capital accumulation. Lemma 11 establishes this result.

Lemma 11. *Consider two economies with distinct Beta start-up cost type distributions g and h with cumulative distribution functions $G(z)$ and $H(z)$. Given the same initial stock of capital in the two economies, in equilibrium $\left(\frac{dq_{t+1}}{d\gamma_t}\right)_g < \left(\frac{dq_{t+1}}{d\gamma_t}\right)_h$ at $\gamma_t = 0$ if g has thicker tails than h and the economies have the same first-best level of capital stock.*

Proof. First notice that because the economies have the same first-best level of capital accumulation we have $z_g^{\star 0} = z_h^{\star 0} = z^{\star 0}$, $G\left(z^{\star 0}\right) = H\left(z^{\star 0}\right)$, and $q_{t+1,g}^0 = q_{t+1,h}^0$. Then the only term that could differ in the numerator and denominator of $\frac{dq_{t+1}}{d\gamma_t}$ under g and h is the value of the pdf. From the assumption that g has thicker tails than h it follows that $g\left(z^{\star 0}\right) > h\left(z^{\star 0}\right)$. Thus $\left(\frac{dq_{t+1}}{d\gamma_t}\right)_g < \left(\frac{dq_{t+1}}{d\gamma_t}\right)_h$. □

For values of $\gamma_t \in \left(0, \gamma^H\right)$ and economies with different levels of the first-best capital accumulation we can compare analytically some components of $\frac{dq_{t+1}}{d\gamma_t}$, but we need to make some assumptions on the functional forms.

Lemma 12. *Assume the production function $F(K,L) = K^\nu L^{1-\nu}$, with $0 < \nu < 1$, and the cost function $x(z) = \zeta + \theta z$, with $\zeta, \theta > 0$. Consider two economies with distinct Beta start-up cost type distributions g and h with cumulative distribution functions $G(z)$ and $H(z)$. If g has thicker tails than h and the economies have the same level of the first-best capital accumulation, or g has thicker tails than h and the same skewness, or h FOSD g, then in equilibrium we have the following for any γ_t :*

1. $F_{11}\left(\kappa G\left(z^{\star}_{t,g}\right),L\right) \geq F_{11}\left(\kappa H\left(z^{\star}_{t,h}\right),L\right)$,

2. $\frac{\partial z^{\star}_{t,g}}{\partial \gamma_t} \geq \frac{\partial z^{\star}_{t,h}}{\partial \gamma_t}$,

3. $\frac{\partial z^{\star}_{t,g}}{\partial q_{t+1,g}} = \frac{\partial z^{\star}_{t,h}}{\partial q_{t+1,h}}$.

Proof. All these inequalities use the fact established in Lemma 10 that given any level of investor protection, the considered distributional changes imply in equilibrium $q_{t+1,g} \leq q_{t+1,h}$, $G\left(z^{\star}_{t,g}\right) \geq H\left(z^{\star}_{t,h}\right)$, and $z^{\star}_{t,g} \leq z^{\star}_{t,h}$.

Part 1 follows from $G\left(z^{\star}_{t,g}\right) \geq H\left(z^{\star}_{t,h}\right)$ and the assumption that $F\left(K,L\right)$ has a Cobb-Douglas form, therefore $F_{11}\left(K,L\right)$ is negative and increasing in K.

Part 2 follows from $q_{t+1,g} \leq q_{t+1,h}$ and the assumption that $x\left(z\right)$ is affine, therefore $x'\left(z\right)$ is constant.

Part 3 follows from the assumption that $x\left(z\right)$ is affine, therefore $x'\left(z\right)$ is constant. □

We can see from Lemma 12 that in numerator of $\frac{dq_{t+1}}{d\gamma_t}$ we have two (negative) terms that are larger under g. Unfortunately, we cannot analytically obtain unambiguous comparison of $g\left(z^{\star}_{t,g}\right)$ to $h\left(z^{\star}_{t,h}\right)$. Numerically, for the economies with the same level of first-best capital accumulation under the benchmark parametrization as in Table 1.I, we have always $g\left(z^{\star}_{t,g}\right) \leq h\left(z^{\star}_{t,h}\right)$ and therefore $\left(\frac{dq_{t+1}}{d\gamma_t}\right)_g \leq \left(\frac{dq_{t+1}}{d\gamma_t}\right)_h$. An important result of these numerical experiments is that the decrease in marginal cost of distorting investor protection associated with the change in the decisive voter identity is stronger than the decrease in marginal benefit associated with weaker general equilibrium effect. This leads to selection of lower investor protection in political equilibrium. The comparison of economies with the same first-best level of capital accumulation can serve as an upper bound in evaluating the decrease in the marginal benefit from deterioration of investor protection for the decisive voter. Changes toward distributions with thicker tails but implying higher first-best level of capital accumulation or to distributions that are first order stochastically dominated will lead to smaller decreases in the marginal benefit and selection of lower investor protection.

I.3 Data Description

I.3.1 Variables Obtained Directly in the Data

anti-director rights index : Sum of six dummy variables indicating whether (1) the country allows shareholders to mail their proxy vote, (2) shareholders are not required to deposit their shares prior to the General Shareholders Meeting, (3) cumulative voting or proportional representation of minorities on the board of directors is allowed, (4) an oppressed minorities protection mechanism is in place, (5) the minimum percentage of share capital required to call an Extraordinary Shareholders Meeting is less than or equal to ten percent, (6) shareholders have preemptive rights that can only be waved by a shareholders meeting. The index was developed by La Porta et al. (1998) for 49 countries reflecting laws in 1993. It was extended by Pagano and Volpin (2005) to the period 1993 - 2001 and revised by Djankov et al. (2008b) for 72 countries according to laws in place in 2003. When I construct the measures of investor protection I use the values corresponding to year 2000 in regressions on the Gini coefficient of the wealth distribution and year 2003 in regressions on the interaction of start-up cost and corruption index.

creditor rights index : Sum of four dummy variables indicating whether (1) there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization, (2) there is no automatic stay on assets, (3) secured creditors are paid first out of liquidation, (4) management does not retain administration during the reorganization. The index was developed by La Porta et al. (1998) for 1993 and extended by Djankov et al. (2007) to the interval 1978 - 2003. When I construct the measures of investor protection I use the values corresponding to year 2000 in regressions on the Gini coefficient of the wealth distribution and year 2003 in regressions on the interaction of start-up cost and corruption index.

anti-self-dealing index : Measures legal protection of minority shareholders against expropriation by corporate insiders. Focuses on private enforcement mechanisms, such as disclosure, approval and litigation. Based on a standardized case study by law firms. Based on legal rules prevailing in 2003. Constructed by Djankov et al. (2008b). Ranges from 0 to 1.

efficiency of debt enforcement : Measures the efficiency of debt enforcement in a country. Based on a standardized case study by law firms. Based on legal rules prevailing in 2006. Constructed by Djankov et al. (2008a). Ranges from 0 to 1.

rule of law index : Measures the quality of contract enforcement, the police, and the courts as well as the likelihood of crime and violence. Constructed by Kaufmann et al. (2008) for 1996, 1998, 2000 and 2002-2008. Ranges from -2.5 to 2.5. In the construction of effective investor protection measures I use values of year 2000 or 2003. I re-scale the index to 0 to 5 scale.

English legal origin dummy : Equals 1 if the country's commercial law is originated in English Common Law. From La Porta et al. (1998) and Djankov et al. (2007).

Gini wealth : Gini index of household wealth distribution in a country. Estimated by Davies et al. (2007) using data for year 2000.

cost of entry : Direct cost associated with meeting government requirements to get the legal status of a firm plus the monetized value of the entrepreneur's time, measured as a fraction of GDP per capita. I use the data compiled by the World Bank Doing Business project using the same methodology as Djankov et al. (2002). I use values for years 2004 and 2006.

corruption : Corruption Perception Index. Draws on corruption-related data from expert and business surveys carried out by a variety of independent and reputable institutions. Compiled by Transparency International I use data for 2003 and 2006. Originally ranges from 0 to 10 with higher score indicating lower corruption. I invert the scoring by rescaling to 0 to 10 scale with higher score indicating higher corruption.

I.3.2 Constructed Variables

formal investor protection : $fip = \frac{\text{anit-director index+creditor rights index}}{10}$

effective investor protection 1 : $eip\,(1) = \frac{\text{anti-director index+creditor rights index}}{10} \times \frac{\text{rule of law}}{5}$

effective investor protection 2 : $eip\,(2) = \frac{\text{anti-director index+creditor rights index+rule of law}}{15}$

Annexe II

Appendix to Chapter 2

II.1 Numerical Algorithm

I solve the model using value function iteration. The main step finds prices and the corresponding invariant distribution over individual states such that the capital market and the labor market clear. The invariant distribution is stored as a long $N = 3$ million sample of triplets (ζ_n, θ_n, a_n). The algorithm proceeds as follows.

1. Guess prices r^p, w^p and the invariant distribution $\left(\{\zeta_n, \theta_n, a_n\}_{n=1}^N\right)^p$.

2. Given the guesses, solve Bellman equation (2.1) for a finite number of states. Particularly, the end-of-period assets ω and the net worth at the beginning of period a are discretized into grids. Use a shape-preserving spline interpolation to evaluate the value functions on the points outside the grid. To compute the expected value of entrepreneurship, use a selection of entrepreneurs from the guessed invariant distribution as a sample of business partners. The expectation is approximated by a Monte-Carlo integral over 1000 points. Once convergence of value functions is achieved, recompute savings decision rules on a finer grid of end-of-period assets.

3. Obtain the updated invariant distribution over individual states $\left(\{\zeta_n, \theta_n, a_n\}_{n=1}^N\right)^{p+1}$ by using the system's transition function to simulate a long time-series for an individual agent. To obtain conglomeration decisions, use a selection of entrepreneurs from the guessed invariant distribution as a sample of business partners. To update saving decision rules use piecewise linear interpolation.

4. Check capital and labor market clearing conditions. If markets do not clear, choose new interest rate r^{p+1} and wage rate w^{p+1} accordingly. The algorithm terminates when both excess demands are lower than 10^{-3}.