A Theoretical and Empirical Exploration into the Heterogeneous Fragility of Chilean Firms and Workplaces

by

Oscar Landerretche

Ingeniero Comercial, Universidad de Chile (1996)

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Signature of Author ....
Department of Economics
September 5, 2006

Certified by ....
Daron Acemoglu
Charles P. Kindleberger Professor of Applied Economics
Thesis Supervisor

Certified by ....
Roberto Rigobón
Associate Professor of Management
Thesis Supervisor

Accepted by ....
Peter Temin
Elisha Gray II Professor of Economics
Chariman Departamental Committee on Graduate Studies

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Abstract

This dissertation consists of three essays on the heterogenous reactions of firms to shocks, with particular empirical applications to the Chilean economy.

The first essay presents a model of heterogeneity in an economy with financial constraints. The main issue in the model is to characterize the entrepreneurs and firms that are affected by shocks or policy innovations. The model delivers a dual margin composed of a segment of relatively poorer but more productive entrepreneurs and a segment of richer but less productive entrepreneurs. The main result we present in this essay is that these two margins will react heterogeneously to shocks in economically meaningful ways.

The second essay is devoted to the construction of the panel and the econometric use of the FUNDES-SII panel firm database. We use this database to study firm creation, destruction and performance on maps of firms. The main result of this essay is that there does seem to be some empirical evidence of a margin of high productivity, low capital entrepreneurs for the Chilean economy, as predicted in the first essay of the thesis. Finally, we find that among smaller firms leverage seems to be an indicator of financial constraint, while among larger firms it is an indicator of financial access.

The third essay is devoted to the construction of the panel and econometric use of the INE-BFL panel worker database to study workplace creation and destruction in Chile. For local interest, the main feature of the chapter is that it is the first time that representative and consistent series of job creation and destruction that is made available for the Chilean economy. The main feature of the chapter, however, is the estimation and characterization of workplace fragility by firm size. We estimate separation, matching and bankruptcy probabilities, and inquire into their sensitivity to the economic cycle.

Thesis Supervisor: Daron Acemoglu
Title: Charles P. Kindleberger Professor of Applied Economics

Thesis Supervisor: Roberto Rigobón
Title: Associate Professor of Management

Dedicatoria

A mi compañera Patricia en tributo a su dulzura y fuerza.

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Introduction

The view that most economies have a sector of fragile entrepreneurs that own small firms or have small entrepreneurial plans, and require the support of the governments to exist, has appeared frequently in development economics. These small enterprises are seen as an important mechanism for social mobility and equal opportunity, and their failure and fragility is usually seen as a social defect of a market economy. The theoretical underpinning for such a failure was first laid out by Stiglitz and Weiss (1981) and has since become mainstream economic theory, with important practical applications such as the microlending experiences.

On the other hand, the existence of a dynamic churning process, were small firms try out new ideas, and are either selected to survive or, when failing, scraped and their resources recycled into new projects, is seen by macroeconomists as a virtue of a dynamic and modern economy. This view has been with us since the inspiring work of Schumpeter (1942), and it has had a recent expression in the work of Caballero and Hammour (1996) and Caballero and Hammour (1998). The failure of an economy to churn resources to truly productive projects is seen by them as an efficiency defect of a modern market economy: what they call economic sclerosis.

Both views are perfectly compatible and probably coexist in a world of heterogeneous entrepreneurs. We will argue that both views are different faces of the same problem: the existence of a sensitive margin of fragile but very productive entrepreneurs. In the following chapters we will understand "fragility" not only as the possibility of a firm to go bankrupt or to close, but also as the possibility that a competent entrepreneur will not be able to implement a productive and socially desirable project. We will show how a standard limited liability hidden action model can deliver socially and economically meaningful multiple margins that react heterogeneously to shocks and policy innovations. We will show evidence of this heterogeneity from the Chilean economy, from the viewpoint of entrepreneurs (counting firms) and workers (counting jobs) and attempt to characterize further the characteristics of firms that predict these different events.

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Gertler and Gilchrist (1994) show us evidence that investment among smaller firms is much more sensitive to monetary policy than among larger firms.[1] Moreover, Oliner and Rudebusch (1996a) and Oliner and Rudebusch (1996b) show that the shifting of bank credit away from small firms is a salient feature of monetary contractions in the US. But this differential behavior of firms of different sizes can be found in many places. For example, Forbes (2003) shows that the implementation of the Chilean capital flow reserve requirement mechanism had a significantly larger (although transitory) adverse effect on smaller firm's access to credit.[2] Harris and Siregar (1994), find evidence that Indonesian financial liberalization increased borrowing costs more for smaller firms. Gelos and Werner (2002) find evidence that the Mexican financial liberalization resulted in an easing of financial constraints that was concentrated among smaller firms, and so forth.

There seems to be, in fact, a consensus that the size of a firm does seem to, at the very least, correlate with the reaction to a crisis or a policy innovation. However, there is less agreement on what characteristics of the firms are delivering this differential sensitivity and on what is being proxied by size in papers that use it as an independent variable. Gertler and Gilchrist (1994) explicitly argue that size is a good proxy for capital market access, but other papers do not necessarily clarify what it is that we are talking about. And there are alternatives: for example Hu (1999) shows that it is highly leveraged firms which are more affected by a contraction in credit, and Kashyap and Stein (1994) show that it is firms without access to bond markets that are the ones that react to shocks with most intensity. All three empirical findings are compatible and it is entirely possible that illiquidity, excessive leverage and imperfect access to capital markets are theoretically and empirically related.

Moreover, it is possible that different characteristics of the firms can compound to make things even more difficult. For example Carpenter and Petersen (2002) show that the classical cash flow effect on investment seems to be

[1]For example, they show that in a monetary contraction, large firms tend to borrow and invest in inventories in preparation for the recovery of demand. Small firms, on the other hand, tend to rapidly lower their inventories during the contraction.

[2]Gallego and Hernandez (2003) use a database of publicly traded firms to show that relatively smaller firms increased their reliance on short term debt as a result of the reserve requirement.

a particularly important restriction for the growth of smaller firms.[3] In their case, they implicitly interpret "small" to be a proxy for "new" in the Jovanovic (1982) sense and/or "owned by financially constrained entrepreneurs" in the Gertler and Gilchrist (1994) sense.[4] It is most likely that different financial characteristics of the firms become more or less important depending on the financial environment that surrounds them. Consider, for example, an Allen and Gale economy[5] where there is a pool of financial liquidity that can quickly become rationed after an aggregate shock. In such an economy it is likely that firms with less liquid assets or thinner cash flows such as those referred to by Oliner and Rudebusch (1996a) and Carpenter and Petersen (2002) will be relatively more affected by aggregate shocks. Consider, on the other hand, a Caballero and Krishnamurthy emerging economy[6] where there is a pool of internationally pledgable collateral that becomes rationed when the country is hit by an international shock. In such an economy one would expect firms with different access to international finance, to react differently to the same shock [7]. Hence, it is very likely that the type of heterogeneity that will be relevant in predicting the reaction of different firms will change from country to country and sector to sector.

The empirical literature that documents heterogenous effects is usually based on databases of relatively large and well established firms.[8] This is

[3]There is a somewhat paradoxical result available in Devereux and Schiantarelli (1989), consisting on the find that cash flows are more important for large rather than small firms among publicly traded UK companies. This result has not been replicated elsewhere to our knowledge.

[4]Small firms are firms that are starting to discover their growth opportunities, cash flow would be, it seems, a particularly important restriction on them. Hence, cash flows would be a good predictor of their growth opportunities or productivity potential.

[5]See Allen and Gale (2004b) for a surveylike view of their work on the effect of liquidity scarcity on asset prices (what they call Cash-in-the-Market Pricing) that can be found in a family of papers that they have produced.

[6]See Caballero and Krishnamurthy (2001) and the family of papers that follows.

[7]Bleakley and Cowan (1995) find evidence of different effects of devaluations on large Latin American firms conditional to the exchange rate composition of their debt and the elasticity of their income to the exchange rate. Benavente and Morandé (2003) find that no such effects for Chilean firms after the 1998 Asian Crisis. The jury is basically out in this type of literature.

[8]Gertler and Gilchrist (1994) use the Quarterly Financial Report for Manufacturing Corporations, so they inherit all the biases that this particular sector can bring. This can be particularly relevant when extrapolating conclusions towards small agricultural commercial or service enterprises. Also due to the nature of their database the "cutoff" for separating small from large firms is somewhere in the US$ 100 to 250 million range for annual sales. This is clearly not what pepople have in mind when they talk of small

true of all the papers referred to in this section up to this point and is a natural bias due to the difficulty of surveying financial data among financially fragile firms. Most of these papers are interested in the transmission mechanism of monetary policy tightenings, exchange rate shocks or capital account policies, so this is probably not a problem for their conclusions. But, as far as statements on the distributive effects of shocks across different types of entrepreneurs goes, they probably underestimate the adverse effects. Hence, for our purposes, the evidence from these papers is motivating but not decisive, since most of the databases used in these studies are biased towards relatively large firms.

We are interested in the fate of high quality entrepreneurs with low financial resources in emerging markets, and we are interested in the effect that this has on workers. Moreover, we are not only interested in the fate of existing small entrepreneurs that either default or survive shocks and regulatory changes. We are also interested in the effect of these shocks on potential entrepreneurs and their decisions to enter or not into the economy. This presents a difficult censorship problem that we have only seen dealt with by Paulson and Townsend (2004) and Paulson and Townsend (2005), we will comment below and deal with it in Chapter 3 of this dissertation.

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In this dissertation we focus particularly on the Chilean economy. Both empirical chapters are based on new Chilean databases. Chapter 2 uses a new panel database containing all Chilean firms that have filed tax returns for a period of six years (the FUNDES-SII panel). This thesis is only the second academic work to use this type of data, the first to use it for this particular period of time, and the first to submit it to extensive econometric analysis.[9] This database has the advantage of containing some very coarse financial data on a large and very representative sample of firms. Its main

businesses that create development and social mobility opportunities for poor households. Forbes (2003) uses a database of publicly listed companies in Chile, so she is estimating the effects of size among already relatively large companies, that have sufficient financial acess to be admited into the Santiago Stock Exchange. Hu (1999) uses the Manufacturing Sector Master File which is composed of large, durable manufacturing companies. Kashyap and Stein (1994) use a subset of this database, the Compustat companies of the Compustat dataset.

[9]Crespi (2003) is the first work to use the FUNDES-SII database to study the vulnerability of small firms in Chile. However, the period of that database (1990-1998) is different from ours (1999-2004) and, due to procedural changes the databases are not fully compatible. Also we focus on a econometric decomposition of effects rather than an extensive documentation of stylized facts.

defect is that it has almost no other information. Chapter 3 uses a panel of workers constructed from the Chilean National Unemployment survey (the INE-BFL panel) to study the fragility of jobs and attempts to trace back to some characteristics of the firms. One of the main features of this dissertation is that it is the first to present national and cross sector job calculations of creation and destruction for Chile. This second database has the advantage of being more representative of the real rather than the formal economy, and since it counts jobs rather than firms it allows us to analyze the fragility of workplaces.

Chile has, of course, interest in itself. But I will spend a couple of paragraphs arguing that it is a particulary interesting economy to look at from a more general perspective when one is interested in the problems faced by entrepreneurs in emerging markets. Chile is well known as an early Washington Consensus reformer. Most of the policies that were adopted globally by emerging economies during the 1990s (e.g. trade liberalization, privatization and pension reform) had already been adopted in Chile during the late 1970s and early 1980s. Generally, this has made the Chilean economy a very attractive case for students of emerging market reforms. Moreover, since it is a free market oriented economy and has been so for quite some time,[10] it offers the possibility of studying the effects of market failures rather than the effects of government failure, which, are present but probably less important than in other emerging economies. Unfortunately, until very recently, only static data has been available to study this economy, with the specific exception of the National Industrial Survey (ENIA).This dissertation, together with other efforts[11] attempts to bridge this deficit.[12] Also by analyzing jointly two panel databases: one for firms and one for workers, we attempt to advance a more comprehensive understanding of churning, creative destruction and fragility in the Chilean economy.

[10]For example, Heritage, the well known conservative think tank ranks Chile in the 14th place of its 161 country Economic Freedom Index (US is 9th, UK is 5th.)

[11]Notably the database being collected by the National Unemployment Insurance System (see Cowan and Micco (2005)); also a database facilitated by one of the major job-place safety insurance companies in the country (ACHS) and used by Ferrada and Reinecke (2005) to estimate job flows; and the retrospective effort made in the Social Protection Survey of the Microdata Center of the University of Chile (see Bravo (2005))

[12]For a more extensive view of Chilean economic history I recommend the following books: Meller (1996) for a perspective of economic policies in Chile over the last century, and Ffrench-Davis (2005) for the last three decades; Edwards and Cox (1991) and Bosworth et al. (1994) for a review of the reforms conducted during the military dictatorship (1973-1989); and Meller (2005) for the post dictatorship democratic period (1990-2005).

The Chilean economy can be characterized as fast growing for Latin American standards, but displays relatively high unemployment rates and growth volatility when compared to East Asian emerging markets. The predominance of certain commodities[13] in its exports and the relatively recent development of massive retail commercial banking are usually seen as the reasons behind the lesser role and fragility of smaller entrepreneurs. Chilean economic fluctuations continue to be caused and explained by the fluctuations of these commodities, and it is seen by many that entrepreneurship outside of the large companies involved in commodity exports is a residual of the economy, that may or may not be there at different points in time. The development of a private economy beyond commodities is seen by many as a social and economic priority, and a candidate area for government action. There is less of a consensus on what specific policies should be involved in a governmental action directed towards these objectives.

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Chapter 1 of this dissertation is of a more general and applied theoretical interest and presents a model of heterogeneity in an economy with financial constraints. The main issue in the model is to characterize the entrepreneurs and firms that are affected by shocks or policy innovations to the economy. The model will show that in a heterogeneous economy there will be a dual margin composed of a segment of relatively poorer but more productive entrepreneurs and a segment of richer but less productive entrepreneurs. It will show how the first segment will be relatively more sensitive to a variety of shocks and policy innovations that we will make this economy endure. We will submit it to changes in financial integration to the world, changes in capital flow taxes, changes in the development and regulation of local capital markets as well as international shocks. In all cases, the margin of poorer and more productive entrepreneurs will be more sensitive to shocks. The chapter also shows that scale can be an effective substitute for capital endowments or productivity in the capital market and, hence, using size as a proxy for financial constraints (which is very frequent in the literature and we will implicitly do in Chapter 3) is compatible with our model. Finally, the Chapter 1 shows that risk will affect the participation constraint more by generating a flight of low quality projects, also risk will tend to increase relatively the interest rates for poorer and more productive entrepreneurs.

Chapter 2 is devoted to the construction of the panel and the econometric use of the FUNDES-SII database. We use this database to study firm

[13]Mostly copper, but also fish meal and cellulose.

creation, destruction and performance in Chile. In the chapter, we test for reactions to macroeconomic and sectoral shocks of creation, destruction and performance on maps of firms ordered in the space we used to derive the model of Chapter 1. The main result of this part of the chapter is that there does seem to be some empirical evidence of a margin of high productivity, low capital entrepreneurs for the Chilean economy. The chapter also finds that there is economically meaningful and significant heterogeneity among Chilean firms. In particular, we show that the smallest firms in the economy leverage is correlated with fragility in the sense that it predicts failure and worse sales performances, while for all the rest of the firms (and very clearly for the largest firms of the economy) the effects have the exact opposite sign. We interpret this as a strong indication that leverage is an indicator of financial constraint among small firms and of financial access among larger firms. We finalize the chapter by illustrating in a multidimensional way the sources and characteristics of heterogeneity among Chilean firms.

Chapter 3 is devoted to the construction of the panel and econometric use of the INE-BFL database to study workplace creation and destruction in Chile. For local interest, the main feature of the chapter is that it is the first time that representative and consistent series of creation and destruction are made available for the Chilean economy. For general interest, the main feature of the chapter is estimation of the economic relevance of workplace fragility in different sizes of firms. Once we control for sector and date dummies as well as for the characteristics of workers it seems clear that small firms are much more likely to destroy jobs and less likely to create them. The steady state of jobs in smaller firms, it seems, is generated by the mechanics of firm creation in the economy: new firms have to start small. But, controlling for that, the jobs and workplaces in these firms are more fragile. We also take advantage on a question on job destruction of the survey to show that small firms are more likely to go bankrupt and we show how this differential effect significantly increased after the Asian Crisis.

Both the second and third chapters of this dissertation have something in common that is less related to the central theme of this dissertation but of empirical importance to students of the Chilean economy and relatively trivial byproducts from the statistical codes we used to estimate the main results. We characterize the geographic and sector identity of the most fragile firms and workplaces. We find them to be in the construction, commerce and services sectors and hence mainly in highly urbanized regions of the country. This emphasizes the importance (maybe even beyond the Chilean experience) of looking at fragility in sector representative databases.

Chapter 1

The Model: Fragility and Heterogeneity

1.1 Introduction

In this chapter we set up an economy with a typical hidden action information asymmetry and heterogeneous entrepreneurs in wealth and in the quality of their entrepreneurial ideas. We show that in an economy such as this, the presence of an information asymmetry will generate dual margins with differential sensitivity to shocks. We show that shocks tend to impact most fiercely on a margin composed of poor entrepreneurs with high quality projects, and less on a margin of rich entrepreneurs with low quality projects. The consequence of the model is that the same market failure that scleroses the economy, minimizes the social and distributive impact of entrepreneurship, by creating a fragile margin of poor but highly productive entrepreneurs.

The most relevant methodological aspect of the model is the mapping of the economy into a partition representing types of entrepreneurs that are subject to different contracts and interest rates. Also, the margins of these partitions may be constituted either by incentive constrained or participation constrained firms. This difference in the nature of the active constraint determines differential sensibilities of these margins to different shocks. The same basic methodological mechanism can be found in a corporate structure model by Acemoglu and Newman (2002).

The logic of our model is best understood comparing two entrepreneurs: a rich entrepreneur with a low quality project and almost enough resources to finance it himself, and a poor entrepreneur with a high quality project and almost no financial resources. From the bank's perspective the rich entrepreneur can be trusted to exert effort since his incentives are almost totally aligned with the project. The big question in lending to him will be how high an interest rate can be charged without the entrepreneur abandoning the project for the outside option. Hence, marginal rich entrepreneurs will be *participation constrained.* On the other hand, enforcing effort is the central issue when lending to the poor entrepreneurs. Hence, the bank will demand higher productivity levels and/or higher interest rates to lend to theses entrepreneurs. They will be *incentive constrained.* In this way, a heterogeneous economy will present dual margins.

The *incentive constrained* margin will be more sensitive to shocks and institutional innovations. The intuitive reason is that entrepreneurs on this margin rely on their ability to extract productivity from the economy to obtain credit from the banks. A deterioration of this ability will be very serious for them. On the other hand the wealthy *participation constrained* entrepreneurs rely mostly on their resources to credibly promise effort. Hence, they will be less sensitive to shocks and institutional innovations.

We explore two extensions an generalizations of the model. First, we find that in this context most risk sources will end up depleting the economy of wealthy entrepreneurs with relatively low productivity projects and increasing interest rates for poor entrepreneurs with relatively high productivity projects. The logic behind this is that *participation constrained* entrepreneurs will be comparing projects inside the risky economy, with projects outside it, while *incentive constrained* entrepreneurs will be in effect comparing two alternative projects inside the risky economy (the one with shirking and the one without it).

Second, we find that a model in which we add an additional source of heterogeneity: scale or size, does replicate the stylized fact that fragility is mostly seen among small firms. The intuition is that as long as effort is not completely proportional to size (as long as there is a fixed cost), scale will substitute for productivity. Hence, larger firms will be less sensitive to shocks and we will observe lower interest rates and more productive projects with increased scale.

This model is clearly connected to the volatility and credit market incompleteness literature pioneered by Greenwald and Weiss (1984) and further developed in papers such as Holmstrom and Tirole (1997), Aghion et al. (2002) and Stiglitz and Weiss (1992). In any case, the objective of most of this literature is to show how the market failure increases macroeconomic volatility. In this chapter we take this for granted and explore the distributive and efficiency aspects of macroeconomic fluctuations in economies with incomplete markets of the same sort but with economic and socially meaningful heterogeneity.

The model is also related somewhat with the credit monetary transmission literature studied empirically by papers such as Gertler and Gilchrist (1994) and Ashcraft and Campello (2002)), also surveyed and documented by Bernanke and Gertler (1995). Again this literature seeks usually to quantify the importance of these constraints and uses heterogeneity in size as an instrument that approximates financial constraints. Towards the end of the paper we show that using size as an instrument in this way is consistent with our model. However, we wish to explain the heterogeneous reactions by understanding how the characteristics of firms and entrepreneurs affect contracting rather than use the characteristics as an instrument.

The model is also somewhat related to the liquidity shortages and financial crises literature developed by Caballero and Krishnamurthy (2001) and Caballero and Krishnamurthy (2002) for balance of payments crises in emerging markets, and by Allen and Gale (2004a) and Allen and Gale (2004b) in a more general financial context. This literature emphasizes financial transmission of shocks towards firms with illiquid assets, and particularly the effect of illiquidity on financial prices such as the exchange rate or the stock market. One could extend the conclusions of this literature to construct a plausible explanation for the higher sensitivity to shocks and the fragility of smaller or poorer entrepreneurs. We do not use these types of models in our paper, our financial market is extremely simplistic, but we view our explanation as complementary rather than competing with this one.

The chapter is organized in the following way: Sections 1.2 to 1.5 present the model and develops the main results of the paper, the mapping of the economy into different types of contracts and the differential sensitivities of different margins to shocks and institutional innovations. Section 1.6 explores the effects of international recessions, international interest rate hikes, capital controls and financial liberalizations, financial development, improvements to the contracting environment, microfinance and technical support. Section 1.7 presents extensions to the main model, the introduction of risk and the introduction of size heterogeneity. We end with the conclusions in Section 1.8. Also Appendices B and C of this dissertation correspond to proofs and derivations for this chapter.

1.2 Dual Economy with Heterogeneity

1.2.1 Setup of the Economy

Consider the following static hidden action problem in the midst of competitive markets (for banking and output) and risk neutral individual agents (firms and banks). Firms live only to attempt the execution of a single entrepreneurial project, and banks live only to provide intermediated finance for these projects. There is a single good in this economy that will serve as a numeraire. The output market is a spot market for this single good. The banking market is an intertemporal market for this good that lasts for one period.

Entrepreneurs can decide not to contract with the bank or the bank may decide that it is not willing to lend. In that case, the entrepreneur can deposit it's wealth outside of the economy at the risk free interest rate r. The banking sector is competitive and exogenous to this economy and demands the same risk free gross interest rate of r for riskless loans.

There is a continuum of agents with mass 1 that are heterogeneous in two dimensions: the proportion of internal funds ($0 \leq k \leq 1$) as a percent of the investment required for each project, and the quality of the project or productivity ($0 \leq \pi \leq 1$) as a percent of the aggregate productivity of the economy (W). Both k and π are observable to the banks and W will be assumed to be exogenous.

All entrepreneurial projects will require an investment of 1 and will be implemented if the agent is able to raise from the banks the $1 - k$ that he lacks. Banks are risk neutral, face no quantum credit constraints but face limited liability when lending to entrepreneurs in this economy since agents have no wealth other than k. All projects have the following identical production function: with probability p_s it will render πW and with probability $1 - p_s$ it will fail and render 0. Output is also sold in an exogenous competitive environment where the production of a firm of productivity π is sold for πW. The probability of success of the project will depend on an universally observable effort decision of cost c made by the entrepreneur. If the agent makes an effort he will have a success probability of p_h for his project, otherwise the success probability will be p_l which is lower. Hence expected gross output by a project of quality π will be

$$E[y] = \left\{ \begin{array}{ll} p_h \pi W - c & \text{if high effort is exerted} \\ p_l \pi W & \text{if low effort is exerted} \end{array} \right\} \tag{1.1}$$

1.3 Perfect Information

Call $A = \{\{H, L, O\}_i\} \subset \Re^2$ the set of all possible partitions of space $B = [0,1] \times [0,1]$ such that $H \cup L \cup O = B$ and $H \cap L \cap O = \emptyset$. Sets H, L and O describe collections of entrepreneurs described by a pair (π, k). H is the set of entrepreneurs that are financed to execute their project with a high level of effort, a set of firms that we will call Tier 1 from now on. L, is the set of entrepreneurs that are financed to execute their project with a low level of effort, and we will call Tier 2 henceforth. Finally set O, is the set of entrepreneurs that decide to invest outside the economy. Call $R = (R_h, R_l) \in \Re^2_+$ a vector describing the interest rate structure of this economy. Equilibrium in this economy is described by $(P, R) \in A \times \Re^2_+$ such that all entrepreneurs maximize their expected profits and banks comply with the zero profit free entry condition.

Hence, set $S \in \{H, L\}$ is the subset of entrepreneurs that, producing inside the economy, maximize their expected positive profits

$$U(s) = p_s(\pi W - (1-k)R_s) - kr - c_s \tag{1.2}$$

by choosing $s \in \{h, l\}$, where $\{c_h, c_l\} = \{c, 0\}$. Set O, on the other hand, is the subset of entrepreneurs that obtain negative results in (1.2) for any choice of s and choose to produce outside of the economy to obtain a risk free return of kr, and is characterized in the definition of A.

Scalars $\{R_s\}$ are the interest rates that are charged by the banks to entrepreneurs belonging to each set S. Under perfect information the level of effort exerted is universally observable, so banks will finance all projects that accept to exert effort S and pay rate R_s such that zero expected profit condition

$$R_s p_s = r \tag{1.3}$$

is satisfied for each penny loaned. Hence, equation (1.3) fully characterizes equilibrium interest rates in this economy.

We can characterize the first best perfect information equilibrium in the following way: firms can only be expected to sign the high effort contract if they have drawn π larger than:

$$\pi_{pch} = \frac{(r+c)p_h^{-1}}{W} \tag{1.4}$$

so we will refer to threshold (1.4) as the *high effort participation compatibility constraint* or PCH henceforth. On the other hand, firms can only be

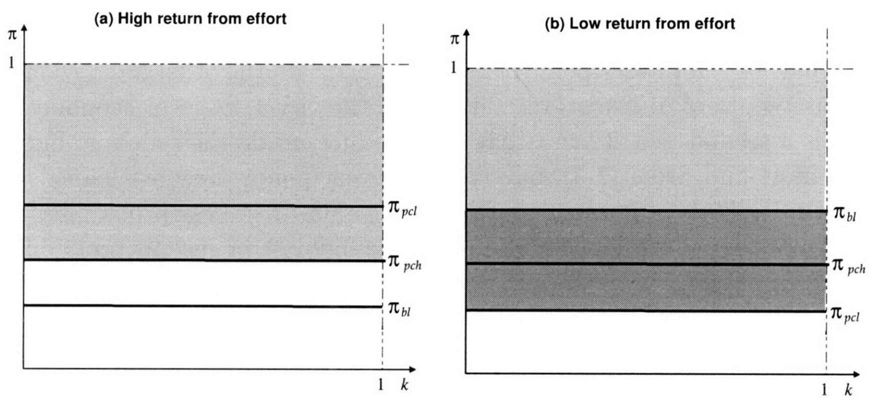


Figure 1.1: First Best Economy

expected to sign the low effort contract if they have drawn π larger than:

$$\pi_{pcl} = \frac{rp_l^{-1}}{W} \tag{1.5}$$

so we will refer to threshold (1.5) as the *low effort participation compatibility constraint* or PCL henceforth. Firms can only be expected to prefer the low effort contract to the high effort one if they have drawn π smaller than:

$$\pi_{bl} = \frac{c(p_h - p_l)^{-1}}{W} \tag{1.6}$$

so we will refer to threshold (1.5) as the *low effort boundary* or BL henceforth.

Like all other results and proofs in section 2, equations (1.4)-(1.6) are derived and developed in B, and are simply the development of (1.2) subject to (1.3).

Sets H are the lightly shaded areas in Figure 1.1 and sets L are the darker shaded areas. Under perfect information, firms are solely discriminated according to their productivity and the level of internal finance or the capital owned by the entrepreneur is totaly irrelevant.

We can have two types of economy. Panel (a) of Figure 1.1 represents the case where $\pi_{pcl} \geq \pi_{pch} \geq \pi_{bl}$, which holds as long as $\frac{p_h - p_l}{p_l} \geq \frac{c}{r}$. Panel (b) represents the case where $\pi_{bl} \geq \pi_{pch} \geq \pi_{pcl}$, which holds as long as $\frac{p_h - p_l}{p_l} \leq \frac{c}{r}$. Economies (a) and (b) both preserve their first best character and have no discrimination among firms by any criteria other than productivity. Economy (a) has only one tier of firms that all exert high effort and, from (1.3), pay rp_h^{-1} for every penny they are loaned. On the other hand economy (b) has two tiers of firms. In addition to the tier 1 firms of economy (a), there is a second tier of firms that will produce inside the economy but not exert effort and, from (1.3), pay rp_l^{-1} for every penny they are loaned.

Ratio $\frac{p_h - p_l}{p_l}$ is a measure of the relative gain in success probability that is derived from effort, since it compares the increase in success probabilities derived from effort with the success probability that the project will have if no effort is exerted. Ratio $\frac{c}{r}$ is a measure of the relative cost of effort since it compares the cost of effort with the alternative use of those resources. As long as the gain derived from effort is higher than the cost, we will be in economy (a) with only one tier. When the gain is lower than the cost we can have a two tier (b) economy, where only very high productivity firms, that have, in a sense, a lot of productivity to protect with their effort will choose high effort finance. Also, among the Tier 2 firms there will be two types. Firms in the $\pi_{pch} - \pi_{pcl}$ range do not derive positive expected returns from effort, but can make a profit executing without effort. On the other hand firms in the $\pi_{bl} - \pi_{pch}$ range expect to derive profits from a low or high effort execution of their project. However, since their productivity is low, when they compare the expected gain from effort with the cost, they prefer low effort finance.

During the next subsections we will assume that effort is relatively important, so that $\frac{p_h - p_l}{p_l} \geq \frac{c}{r}$ and that the first best version of the economy that we distort with a market failure will be the one tier economy represented in panel (a) of Figure 1.1.

1.4 Setup of the Market Failure and the Contract

There are three features that make this a plausible model for an emerging economy. First, it is an economy that depends entirely on international capital markets to finance the implementation of it's most profitable projects (mass 1 of entrepreneurs has $k < 1$). Second it is a financially open economy that faces an exogenous risk free rate (r). Third, there is relevant multidimensional heterogeneity including entrepreneurs with good ideas but very little capital (small k and high π). Two other characteristics of emerging markets that are useful to introduce are relatively high information costs and costly monitoring. These two characteristics will serve us to set up the market failure of this paper.

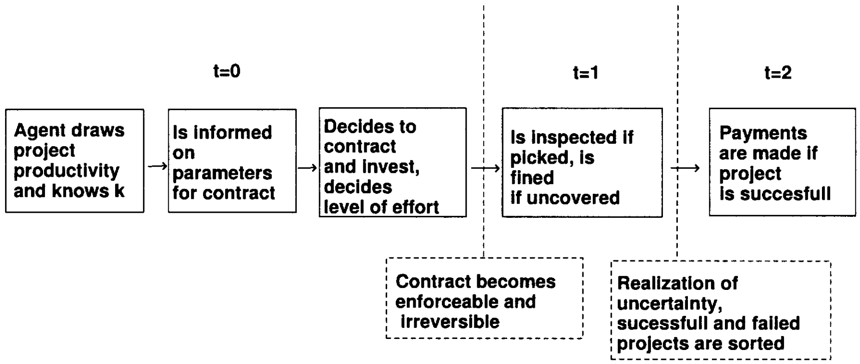


Figure 1.2: Timing of Events

The hidden action problem comes from making effort non observable. Faced with this asymmetric information problem, we will assume that the exogenous banking sector will be able to make use of a costless inspection technology. With probability q it will inspect a firm expected to be expending effort, and will fine it by the amount f if it finds it not to be doing so. Both q and f are exogenous to this economy and are costlessly applied to each marginal firm. The contract signed by the entrepreneur is characterized by $\{k, R_s, q, f, s\}; s \in \{h, l\}$. The contract specifies the amount of the loan $(1-k)$, the rate of the loan $(R_s = rp_s^{-1}, s \in \{h, l\})$, the level of effort expected (h or l), the probability of inspection q and the level of the fine f.

The sequencing of events is presented in figure 1.2, and unfolds in the following way: an agent of capital k draws a project of productivity π, informs himself of the parameters of the contract available in the exogenous banking sector, decides to contract or not (an how) and the level of effort to exert. Once the contract is signed, the firm is subjected to the inspection draw and fined if uncovered to be shirking under a high effort contract. Then, uncertainty is realized, and successful and failed projects are sorted out. Successful projects repay the loan, failed projects do not pay since there is limited liability.

1.5 Hidden Action

Equilibrium in this economy again is described by a pair $(P, R) \in A \times \Re_+^2$ just as in section 2.2, in which all entrepreneurs maximize their expected profits and banks comply with the zero profit free entry condition. Just as in the first best economy, entrepreneurs choose in what subset of the partition they prefer to be. However, since effort is not observable any more, they must choose considering the whole of the contract described in section 2.3. So the entrepreneurs problem is modified slightly from (1.2), it is now to maximize:

$$U(s,z) = p_s\left(\pi W - (1-k)R_z\right) - kr - c_s - qf(z,s) \tag{1.7}$$

by choosing actual effort $s \in \{h,l\}$ and promised effort $z \in \{h,l\}$, where $\{c_h, c_l\} = \{c, 0\}$ as before, but now also

$$f(z,s) = \left\{ \begin{array}{ll} f & \text{if } z \neq s \\ 0 & \text{if } z = s \end{array} \right\} \tag{1.8}$$

and since we have assumed the inspection technology of the banks to be free (very cheap or just rationed) banks will lend so that the zero profit condition (1.3) is satisfied for every penny lent.

We can characterize the imperfect information equilibrium equilibrium of this economy in the following way. Firms owned by entrepreneurs with capital k can credibly promise to exert effort if they have drawn π larger than:

$$\pi_{ich} = \frac{(1-k)rp_h^{-1} + (c - fq)(p_h - p_l)^{-1}}{W} \tag{1.9}$$

so we will refer to constraint (1.9) as the *high effort incentive compatibility constraint* or ICH henceforth. It is important to notice that equation (1.9) has a negative slope on the $\{\pi, k\}$ plane. Set H of Tier 1 firms will be bounded from below by the upper envelope of equations (1.9) and (1.4). Set L of Tier 2 firms (if existent) will be bounded from below by (1.5) and from above by the lower envelope of the lower bound of the aforementioned Tier 1 set.

Figure 1.3 shows the effect of the market failure on this economy. Consider panel (a), two notorious things happen as a result of non observable effort. First, a whole section of the economy (triangle ACD) looses it's access to high effort interest rates. The losers tend to be highly productive

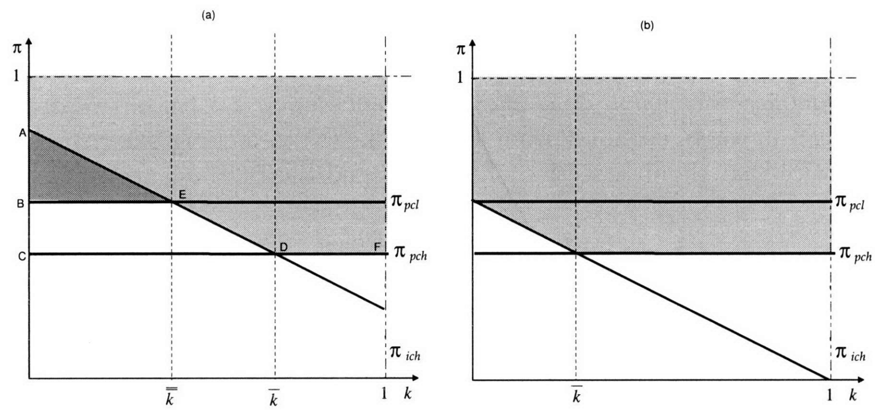


Figure 1.3: Dual Margins and Dual Economies

firms that are the property of poorer entrepreneurs. The most productive among these losers (subtriangle ABE), manage to stay eligible for low effort interest rates. These firms stop exerting effort but continue to produce, albeit with more expensive financing. Compared to the first best economy of Subsection 2.2, there are two sources of welfare loss: the entrepreneurs of rectangular trapeze BCDE seize to produce inside the economy and the fall in expected profits for entrepreneurs of triangle ABE.

The information asymmetry has created an economy with a triple margin and dual tiers of firms. Margin DF is a participation constrained margin conformed of the least productive active entrepreneurs of the economy. These entrepreneurs are relatively wealthy and are able to secure low cost finance for their projects. Since they have abundant internal resources to invest in the project, their incentives are aligned with the project and the ICH constraint is not binding (they are betting mostly with their own money). Margin DE is a incentive constrained margin of less wealthier entrepreneurs that compensate this handicap with an increasing level of productivity. Margin BE is a participation constrained margin conformed of the most productive marginal entrepreneurs of this economy. These entrepreneurs are relatively poor and are able to secure only high cost finance for their projects. Finally, margin EA is an internal margin of this economy, a frontier between Tier 1 and Tier 2 projects (and consequently high or low interest rates). It is a incentive constrained margin composed of projects of the highest quality owned by the poorest entrepreneurs. Generally speaking, however, this economy could look like the one in panel (b) where there is no Tier 2 and the economy only has a dual margin. In subsection 2.4 below, we discuss what can move an economy from looking like (a) to looking like (b).

Notice that the intersection of the ICH and the PCH occurs at:

$$\bar{k} = \left(\frac{c}{r}\right)\left(\frac{p_l}{p_h - p_l}\right) - \left(\frac{fq}{r}\right)\left(\frac{p_h}{p_h - p_l}\right) \tag{1.10}$$

so the sufficient condition for this economy to have a dual margin is that the relative benefit of effort $\frac{p_h - p_l}{p_l}$ is larger than the cost of effort $\frac{c}{r}$. This is the same condition that we needed in section 2.2 to have a first best economy with only one tier like the one represented in panel (a) of Figure 1.1. Hence, under these conditions the existence of a second tier and the existence of a dual margin can both be attributed to the market failure that results in the imposition of the ICH constraint. More generally, if the effect of effort were not so large, and our first best baseline were panel (b) of Figure 1.1, $\bar{k}$ could be larger than 1 or not. In any case, the effect of the market failure would be to create a dual margin between tiers and to deny low cost finance to a triangle of highly productive yet relatively poor entrepreneurs.

Also note that introducing a more general effort function does not alter qualitatively the model, but does change the geometry and reduce it's elegance. Consider a function $c(\pi)$ such that more productive projects require more effort. Equations (1.4)-(1.6) will not be affected in their forms (they will continue to be flat) but may be affected in their sensitivity to parameters. On the other hand, equation (1.9) will cease to be a line. If the effort function is concave (which is the most reasonable assumption), then the ICH will be convex, so that incentive compatibility does not relax very much with grater k, but does so with greater π. Conversely the ICH will be concave if the effort function is convex. So, the model is not altered substantially, as it will not if we introduce more general inspection effectiveness functions $f(\pi)$.[1]

In the following subsections, we will do comparative statics on the three margin two tier economy of panel (a) in Figure (1.3).

[1]The slope of the ICH from equation (1.9) with a general function $c(\pi)$ rather than c is: $\frac{\partial \pi}{\partial k} = -\frac{r p_h^{-1}}{W - \frac{\partial C}{\partial \pi}}$ It is negative, and becomes less negative with π if the effort cost function is concave.

1.6 Comparative Statics of the Dual Economy Model

1.6.1 Capital Flows and Capital Controls

We can represent capital controls in this economy as taxes either on capital inflows or outflows. A tax on inward capital flows will also be equivalent to a shock to the idiosyncratic rates that local firms face in international capital markets.[2] Conversely we can represent a capital control on outward flows as a tax that diminishes the profitability of investing in the risk free outside option. So the entrepreneurs problem is again modified slightly from (1.7), it is now to maximize:

$$U(s,z) = p_s\left(\pi W - (1-k)(1+t_{in})R_z\right) - kr(1-t_{out}) - c_s - qf(z,s) \quad (1.11)$$

by choosing actual effort $s \in \{h,l\}$ and promised effort $z \in \{h,l\}$, where $\{c_h, c_l\} = \{c, 0\}$ and

$$f(z,s) = \left\{ \begin{array}{ll} f & \text{if } z \neq s \\ 0 & \text{if } z = s \end{array} \right\} \quad (1.12)$$

where t_{out} is the tax on capital outflows and t_{in} is the tax on capital inflows. Banks will continue to lend so that the zero profit condition (1.3) is satisfied for every penny lent.

The new thresholds are

$$\begin{aligned} \pi_{ich} &= \frac{(1-k)(1+t_{in})rp_h^{-1} + (c-fq)(p_h-p_l)^{-1}}{W} \quad (1.13) \\ \pi_{pch} &= \frac{((1-t_{out})r + c - rk(t_{out}+t_{in}))p_h^{-1}}{W} \\ \pi_{pcl} &= \frac{((1-t_{out})r - rk(t_{out}+t_{in}))p_l^{-1}}{W} \end{aligned}$$

and are derived in B.

An ad-valorem tax of rate t either on outward or inward capital flows will drive a wedge between the passive and active interest rates faced by this

[2] A shock could be a diminishment in the international taste for assets in this economy, such as shifts to quality in international capital markets that drives lenders away from emerging markets, or an expected devaluation of the currency for some reason exogenous to our model.

economy.[3] Geometrically this will cause both participation constraints to acquire a slope since the alternative cost of funds will now be different from the marginal cost of credit that firms face.

The inflow tax will be increasingly costly for poorer entrepreneurs, since a larger proportion of their investment will be financed with credit. The outflow tax (levied only on residents), on the other hand, will usher investment into the economy by reducing the returns of the outside option. This effect will be stronger for richer entrepreneurs that actually have funds to invest in the outside option. Moreover, the PCL constraint will become steeper than the PCH constraint for the same tax, since the tax is not affecting the cost of effort which is an important part of the high effort participation choice but is not part of the low effort participation choice. On the other hand, the effect on the participation constraint is totally different in one case or the other. The incentive constraint compares two options for executing the project inside the economy considering the cost of effort. The tax on capital inflow makes the return from effort lower. The tax on capital outflow does not affect this constraint, rather, it affects the constraints that compare an option inside the economy with an option outside the economy. Hence, the ICH constraint will become more restrictive in the case of a tax on inflows and will not change in the case of a tax on outflows.

Figure (1.4) shows the effects of taxes on capital flows on this economy. Panel (a) shows the effect of a tax on capital inflows. The lighter shaded area represents Tier 1 firms that are downgraded to Tier 2 and consequently charged a higher interest rate. The darker shaded area indicates firms that are no longer financed. As a result of the pivoting of the constraints that was discussed in the previous paragraph, the majority of the adverse effects are on poorer entrepreneurs with projects of relatively high productivity.

Panel (b) shows the effect of a tax on capital outflows. The darker shaded area indicates new projects that are financed as Tier 2, and the lighter shaded area indicates new projects that are financed as Tier 1. As a result of the pivoting of the constraints that was discussed in the previous paragraph, new low quality projects are financed among relatively rich entrepreneurs, although they would have preferred to invest abroad.

Finally panel (c) indicates an economy that closes financially, that is, that levies a tax on all capital outflows or, equivalently, a tax on inflows

[3]Here, for purely expositional purposes we assume that the a capital flow that has been charged when coming in is not charged when it goes back out (when credit is settled). Moreover, conceptually a tax on capital outflows is a tax on all capital flows that are relevant for this economy. So the capital outflow tax that we present is a capital outflow tax on residents in the economy.

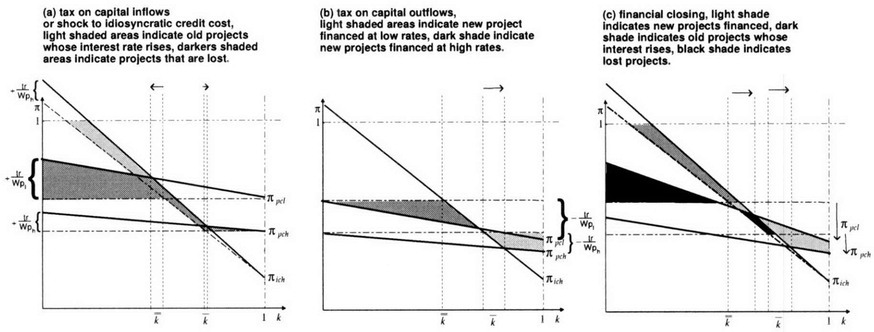


Figure 1.4: Capital Controls, Taxes on Capital Flows or Shocks, and Closing the Economy Financially

from non-residents and a tax on outflows from residents. The light shaded areas indicate new firms that come into existence as a result of the financial closing of the economy. The darker shaded area indicates Tier 1 firms that are downgraded to Tier 2, and the black areas indicate firms that loose access to finance. The result of the financial closure of this economy, is a transfer of finance from high quality projects owned by poor entrepreneurs to low quality projects owned by rich entrepreneurs, and an aggregate loss of welfare.

The effect of capital flow taxes in this model can be interpreted to represent the effects of any form of imperfect or costly access to international lending by domestic entrepreneurs. Quantum restrictions such as capital controls and quantum total lending constraints faced by countries can be interpreted as a convex tax function $t(L)$ that is a function of total lending to the economy L.[4] In this case, equilibrium continues to be described by the partition of entrepreneurs into three sets, plus an equilibrium tax rate, but it is no longer constrained efficient due to the assumed externality. A development of policy choices faced by the government of such an economy is developed in section 3.2 below.

In the following subsection, I will do comparative statics on a three margin two tier economy, such as the one I use in Figure (1.4) that faces some form of imperfect access to international lending. Hence, participation

[4] A microfoundation of how a country can end up sharing assets when dealing with international credit markets can be found in the series of papers by Caballero and Krishnamurthy quoted in the References.

constraints will have a slope, as we have derived in this subsection.

1.6.2 Financial Policies and Development

Financial development can be represented in this model by an increase in the enforceability of the promise to expend high effort. Hence, it can be represented by an increase in the expected fine fq. This increase affects only the ICH constraint as is clear from inspecting equation array (1.13).

Panel (a) of Figure 1.5 shows the increase in the expected fine as a parallel relaxation of the ICH constraint. The light shaded area is the set firms that are upgraded from Tier 2 to Tier 1 status, the dark shaded area is the set of new projects that become eligible for finance. Three things are important to notice. First, the effect is concentrated among poorer entrepreneurs with higher quality projects. The reason for this is that entrepreneurs on this margin are "working with other peoples money" so their main problem is contracting and promising effort. Second, all the new projects are financed as Tier 1, since low effort contracting is not affected. Third, a negative shock to financial contracting, such as reduced enforceability, or even a credibility shock were international banks adjust downwards their belief about q, will have the same effects in reverse: concentrating it's effect on incentive constrained, poor, highly productive entrepreneurs. In the limit, by implementing policies that increase enforceability from abroad and transparency, economies will transit from the three margin two tier configuration of panel (a) of Figure 1.3 to the two margin one tier configuration of panel (b).

An alternative to increasing fq for the whole economy is to lower the technological cost of effort c. This is a very common type of policy towards poorer and smaller entrepreneurs. The effect of a subsidy to c is shown in panel (b) of Figure (1.5) and it's magnitudes are straightforward from equation array (1.13). Geometrically it is a parallel shift downward of all the constraints, although the effect will be different for each of them. There will be a large area of new firms financed as a result of the policy, an these firms will be of all qualities and types of owners. The effect, however, will be larger for poorer entrepreneurs for two reasons. First, there will be an area of poor but productive Tier 2 entrepreneurs that will be upgraded to Tier 1. Second, the effect of the reduced technological cost of effort on the ICH constraint will be larger than on the PCH constraint since promising effort is much more critical for incentive constrained entrepreneurs than for participation constrained entrepreneurs. Hence, even if technical support is not focalized on poorer entrepreneurs, it will end up having a larger effect

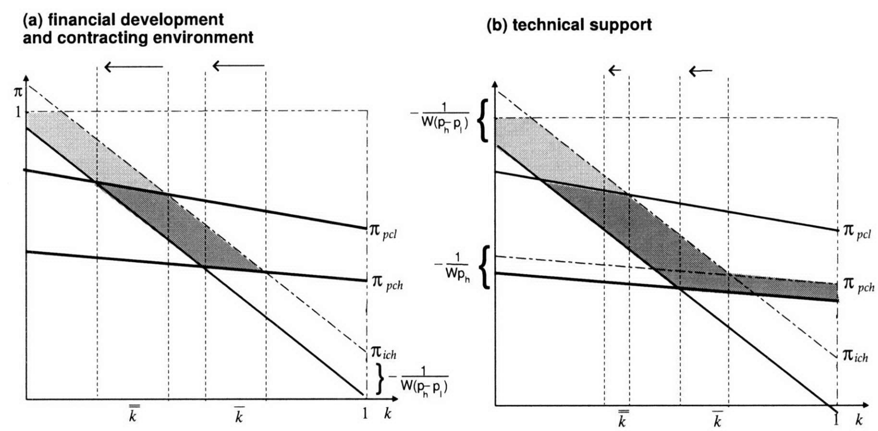


Figure 1.5: Financial Development and technical support

on them since it is they who are on the incentive constrained margin.

Notice that a development policy that provides technical support to the projects, that is, that increases π for all firms (or for all that request it) will shift all margins down in the same distance, and hence relax the constraints of entrepreneurs of all k and π. This policy can, of course, be focalized on poorer entrepreneurs with higher quality projects. However, the policy of providing technical support to the effort associated with the contracting problem will naturally be focalized on poorer entrepreneurs that own higher quality projects.

Microfinance policies, usually consisting of small and cheap loans to poor entrepreneurs (usually to entrepreneurial cooperatives) can be introduced in a simple way into this model by assuming that the development agency gives a gift of $\alpha(1-k)$ to every entrepreneur of capital k. Unfortunately, the development agency will face a hidden action problem in verifying that entrepreneurs actually end up investing in the project and do not deposit the funds (incremented with the subsidy) in the risk free outside option. This turns out to be critical when evaluating the effects of this policy. Panel (a) of Figure 1.5 shows the effect on this economy of microfinance policy α when investment by the entrepreneur is verifiable by the development agency. All three constraints pivot in the same way that they would if the outflow tax were lowered. Moreover, the effect on the PCL constraint is larger than the effect on the PCH and ICH constraints (which are equal), once again

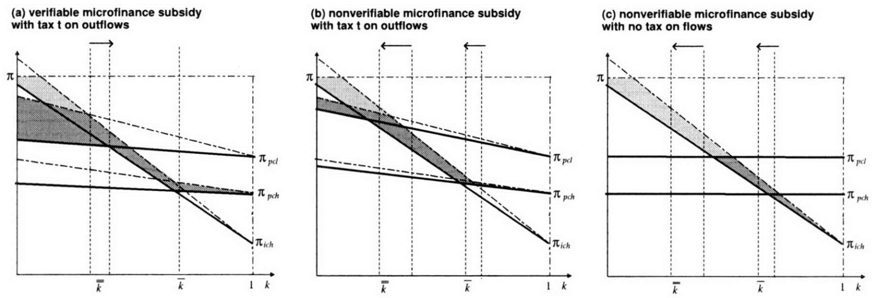


Figure 1.6: Microfinance

because an increase in capital directly targets the whole problem that a low effort entrepreneur faces, while the high effort entrepreneurs problem with the cost of effort is not being helped directly.

In panel (a) we can see very high creation of high quality firms among poorer entrepreneurs. In panel (b) we make it impossible for the development agency to verify if the subsidized entrepreneur actually invested or just deposited its increased funds at rate r. The effect on participation constraint almost disappears (see B). In fact, in panel (b) at $k = 0$, the effect on both participation constraints will be smaller than in panel (a) by the proportion $t/(1+t)$. Panel (c) shows how the effect completely disappears when $t \to 0$ if investment is not verifiable by the subsidiser.

In the following subsection, we will do comparative statics on the simpler economy with no taxes to capital flows.

1.6.3 International Shocks

International recessions for this economy are a general fall in the aggregate gross productivity W from which firms extract with varying degrees of efficiency. Panel (a) of Figure (1.7) shows a the effect. As proven in B, the effect will be larger for marginal firms of higher productivity (the darker shade in the figure). Intuitively this is due to the fact that these firms depend almost completely on their capability of extracting from aggregate productivity to convince banks to lend to them. Moreover, they depend on their capacity to extract productivity to convince themselves to participate, so even the PCL constraint will contract significantly. In this case, there will be a relatively large mass of the most productive firms owned by the poorest entrepreneurs

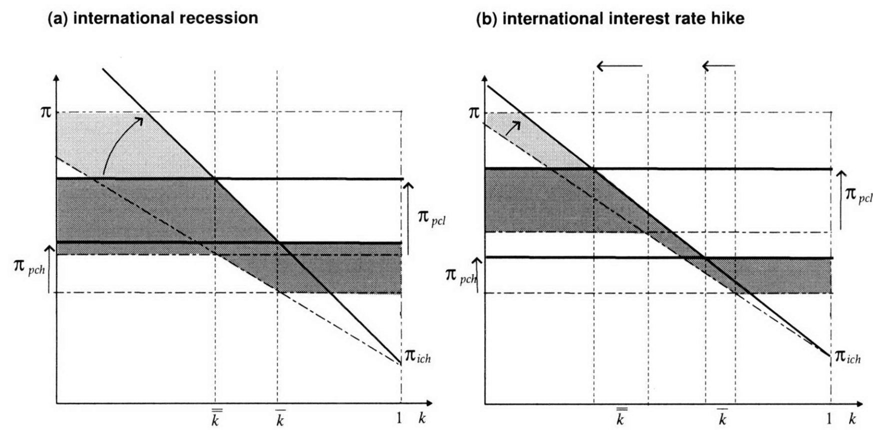


Figure 1.7: Capital Controls, Taxes on Capital Flows or Shocks, and Closing the Economy Financially

that will be downgraded from Tier 1 to Tier 2.

An international increase in interest rates is similar to the international recession in the way it moves the constraints, but different in the relative size of the adjustments of each margin. In this case (see B), the PCL margin adjust the most since it is these firms that are exclusively comparing productivity with outside options (with no role for effort). The ICH constraint will pivot on $k = 1$ since firms that finance themselves with internal funds will not feel that the financial cost of effort has changed very much when the interest rate increases. Finally, as $k \to 0$ the effect on the ICH and PCH constraints becomes the same, since the absence of internal funds becomes the overriding problem in both deciding to participate and convincing creditors to loan at the low rate. In this case, once again, the most affected projects are high quality ones owned by poorer entrepreneurs. A nuance of this last shock is that projects of middle income entrepreneurs are affected less than those of richer entrepreneurs. This happens because the richest entrepreneurs are participation constrained and will move their funds to the outside riskless option very quickly. Middle income entrepreneurs don't have enough funds to make that option profitable. On the other hand, credit is not such a large proportion of their funding as for poorer entrepreneurs.

1.6.4 Summary

I have shown how a very simple static economy with heterogeneous entrepreneurs can have firms with dual access to credit (two tiers of financed firms and non financed firms), although projects are identical. I have shown how this can depend on the existence of a simple asymmetric information problem of the hidden action variety with the absence of externalities. I have shown how this economy can also display dual or even triple margins, and how these margins have different sensitivities to a variety of shocks and policies. In all cases, the effects of shocks (positive and negative) as well as different varieties of development policies are larger on the margin composed of poorer entrepreneurs. The central feature of this paper is that these poorer and more sensitive entrepreneurs happen to own the most productive marginal projects in the economy.

1.7 Extensions and Generalizations, Risk and Size

1.7.1 Risk

Up to this point we have assumed that the entrepreneurs of this economy are risk neutral. Also, the banks do not face any risk since they hold portfolios composed of a continuum of identical entrepreneurial projects. In this section we will introduce different types of risk, and analyze how it affects the mapping of this economy into different credit contracts zones.

Call $\nu_x \sim \nu(\epsilon, x)$ any mean preserving shock that affects a parameter x of the economy with a standard deviation of ϵ. In order to remember them we can label the shocks in the following way: call ν_w domestic productivity risk, ν_r international credit risk, and ν_c domestic institutional risk. Two of these types of risk are domestically generated, and one is imported, but all are exogenous to the problem. Assume that entrepreneurs have a concave utility function $U(.)$. As a result the entrepreneurs problem is modified slightly from program (1.7). Now each entrepreneur has to maximize expected utility:

$$EU(s,z) = EU\begin{pmatrix} p_s\left(\pi(W+\nu_w) - (1-k)(r+\nu_r)p_z^{-1}\right) \\ -k(r+\nu_r) - c_s - qf(z,s) \end{pmatrix} \tag{1.14}$$

by choosing actual effort $s \in \{h, l\}$ and promised effort $z \in \{h, l\}$, only now $\{c_h, c_l\} = \{c + \nu_c, 0\}$, and as before

$$f(z,s) = \begin{Bmatrix} f & \text{if } z \neq s \\ 0 & \text{if } z = s \end{Bmatrix} \tag{1.15}$$

and, we are already assuming in equation (1.14), that the zero profit condition (1.3) is satisfied for every penny lent.[5] For the sake of simplicity, we have assumed that the cost of effort c_s is potentially subject to risk, and not the monitoring probability q or the fine function $f(z,s)$, since introducing the mean preserving shock to any of them delivers the same results.

We can characterize the imperfect information equilibrium equilibrium of this economy in a similar way to that of section 2.4. Firms owned by entrepreneurs with capital k and productivity π can credibly promise to exert effort if:

$$EU(l,h) \leq EU(h,h) \tag{1.16}$$

which is our incentive compatibility constraint. Firms will be willing to participate in high effort contracts only if:

$$0 \leq EU(h,h) \tag{1.17}$$

which is our high effort participation constraint PCH and they will be willing to participate in low effort contracts only if:

$$0 \leq EU(l,l) \tag{1.18}$$

which is our low effort participation constraint PCL.

Since all shocks are mean preserving and independent and the utility function is concave, all expected utilities will fall as a result of an amplification of any source of risk. The transition from an economy with no risk to one with risk will be a particular case of the amplification of ϵ. Hence, from equations (1.17) and(1.18) we see that both the PCL and the PCH will tighten as a result of an increase in any of the three types of risk sources, with the exception of domestic institutional risk ν_c that will not have an effect on the PCL constraint, since the enforcement of effort is not relevant for this type of contract.

It is interesting to note from equation (1.14) that the domestic productivity shock is amplified by π and p_s. This will mean two things. First, that the constraint will tighten more for higher productivity marginal firms.

[5]Instead of the term R_z that we had in equation (1.7) we have the explicit interest rate when the zero profit constraint is satisfied: rp_z^{-1}

Second, that the PCH constraint will tighten more than the PCL constraint, since the shock has a grater amplification. The intuition is simple: entrepreneurs that would have contracted high effort credit contracts have more riding on productivity than others. Uncertainty on these return will discourage them from signing these contracts and committing to high effort. Also note that the international credit risk ν_r will have the same effect on both EU(h,h) and EU(l,l), and will have the same effect on entrepreneurs of all productivity levels and wealth. These effects are represented in Figure 1.8. Proofs can be found in C.

To see the effect of risk on the ICH constraint we must see if EU(l,h) or EU(h,h) tightens more with an the amplifications of ϵ. The simplest case is the amplification of domestic institutional risk (ν_c), since this random variable is in EU(h,h) (which will fall) but not in EU(l,h). Hence, an increase in domestic institutional risk will unambiguously tighten the ICH constraint, making it less possible to credibly commit not to shirk.

The amplification of international credit risk (ν_r) generates different effects on EU(h,h) and EU(l,h). In C, we prove that the ICH will pivot and tighten less than the PCH and PCL constraints. The intuition is similar to the one that is behind the existence of multiple margins in this economy. International credit risk has two effects on contracting: on the zero profit interest rate that is charged by banks, and on the returns on the outside option that is faced by entrepreneurs. Since entrepreneurs need to complete the investment of 1, they will either be paying an interest rate for whatever capital they borrow, or foregoing the interest rate that they would earn on the capital that they already have. Hence, the amount of capital that they have does not amplify the effect of the increase in risk. On the other hand if the entrepreneur contracts on effort and then shirks, the interest rate on the outside option and the opportunity cost are different. Moreover, since the benefits of shirking dilute away as $k \rightarrow 1$, so will the effect of this wage and, hence, the effect of risk on the ICH constraint.

The amplification of domestic productivity risk (ν_w) will have a smaller effect on EU(l,h) than on EU(h,h), for the marginal firm, since it is amplified by the technological success probability that is actually chosen. Hence, again the ICH will contract, in this case, amplified by productivity π, so it's slope will increase.

In Figure 1.8 we put together the effects on the three types of constraints for two types of economy. The top three panels show the effects on a dual margin economy such as the one we presented in panel (b) of Figure 1.3, the bottom three panels show the effects on a triple margin economy such as that of panel (a) of Figure 1.3. It is important to note that the effects

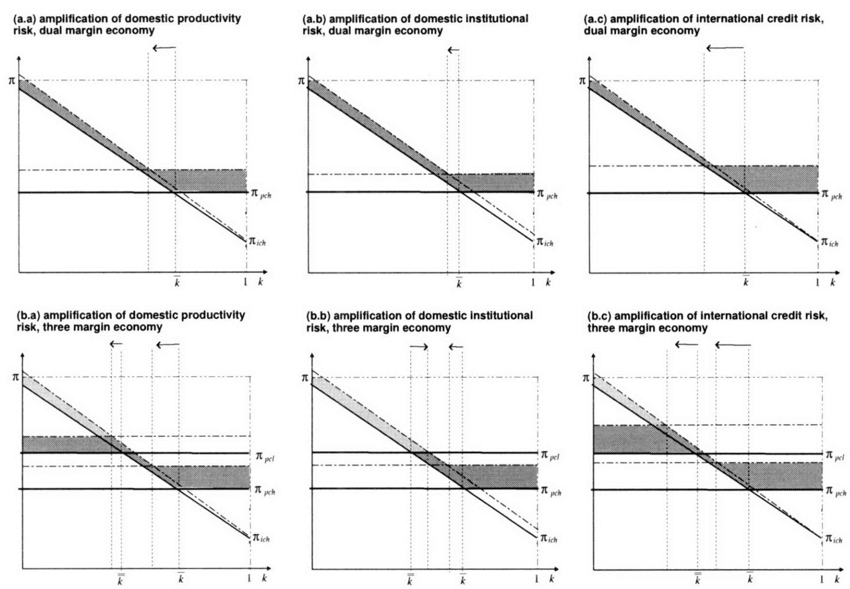


Figure 1.8: Effects of Risk Amplification

of heterogeneous k or π on the amplification of shocks is, in this case, circumscribed to the ICH constraint since we are asuming an economy with no taxes or distortions that make the participation constraint slopes, such as those studied in the last subsections of section 2.

As we can see, the effect of a domestic institutional risk amplification is identical to that of a international credit risk amplification (panels a.a, a.c, b.a and b.c of Figure 1.8). In both cases, the effect is concentrated on the participation constrained margin composed of low productivity yet relatively wealthy entrepreneurs. This is especially true in the dual margin economy, where the effect on poorer and higher productivity entrepreneurs is circumscribed to the tightening of the ICH constraint. We prove in the C that the contraction of ICH will be less than the contraction of PCH for any level of k. There is a powerful intuition behind this result and it is the following: the ICH curve is the result of comparing two projects inside the economy, the PCH curve, on the other hand is the result of comparing a project within the economy with a project outside of it. In the case of the domestic productivity shock it is very clear why it makes the domestic economy relatively more risky than the outside option, and hence tightens the PCH constraint more. In the case of the international credit risk it also ends up making the domestic economy more risky. ¿Why? Well, because entrepreneurs that invest inside the economy will save interest rate payments on the amount of k, while if they stay outside they will receive payments for k. It makes no difference. ¿What changes? Well, if they stay inside the economy, the international credit risk becomes risk on the margin that they keep on the productivity of their borrowed capital

In the case of the triple margin economy this changes slightly since we now have to add the effect of the tightening of the ICL constraint on the Tier 2 firms. Now, part of the highest productivity IC constrained firms suffer only an interest rate increase (light shaded areas). Still the effect on richer entrepreneurs is greater in the case of an amplification of domestic productivity risk ν_w because, as shown in C, the contraction of the PCH constraint is larger than that of the PCL constraint. In the case, of international credit risk, they are the same.

Consider the amplification of domestic institutional risk ν_c, that is, uncertainty on the cost of shirking. In this case, as shown in C, the ICH constraint will tighten less than PCH. The intuition, as above, is that the PCH compares the project inside the economy with one outside, while the ICH compares two projects inside. An amplification of the risks involved in being inside the economy will affect more entrepreneurs that are participation constrained.

This general intuition behind this section has two implications. First, riskier economies will be predominantly drained of wealthy, but relatively low quality entrepreneurs. Second, average interest rates charged to these economies will, naturally, increase, but will not across the whole economy, but rather across the incentive constrained margin of poorer and productive entrepreneurs.

Finally, it must be pointed out that in this economy all entrepreneurs have the same residual risk aversion as far as the model is concerned. In reality, it might be the case that richer entrepreneurs have several projects, that they are able to hedge against each other, while poorer entrepreneurs only have one. In the extreme, a rich entrepreneur, could own a continuum of projects and face no risk at all. This could make the effects of this economy less realistic.

1.7.2 Size

In this section we outline a model of an identical economy to which we add an additional source of heterogeneity: size, understood as the scale of the project relative to the capital owned by the entrepreneur. It's interesting to understand how the size of the projects would enter into our model since, as we have shown in subsection 1.1, most empirical evidence on heterogenous reactions to shocks is constructed using size as a proxy of firm fragility (even most of our own). The model of this paper, up to now, does not consider heterogeneity in size. Moreover, all projects required an investment of 1, but had different returns. In this section we will show that including this source of heterogeneity, maintains the characteristics of the model and generates an economy in which size is correlated with fragility on the margin.

The model can be adapted with great ease. Up to this point all projects return πW as a result of an investment of 1. Now, we will assume that all projects will return $\phi\pi W$ as a result of an investment of $0 \leq \phi \leq 1$, so this parameter will be our indicator of both the scale of a project and the required investment. Before writing out the program to be solved in characterizing the contracts that will finance each project, we must note a nuance of this section: that in this economy there will be an area of entrepreneurs that will not require external finance to execute their projects. That is, all entrepreneurs for which $\phi \leq k$ will finance their projects directly and even invest their remaining capital in their outside option k. The constraints will, therefore, be relevant for the space of entrepreneurs that do not have enough capital to finance their projects on their own.

Now we must redefine $A = \{\{H, L, O, S\}_i\} \subset \Re^3$ the set of all possible partitions of space $B = [0,1] \times [0,1] \times [0,1]$ such that $H \cup L \cup O \cap S = B$ and $H \cap L \cap O \cap S = \emptyset$. Sets H, L O and S describe collections of entrepreneurs described by a pair (π, k). H is the set of entrepreneurs that are financed to execute their project with a high level of effort, a set of firms that we will call Tier 1 from now on. L, is the set of entrepreneurs that are financed to execute their project with a low level of effort, and we will call Tier 2 henceforth, set O, is the set of entrepreneurs that decide to invest outside the economy, and finally, set S is the set of entrepreneurs for which $\phi \leq k$, that are able to invest in the project without external finance. Call $R = (R_h, R_l) \in \Re^2_+$ a vector describing the interest rate structure of this economy. Equilibrium in this economy is described by $(P, R) \in A \times \Re^2_+$ such that all entrepreneurs maximize their expected profits and banks comply with the zero profit free entry condition.

The entrepreneurs problem is modified slightly from (1.7), it is now to maximize:

$$U(s,z) = p_s\left(\phi\pi W - (\phi - k) r p_z^{-1}\right) - kr - c_s - qf(z,s) \tag{1.19}$$

if $\phi \leq k$. The maximization is done by choosing actual effort $s \in \{h, l\}$ and promised effort $z \in \{h, l\}$. To be as general as possible we will assume that the cost of effort is proportional to the size of the project $\{c_h, c_l\} = \{c\phi, 0\}$ and also, that the fine (of enforced) is proportional to the size of the project, although this is maybe less intuitive.

$$f(z,s) = \left\{ \begin{array}{ll} f\phi & \text{if } z \neq s \\ 0 & \text{if } z = s \end{array} \right\} \tag{1.20}$$

and we are already assuming in equation (1.19) that banks will lend so that the zero profit condition (1.3) is satisfied for every penny lent. If, on the other hand $\phi \geq k$, the entrepreneur will always execute the project as long as $\phi W \geq r$, or otherwise will simply invest abroad.[6]

The new thresholds will be

[6]In our model internal funds are always cheaper than external funds. The cost of internal funds is r while the cost of external funds is rp_s^{-1} depending on what level of effort s was promised.

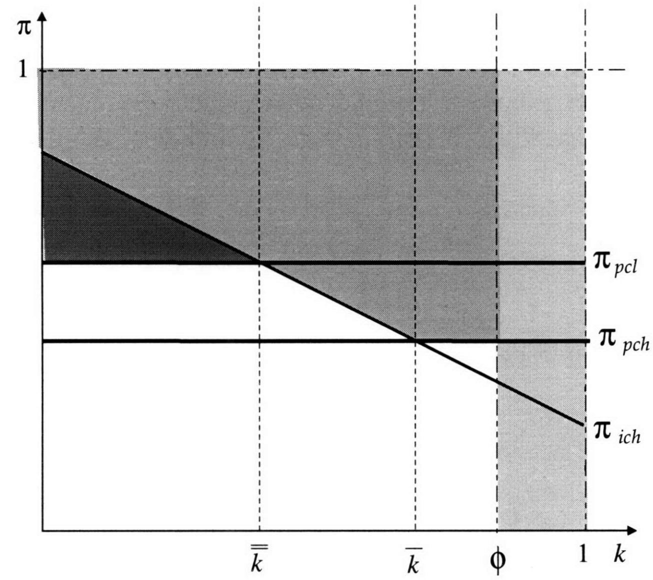


Figure 1.9: Slice of B at Size ϕ

$$
\begin{aligned}
\pi_{ich} &= \frac{(1-k\phi^{-1})rp_h^{-1}+(c-fq)(p_h-p_l)^{-1}}{W} \\
\pi_{pch} &= \frac{(r+c)p_h^{-1}}{W} \\
\pi_{pcl} &= \frac{rp_l^{-1}}{W}
\end{aligned} \tag{1.21}
$$

and it is especially important to note that size does not affect any of the participation constraints resulting from the model. The reason is that the participation constraints result from the comparison of the use of capital inside and outside of the economy. The scale of the project on the other hand has to be dealt with using credit, and hence is constrained by incentive problems. In the case of the ICH constraint scale is critical, since a larger project will increase the return from effort, and hence make promises more credible.

Figure 1.9 shows a slice of the partition at size *phi*. In addition to the areas with the two tiers of firms and the area of entrepreneurs that are not able to finance the project, there is now an area of entrepreneurs (lightest shade) that are able to self finance their projects.

If we assumed the cost of effort and fines not to be proportional to the size of the project, Figure 1.9 would not change very much (although it's comparative statics will). If $\{c_h, c_l\} = \{c, 0\}$ and also, the fine of equation (1.20) is back to

$$f(z,s) = \left\{ \begin{array}{ll} f & \text{if } z \neq s \\ 0 & \text{if } z = s \end{array} \right\} \tag{1.22}$$

then, the constraints become

$$\begin{aligned} \pi_{ich} &= \frac{(1-k\phi^{-1})rp_h^{-1} + (c-fq)\phi^{-1}(p_h - p_l)^{-1}}{W} \\ \pi_{pch} &= \frac{(r + c\phi^{-1})p_h^{-1}}{W} \\ \pi_{pcl} &= \frac{rp_l^{-1}}{W} \end{aligned} \tag{1.23}$$

and the PCH becomes sensitive to size since effort acts as a fixed cost that is being compared to a benefit that is proportional to size. On the other hand PCL remains insensitive to size. For robustness, we will analyze both cases.

In Figure 1.10 we show the change in the constraints for two sizes $\phi_h \geq \phi_l$. The top panels illustrate the effects on the two tier economy of panel (b) in Figure 1.3, and the bottom two panels illustrate the effects on the three tier economy of panel (a) in Figure 1.3 Panels (a.a) and (b.a) show the case of equation array (1.21) with total proportionality to size in the costs of effort and fines. Panels (a.b) and (b.b), on the other hand, shows the case of equation array (1.23) where there is no such proportionality. In all cases, the increase in size of the project has the trivial effect of leaving out a group of marginal low productivity projects owned by wealthy entrepreneurs. They are not eligible for contracting and they cannot finance this size of project, so they will be investing abroad.

When effort costs and fines are proportional to size, the only effect of size will be that the ICH constraint will tighten for larger projects. As the size of the project increases, it becomes less and less credible for the entrepreneur to pledge effort, since, the moral hazard problem becomes more and more important. The entrepreneur's capital is a lower proportion of the

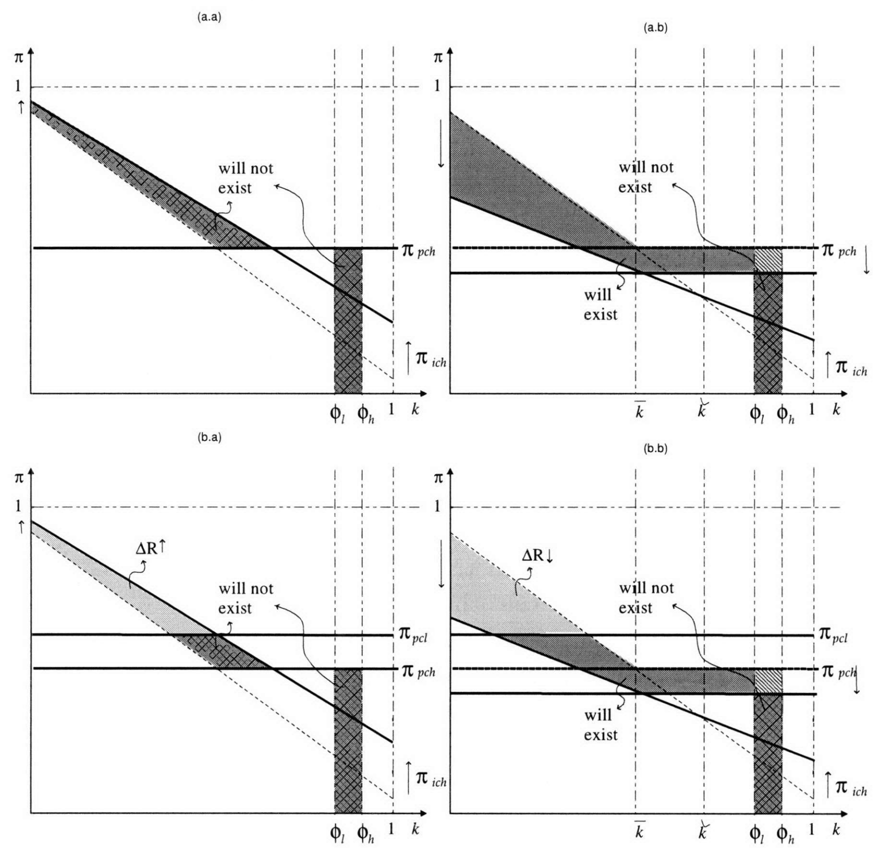


Figure 1.10: Effect of Size ϕ

investment and enforcing effort is more and more difficult. Moreover, this effect of size is more important when capital is the main source of incentive compatibility (larger k) and less when productivity is the source of incentive compatibility (larger π) since productivity will be high for the whole project no matter it's size. Hence, the ICH constraint become more elastic for slices of B at higher sizes ϕ. In this case, then, less projects are financed at higher scales, and the entrepreneurs that loose credit to scale are mostly poor and own highly productive projects. In the case of the triple margin (panel b.a.) an important portion of these entrepreneurs will be offered credit at Tier 2 interest rates. Hence, in this economy we should not expect size to be correlated with either productivity or wealth, and moreover, we should expect size to be correlated with higher interest rates. All of which is, of course, not realistic.

When effort costs and fines are not totally proportional to size, the model starts giving more realistic stylized predictions. Two thing change. First, the PCH curve is now relaxed by the growing scale of projects. The reason is that the cost of effort starts to act as a fixed cost that is diluted with size. Secondly, the ICH constraint pivots around a fixed point $\check{k}$ (see C for proofs) as the amplification of moral hazard that we described in the previous paragraph due to the decreasing of the proportion of investment financed by the entrepreneur interacts with another effect. In this case moral hazard is loosened due to the dilution of the cost of effort. Hence, for poorer entrepreneurs that rely on productivity to commit credibly to effort, the ICH constraint will relax. On the other hand, less productive IC constrained marginal entrepreneurs, that rely on their wealth to overcome moral hazard, the ICH constraint will tighten. Fortunately for them we can prove (see C) that all of the entrepreneurs for which the ICH constraint tightens will be in fact participation constrained, and since the PCH constraint relaxes, they will, in fact be benefited by size. Hence, in this other economy we should expect size to be correlated with both higher average productivity, less financial constraints (just like Gertler and Gilchrist (1994) assumed) and lower interest rates. But it is important to note that we rely on a non proportionality of effort and fines, hence, in the end, on a fixed cost.

One interesting question that one could ask is the following: are the heterogeneous effect of shocks that we document in subsections 2.5-2.7, increased or decreased in intensity by size? Or, in other words, we have already shown that productive firms owned by financially dependent entrepreneurs are relatively more sensitive to shocks. Will they also be more sensitive if they are small? For a sufficiently clear answer we will focus on the dual

Table 1.1: Summary of Effects of International Shocks

Constraint	ICH	PCH	PCL
W falls	$\left\|\frac{\partial \pi_{ich}}{\partial W}\right\| = \frac{\pi_{ich}}{W}$	$\left\|\frac{\partial \pi_{pch}}{\partial W}\right\| = \frac{\pi_{pch}}{W}$	$\left\|\frac{\partial \pi_{pcl}}{\partial W}\right\| = \frac{\pi_{pcl}}{W}$
r increases	$\frac{\partial \pi_{ich}}{\partial r} = \frac{(1-k\phi^{-1})p_h^{-1}}{W}$	$\frac{\partial \pi_{ich}}{\partial r} = \frac{p_h^{-1}}{W}$	$\frac{\partial \pi_{ich}}{\partial r} = \frac{p_l^{-1}}{W}$

margin economy (because it has the simplest geometry), and on the international shocks of subsection 2.7, although the conclusions are generalizable to all shocks of section 2. Also, we will constraint ourselves to an economy with non proportional costs of effort and fines which is described by equation array (1.23), since it has delivered the most realistic stylized predictions. The partial derivatives of these constraints with respect to adverse shocks to gross productivity W (that we use to represent the world economy) and the international interest rate r are:

In panels (a.b) and (b.b) of Figure 1.7 we have illustrated how the ICH constraint will be looser for poor but productive entrepreneurs if the scale of their projects is large. We can infer from Table 3.2.1 that the effect of a world recession will also be smaller (since π_{ich} is lower). So, these entrepreneurs will be relatively insulated by their scale from the effect of the global recession on moral hazard. In fact, this will also be true for participation constrained entrepreneurs on the PCH margin, since, as we have shown above, the PCH will also be more relaxed for large firms. In contrast, the effect of the interest rate shock on the PCH and PCL is the same for all sizes. On the other hand, the effect on the ICH constraint is smaller again since:

$$\frac{\partial^2 \pi_{ich}}{\partial r \partial \phi} = -\frac{k p_h^{-1}}{W \phi^2} \tag{1.24}$$

In summary we find that it is consistent with this model, to use size as a proxy for productivity or financial access as the literature has. Also, we find that scale will help to ameliorate the heterogeneous effects of different shocks.

1.8 Conclusion

The chapter starts by documenting how smaller and more financially dependent firms have higher churning and higher volatility in creation and destructions rate in Chile. This is done using two entirely new databases that allow us to construct stylized facts from the job flow side and the firm creation and destruction side.

We have studied a model of an economy with heterogeneous entrepreneurs in productivity, wealth and also size. e have shown that in such an economy, with contracting originating from a hidden action problem, there will be at least a dual margin with high productivity firms owned by poor entrepreneurs being incentive constrained and low productivity firms owned by richer entrepreneurs being participation constrained. The constraint will be tighter for poorer and more productive entrepreneurs. We have shown that this setup can also lead to an economy with multiple margins and differential interest rates in contracts. Again, poorer entrepreneurs will be the ones to face the higher interest rates.

We show that this participation constrained margin composed of poorer but productive entrepreneurs will be more sensitive to shocks in this economy, more benefited by institutional improvements to contracting, financial opening, financial development and the provision of technical support by the government. This can help explain why in a developed country such as Chile, small firms and financially dependent firms tend to be more volatile and generally sensitive to shocks.

We show that these differences in sensitivity effects are amplified for smaller scale projects and that it does seem reasonable to use size as a proxy for fragility in a model such as the one presented in this paper. Finally, we show that risk generally affects more the participation constrained margin composed of wealthier entrepreneurs that will flee. We also show that in riskier economies interest rates will be higher among poor entrepreneurs with relatively high productivity.

Chapter 2

Fragility in Chile: The Firm Side

2.1 Introduction

The ideal data set required to test the implications of the model we present in Chapter 1 would contain data both on the quality of the entrepreneurial project, it's financial conditions and the total wealth and financial resources of the entrepreneurs or their households. Ignoring the financial structure of the household that owns a small firm is a significant problem. Some indirect proof of this can be found in Berkowitz and White (2004). They show that firms that can credibly pledge homestead resources (because they are located in states without limits on the event of bankruptcy) are 25% less likely to be denied credit. This comes to show how relevant it is, when studying small firms, to consider the assets and financial structure of households behind them. If homestead financial resources are relevant for banks, they must be relevant for regressions. At most there are proxies of the productivity of projects[1] and of the financial resources of entrepreneurs (size is most people's favorite).

[1]For example Galindo and Weiss (2005) use a sales to capital ratio and an operating profits to capital ratio for publicly traded firms to show that financial liberalizations in emerging markets have improved the efficiency of credit allocation.

One of the crucial database problems that this literature has is censorship. When entrepreneurs are surveyed it is not usual for the methodology to include households or individuals that do not engage in enterprises. An ideal data set should control households that decide or are forced by circumstance not to execute their entrepreneurial ideas or do not invest time in developing them. Unfortunately such data sets are not easy to come by. The closest to this ideal data set is the Thai and Indian survey projects implemented by Bob Townsend of the University of Chicago, as well as his Chicago Ethnic Neighborhood project.[2] In these cases there are comprehensive surveys of households that own micro and small enterprises. Through very comprehensive (and expensive) surveying, Townsend is able to penetrate the curtain between the finances of the firm and the household. On the other hand, his surveys purposefully emphasize very fragile sectors with salient and significant cultural and idiosyncratic characteristics. In any case, these surveys have enabled Paulson and Townsend (2004) to show empirically, the expected result that (in Thailand) wealthier household are more likely to set up businesses and less likely to face financial constraints. Paulson and Townsend (2005) use these databases to show the slightly Schumpeterian result that the Thai 1998 crisis generated an increase in entrepreneurship, particularly among poorer households.

The advantage of the FUNDES-SII database that we use in this chapter (apart from its size and representativeness) is that it has some (very coarse) financial variables of the firm. But still, we have total debt, assets and sales, which, as we will explain allow us to locate the firms into the space we used in the model of Chapter 1. Its main disadvantage is that it has no information on the entrepreneur, his endowment, his household or the labor he employs. On the other hand, we will take advantage of it's size to deal with the censorship problem we discussed in the previous paragraph. In this chapter we use another entirely new database for Chile which has just been constructed in a joint project by FUNDES and the Internal Revenue Service, with the objective of studying firm dynamics in Chile.[3]

The Chapter is organized in the following way: Section 2.2 presents the

[2]For more information on these projects and papers that have used the resulting databases see Bob Townsend's website at http://www.src.uchicago.edu/users/robt/.

[3]A similar panel has been constructed and used by Crespi (2003) for the FUNDES project. But this is the first time it is used in such extension as a panel and subjected to extensive econometric analysis. Also Crespi (2003) comprises the 1990-1998 period while we use the 1999-2004 period. It is unfortunate that procedure changes in the Chilean IRS (SII) make the two databases incompatible. It is also unfortunate that the fault line occurs simoultaneously with the mayor crisis of the 90s decade: the Asian Crisis.

data, it's origins, advantages and limitations, and presents some basic stylized facts on firm flows for Chile. Section 2.3 presents our main empirical findings on creation, destruction and performance of Chilean firms. Section 2.4 presents our main empirical findings on heterogenous reactions to shocks. We end with the conclusions in Section 2.6. Also Appendices A.2 and D contain detailed descriptions of the data and extended results that correspond to this chapter.

2.2 Creation, Destruction and Performance

2.2.1 The Data Set

The FUNDES-SII data set compiles information for all the firms that have made their tax statement in Chile for the years 1999-2004. It contains information on the economic sector of the firm, it's sales, value of assets, total debt and profits. The database contains observations for roughly 650-700 thousand firms per year with fictitious identities. The complete database as an unbalanced panel contains 4.1 million observations, making it by far the most representative database for the Chilean economy. We use this database to construct propensities for creation and destruction among different types of firms, as well as improvement or worsening of sales performance among surviving firms. All firm flows presented in this section are normalized with respect to the average performance of the sector they belong to.[4] In the next sections of this chapter we run regressions where we properly identify sector effects.

There are several problems that the database presents that make the interpretation of its results complicated. First, these are legal rather than economic definitions of firms. There are plenty of firms in Chile that have several identities for accounting and tax purposes. We have no way of accounting for these "hidden" larger firms. Second, we do not know that firms that fall out or step into the panel are actually being created or destroyed. We only know that they are not declaring taxes, hence, they could be stepping in and out of informality. In the job flow database of Chapter 3, for

[4]Specifically, we calculate a flows and performances by characteristic, sector and year. Then we aggregate deviations from sector averages and finally weigh them according to the importance o different sectors. on average in the FUNDES IRS database, 10% of firms are from the agricultural sector, 0.6% are from forestry, 0.5% are from fishing, 0.2% are mining (but they are very large), 6% are manufacturing, 0.3% are utilities (also large), 5% are construction, 37% are commerce and 41% are services.

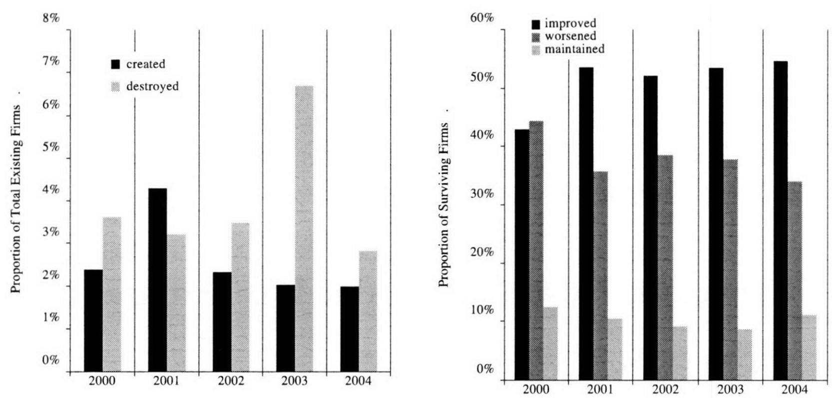


Figure 2.1: Firm Performance in Chile

example, this makes no difference at all since it is the surveyed worker that subjectively classifies the workplace as a dependent job or not. Hence, its very likely that we are, in this chapter, forced to ignore a large section of micro and informal firms that could end up accounting for a large proportion of entrepreneurial fragility in Chile.

2.2.2 The Stylized Facts

One of the first clues that the sample of firms in this dataset is different comes from the panel of Figure 2.1. Here we show the percentage of firms destroyed and created every year in this panel of firms. The numbers are much smaller than what can be inferred from the database of Chapter 3. Annual churning of firms seems to be in the 2%-4% range, as we have mentioned above it is entirely possible that the more fragile firms are, in fact, labor intensive and hence the result of high job churning due to bankruptcy that we found in the previous section. A second interesting feature of this period is that it is one of post Asian Crisis net firm destruction. The exception is 2001 (indicating flows from 2000 to 2001, hence it is pre 9/11) when creation was higher. In Figure 3.1 we can see that this coincides with a period of relatively high growth (unfortunately we do not have data for the relatively rapid growing year of 2005). The spike in firm destruction in 2003 is somewhat suspicious in the sense that it could indicate changes in

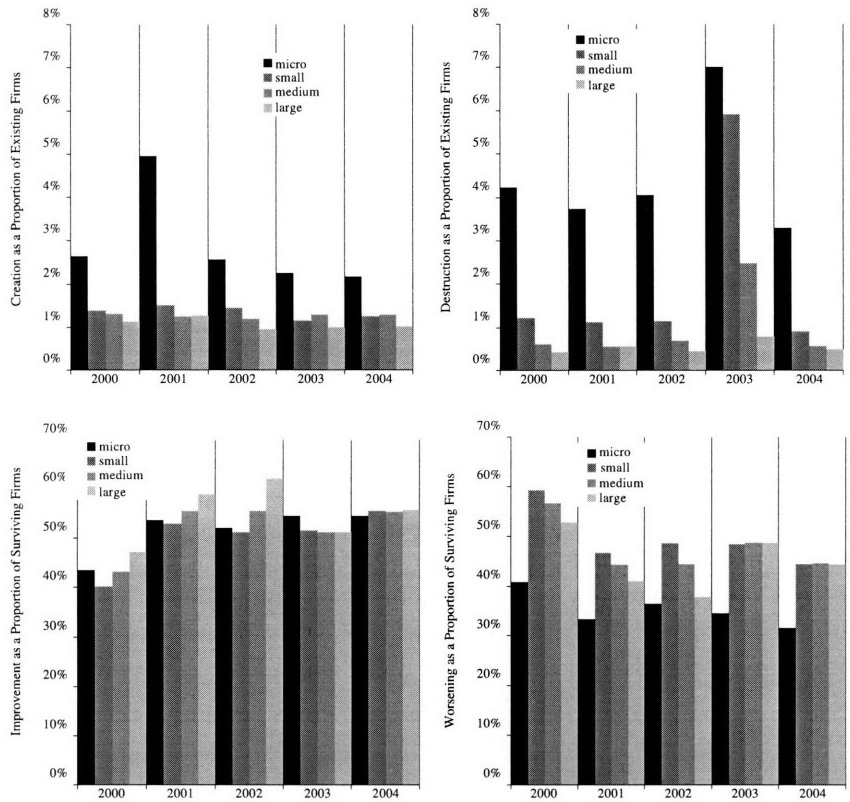


Figure 2.2: Firm Performance and Size

registry of firms. As we will see in the sections that follow, this will not change our results and, in fact, the econometric results for 2003 are robustly in line with those for the rest of the sample. The second panel of Figure 2.1 counts the number of firms that having survived, either improved, worsened or maintained their sales levels during a given year. interestingly enough, with the exception of 2000, most surviving firms are improving their sales levels (in real terms).

Before running any regressions that control for sector specific effects, we calculate firm performance by size, only this time size is defined according to sales levels. The FUNDES-SII database provides us with seven categories that we aggregate into four familiar categories: micro, small, medium and large.[5] Figure 2.2 shows firms performance by firm size. We can see that, with the exception of the 2003 destruction spike, there is a clear difference in the firm churning rates of micro firms and the rest. around 4% of micro firms are destroyed and crated, while only around 1% are destroyed and created among the other categories. It is also more likely for larger firms to improve their sales, although this result is less robust and is not observed in 2003 and 2004. On the other hand it is very unlikely for micro firms that survive to worsen their sales level. This could be a very strong indicator of the fragility of these firms: either they improve and maintain their sales levels or they fall into bankruptcy or informality. As an interesting feature, from the "small" category onwards, the probability of worsening falls with size for 2000-2002.

For Figure 2.3 we have divided the databases according to "financial dependency" defined as total debt over total assets. That is, the extent to which the entrepreneur is actually working with someone else's capital to financie his enterprise or $1 - k$ in the notation of Chapter 1. However, it is important to consider that, in the model below k includes all the assets and financial resources of the entrepreneur's household. Whilst in this database we only see the assets and debt of the firm. Even if the household's assets are not formally associated or mortgaged, a bank will obviously feel more reassured if the entrepreneur has other sources of liquidity that can sustain a business through rough times. Hence, there is a chance that we may confuse financial dependency with access to credit markets, and, as we shall see in the next sections of this Chapter this is in fact a crucial distinction. In any case, in this section we divide the database into four quartiles, where the first quartile is composed of firms with the least financial dependency. [6]

The evidence is that firm churning is higher among more financially

[5] The "official" definition of sizes in Chile (relevant for policy indicators mostly) is the following: micro firms have annual sales up to 2,400 Unidades de Fomento (UF, the Chilean official inflation index) which is just bellow US$ 80,000; small firms are those in the 2,400-25,000 UF range which is up to just over US$ 800,000; medium firms are those with annual sales in the 25,000-100,000 UF range which is just over US$ 3 million; and over this benchmark a firm is considered large. Accordin to this database, the Chilean economy has arround 550,000 micro firms, 100,000 small firms, 15,000 medium firms and 7,000 large firms.

[6] One interesting feature of the FUNDES IFS database is the enormous number of firms with negative equity when comparing assets and debt. Tax accountants will explain that the value of assets that is recorded for many firms is constrained by legal definitions and book values, while the value of debts is priced in the market. It is frequent, hence, for the firms in this database to have large debt to asset ratios.

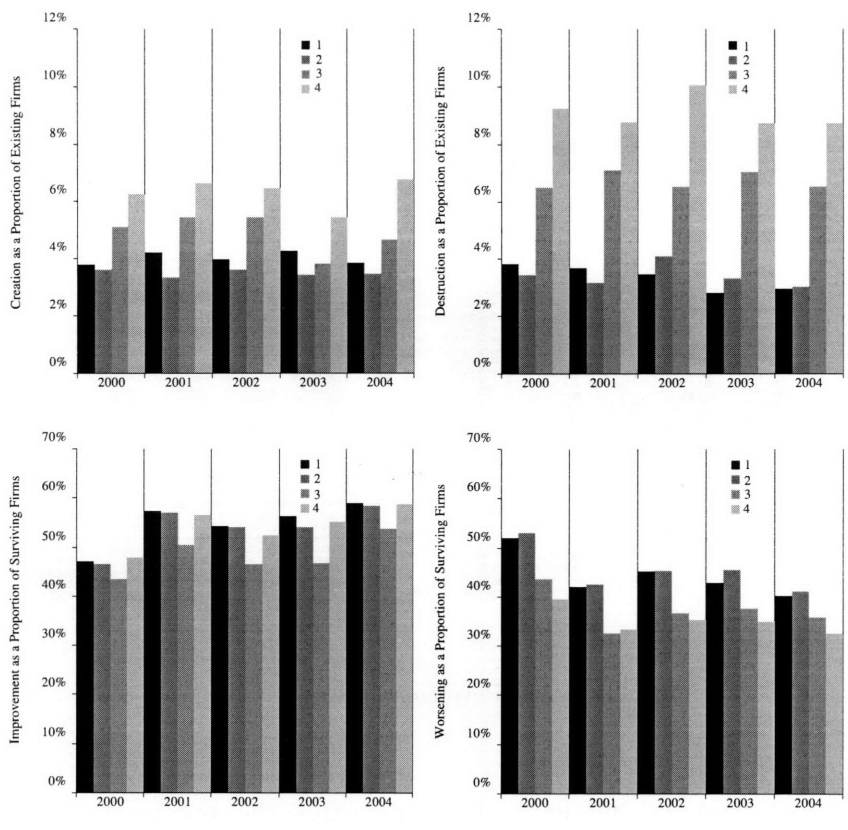


Figure 2.3: Firm Performance and Financial Dependency

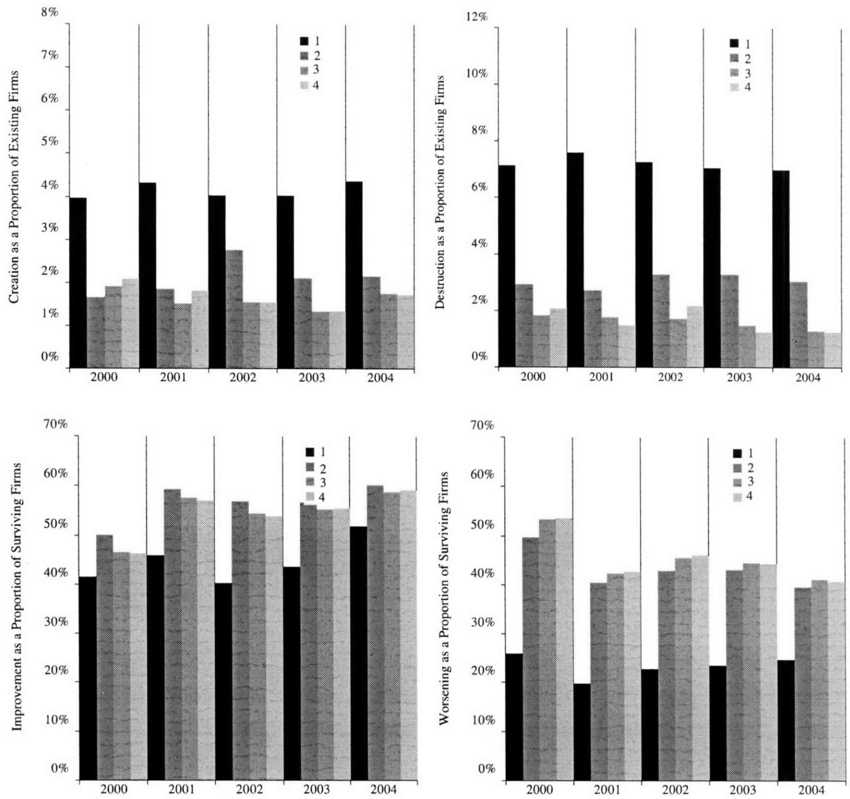


Figure 2.4: Firm Performance and Cash Flows

dependent firms. We find particularly interesting, the concentration of firm destruction among micro firms. Among the fourth quartile firm destruction is roughly 9% per year, while it fluctuates around 3% for firms in the first quartile. This partition of the database is less meaningful when analyzing sales performance among surviving firms. there is no clear pattern for sales improvement, but there is a seemingly paradoxical trend towards a lower proportion of financially dependent firms to worsen their sales. Again, this is probably a sign that, among surviving firms, our measure of financial dependence is really capturing credit market access to some extent.

Finally, we divide the database into quartiles according to the most common productivity indicator in this literature, which is cash flow (sales) over asset value.[7] Figure 2.4 displays the results. In this case, quartile 1 is comprised by firms with the lowest cash flows and quartile 4 by firms with the highest cash flows. The evidence is that destruction and creation is particularly high among first quartile firms. Destruction is exceptionally low among third and fourth quartile firms. Among surviving firms, on the other hand, there seems to be some evidence of a high percentage of firms that maintain their sales level (one minus the percentages in the two lower panels of figure 2.4), but particularly strong evidence of very little firms that worsen. Again, these fragile firms seem to have much more dramatic outcomes.

2.3 Heterogeneity and Small Firms

In this section we will attempt to estimate the determinants of destruction, creation and performance of entrepreneurial projects using the FUNDES-SII database for Chile. The model we are estimating is a reduced form of the model presented in the first chapter of this dissertation, but there are some additional assumptions that we must make in order to take the model literally and proceed towards estimations.

The main result of the model of Chapter 1 is summarized in Figure 2.5 where we represent a country or sector constituted by firms that have three types of heterogeneity: financial dependency $0 \leq k \leq 1$ (the proportion of their capital that is financed externally), productivity $0 \leq \pi \leq 1$ (the capability they have of extracting value added from the economy), and scale or size $0 \leq \phi \leq 1$. The economy has a continuum of entrepreneurial projects that are distributed on this space in some way (in the model of Chapter 1 we have assumed a homogeneous distribution), and occupies the area comprised by space $B = [0,1] \times [0,1] \times [0,1]$. A hidden information problem makes it possible only for a subset of firms to sign contracts were they credibly promise to exert unobservable effort. Generally, this partitions B into an area of entrepreneurial projects that are financed and another that is not.[8]

[7] See previous footnote. Again cash flow is valued at market prices and is a crucial input for the IRS to calculate the firms tax liabilities. Assets, on the other hand, have book values, giving us some pretty wild cash flow indicators. Since all we do is in this section is rank them, this should not be a major problem.

[8] In the complete model there is also the possibility that some firms are profitable even if they do not promise high effort. In this case these firms are financed but are charged higher interest rates. In the database we use in this chapter there is no information on the interest rates being payed by the firms so we will simply ignore this possibility and

Panel (b) of Figure 2.5 shows the margin of such an economy constituted by the upper envelope of two types of constraints: a participation constraint that will be active for relatively less productive firms that use mainly internal finance, and an incentive compatibility constraint that will be active for relatively more productive firms that use external finance intensely. All firms above the envelope will be financed, all firms bellow the envelope will not. In panel (a) of figure 2.5 we show a slice of space B at a certain size. In Chapter 1 of this dissertation we prove that, as size increases, the constraints are relaxed, particularly the incentive constrained margin, hence the slant in the margin as size ϕ increases.

In this chapter we will assume that it is feasible to represent the whole of the model of Chapter 1 in an instrumental function $E(\pi, k, \phi)$ that we will call *eligibility*. We will assume that $E(1,1,1) = +\infty$, $E(0,0,0) = -\infty$ and $E(\pi^*, k^*, \phi^*) = 0$ such that firm $\{\pi^*, k^*, \phi^*\}$ is a firm on the margin. Function $E(.)$ will be some measure of distance from the margin that we do not know, although we know the arguments of the function, and the model where it comes from. Critically for our estimation we cannot observe $E(.)$ only it's arguments and wether it is greater or smaller than zero at any moment in time. In Figure 2.5 we illustrate a position for a sample firm. Function $E(.)$ will be some measure of distance from the margins that properly represents the model of Chapter 1.

The second relevant result that we must rescue from Chapter 1 is the fact that the incentive constrained margin will be more sensitive to a variety of shocks. Figure 2.6 illustrates a generic adverse shock to this economy. The effect is to make non viable a set of firms that is close to the margins. However, the model shows that this shock will have larger effects on smaller firms (lower ϕ), less productive firms (lower π) and more financially dependent firms (larger k), although most of the destruction will be concentrated among relatively productive firms owned by financially dependent entrepreneurs. In the following sections of this chapter we will attempt to estimate which characteristics of these firms increase the sensitivity of eligibility $E(.)$ to external conditions.

One of the many insufficiencies of the model in Chapter 1 is that it is a static model. Entrepreneurs have a single project that is either financed or not. The concept of fragility that we use in that chapter is particular to the characteristics of the model. We say that entrepreneurs are fragile if it is very likely that a shock can devoid them from external finance that they would have otherwise secured. To be more realistic, firms in this model

stick to the dual margin model with only one Tier of firms being financed.

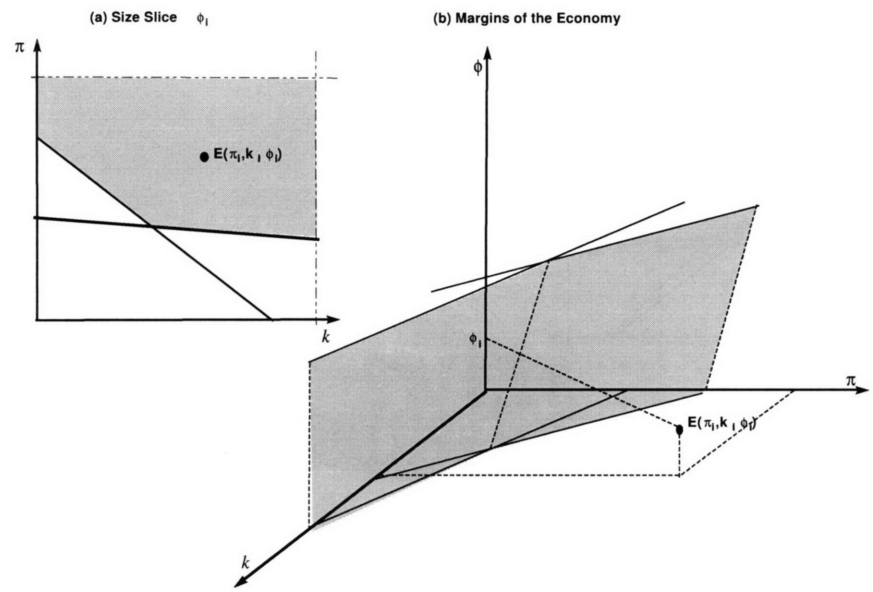


Figure 2.5: Partition of Space B

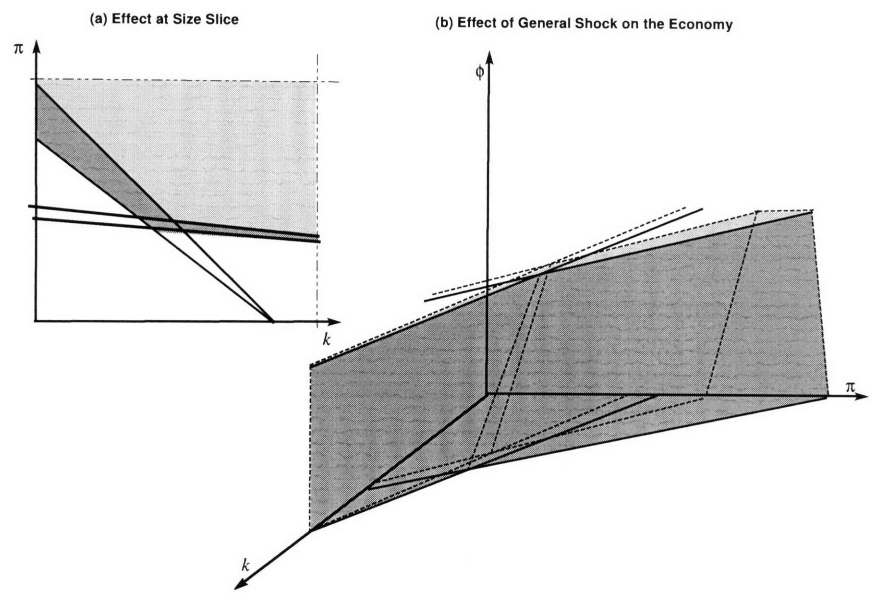


Figure 2.6: Effect of a Generalized Shock on the Partition of Space B

should really be a succession of static entrepreneurial projects. A shock may interrupt the operation of a fragile firm for a period driving it back in it's process of accumulation of capital or driving it into bankruptcy. In this sense, the model is really one of creation and destruction of static projects, rather than firms.

It turns out that this fits rather well with the nature of the database we are using since it is constructed from reports to the Chilean Internal Revenue Service. The rule at the Chilean IRS is that the firms RUT identification number (Unique Tax Registry or Registro Único Tributario) is dropped from the database when it does not file tax forms for a third consecutive year. It is possible that firms do not have activities for a year (for example due to restructuring) and cease to produce. It is also possible that they have simply disappeared and actually been destroyed as firms. Since our panel is quite short it is not possible for us to determine which is the case. All we can say is that it has not filed a report so that a particular year's project has been destroyed, not the actual firm. We will use this concept of project creation and destruction as an empirical approximation to entrepreneurial creation and destruction in Chile.

2.3.1 Destruction

Call $x_{i,t} = \{\pi_i, k_i, \phi_i\}$ the vector that characterizes the firms in this model. It will be critical for our estimation to assume that this vector of characteristics evolves dynamically in a way that can be approximated by some unknown process:

$$\begin{aligned} x_{i,t} &= \gamma x_{i,t-1} + e_{i,t-1} \\ e_{i,t-1} &= \epsilon_{i,t-1} + \eta_{t-1} + \mu_i \end{aligned} \tag{2.1}$$

that is shocked through time by an i.i.d. vector of shocks that are particular to the firm (μ_{i-1}), to the economy but particular to a moment in time (η_{t-1}), and particular to the firm at a moment in time $(\epsilon_{i,t-1})$.

We must assume that vector x is measured with error in our database. In particular, we will observe a vector $\tilde{x}$ such that

$$\tilde{x}_{i,t} = x_{i,t} + \nu_i \tag{2.2}$$

where ν is a a vector of i.i.d. noises. Since we are interested in destruction, we will be interested in observing firms that disappear from the database. That is, we will be interested in understanding the determinants of

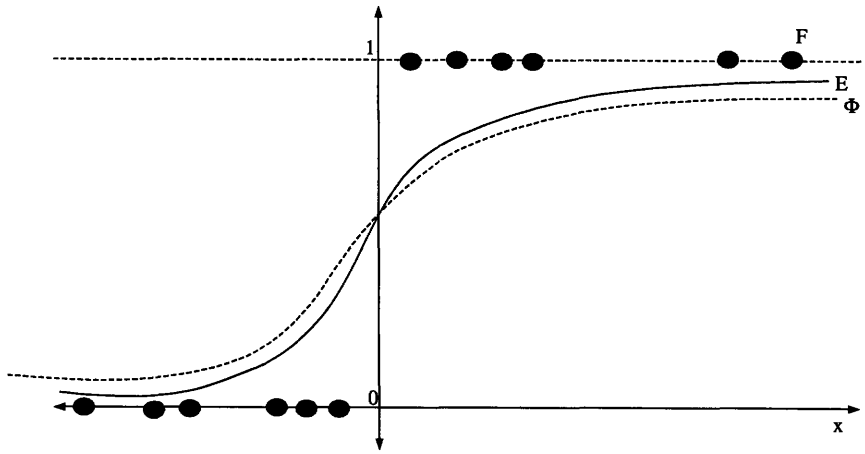


Figure 2.7: Eligibility Function, Chosen Function and Approximation

$$P(Destruction) = P\left(E(x_{i,t}) < 0 / E(x_{i,t-1}) \geq 0\right) \tag{2.3}$$

and although we will not be able to observe $x_{i,t}$ directly we know from 2.1 and 2.2 that

$$x_{i,t} = \gamma \tilde{x}_{i,t-1} + (\epsilon_{i,t-1} + \eta_{t-1} + \mu_i - \gamma \nu_i) \tag{2.4}$$

so that, theoretically we can use an estimation $\hat{x}_{i,t} = \gamma \tilde{x}_{i,t-1}$ to estimate the probability of destruction of equation (2.3) if we knew γ and the form and parameters of the eligibility function $E(.)$. However, we do not know the parameter. We do observe the outcome function $F(.)$ that summarizes $E(.)$ by reporting who is chosen and who is not chosen to execute their project, given by

$$F_{i,t} = \left\{ \begin{array}{ll} 1 & \text{if } E(x_{i,t}) \geq 0 \\ 0 & \text{if } E(x_{i,t}) < 0 \end{array} \right\} \tag{2.5}$$

which we can see compared to $E(.)$ in Figure 2.7. In this paper we shall attempt to estimate E(.) by adjusting a function Φ. The usual choice is to use the cumulative distribution function of the standard normal density for Φ which yields the probit model or the lognormal distribution yielding the logit model.

Table 2.1: Preferred Probit Regressions: Probability of Destruction

	full panel	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
π	-6.13%	-5.53%	-7.09%	-6.56%	-5.65%	-6.07%
	(0.08%)***	(0.18%)***	(0.20%)***	(0.21%)***	(0.18%)***	(0.18%)***
$1-k$	-0.00%	0.29%	-0.28%	0.10%	0.13%	-0.12%
	(0.06%)	(0.12%)**	(0.13%)**	(0.15%)	(0.13%)	(0.12%)
ϕ	-2.23%	-2.02%	-2.67%	-2.33%	-2.02%	-2.20%
	(0.01%)***	(0.02%)***	(0.02%)***	(0.02%)***	(0.02%)***	(0.02%)***
Obs.	938,561	206,727	174,049	189,510	191,384	176,895
LogPLike	-199066.85	-41440.224	-37193.162	-42660.072	-39368.965	-38050.662
Pseudo R2	0.2095	0.2099	0.2464	0.2026	0.2018	0.1910

Note 1: Marginal effects on the probability of destruction, standard errors in parenthesis.
Note 2: * is 90% significance, ** is 95% significance,*** is 99% significance.
Note 3: Dummy for micro firms, $Dsz(micro)$ has been dropped.

The equation of our preferred probit regression is:

$$P(Destruction)_{t,i} = F\left(\beta_0 T + \alpha_1 \pi_{t,i} + \alpha_2 (1-k_{t,i}) + \beta_3 DSc_i + \beta_4 DSz_i\right) \tag{2.6}$$

Where π, our measure of productivity of the firm, will be the cotangent of the ratio of profits to total assets.[9] Our measure of k will be the ratio of equity over assets, so that we will call $1-k$ "financial dependency" and measure it by the ratio of credit to assets. Finally we include a set of time dummies T, a set of sector dummies DSc and a set of size dummies Dsz.[10] The results are presented in Table 2.1. The Table presents the marginal effects of π and $1-k$, and the marginal effects of each of the size dummies Dsz. The table with the complete results (sector dummy marginal effects and year dummy marginal effect for the full panel regression) is available in Appendix D.

The table shows the probit regression for the full panel and also for five sets of consecutive years. A few things are worth noticing The first is that the marginal effect of productivity π is always negative (better quality firms have a lower probability of disappearing) and statistically relevant at the highest significance level. Second, the estimated marginal effect of productivity is very robust, with the exception of the first couple of years when profitability seems to have taken a back seat. Secondly, the size dummies are always significant at the highest level, and indicate that there is always

[9]Cotangent is defined for $(-\infty, +\infty)$ but is bounded so it helps to limit the effect of outliers on the regression

[10]Where we have classified sizes in the way that is customary in Chilean public policies and is used in subsection 2.2.

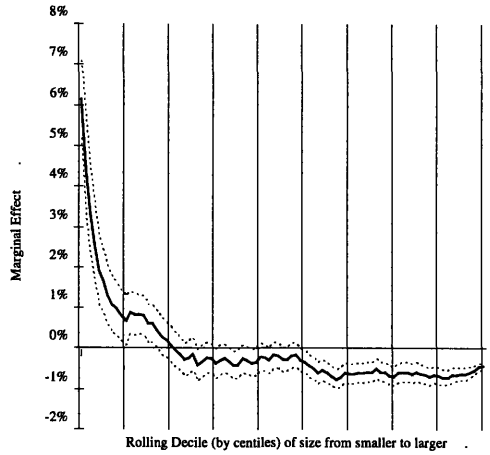


Figure 2.8: Marginal Effect of $1-k$ on the probability of default

a smaller chance of survival for firms that are larger than what we classify as micro firms (excluded dummy). And finally, it is interesting to see that the marginal effect of financial dependency $1-k$ is not very significative, if anything it shows a 10% significance level for the 2000-2001 pair. Given this result we should reject that financial dependency or leverage, at least in the way we are measuring it is an important variable in our model and *prima facie* we should cast doubt on the model of Chapter 1.

However, and this is the main finding of this section, we know from the stylized facts of the previous section that the regressions of Table 2.1 hide a some meaningful heterogeneity. To illustrate this instead of artificially dividing the sample into the size categories we have used up to this point, we decide to divide the sample according to a criteria that imposes less structure on the regression and attributes less meaning to the particular thresholds that are used in Chilean development policies. We rank the full panel and order the observations according to size measured as the log of sales in real terms and then run probit regressions for a rolling sample of centiles starting from the smallest firms and moving to the largest.

Figure 2.8 reports the estimated marginal effect of $1-k$ for deciles of different sizes. As we can see, for smaller firms, the effect is positive and significant while for larger firms it becomes negative and significant. This means that for smaller firms $1-k$ acts as an indicator of "financial fragility" or "financial constraint" while for larger firms it is more of an indicator of financial access. This, in our view, is consistent with the prediction of Chapter 1 that the scale of entrepreneurial projects helps relax the incentive constrained margin composed of very productive and poor entrepreneurs: scale helps with the asymmetric information problem.Furthermore, Figure D.1 in Appendix D sows the robustness of this result by running the same program but separated by years in the same way that we used to checked for robustness in Table 2.1. Of course, as samples are reduced, the significance of the result is also hurt (so the confidence intervals are thicker) but the form of the curve and the general conclusion is sustained.

2.3.2 Creation

Studying creation of firms in this database does not allow for a lot of well specified econometrics since we do not have a control group. We do not have data on what would have been the size, the financial dependency and the productivity of entrepreneurial projects that were not implemented either because of strategic decisions by the entrepreneurs or did not accede to financing due to adverse evaluations in the banking sector. Hence we are, by nature, restricted to a statistical description of the firms that are created. Our solution is to calculate "propensities" to create among different types of firms and then try to predict with econometrics these propensities. In a sense, this methodology is very similar to the construction of pseudo panels that is frequent in labor and public finance econometrics. What this literature does is to construct "fictitious" representative individuals that can be observed through the population that they represent, even if actual individuals cannot. Usually, these individuals are constructed by grouping the observed samples according to some subset of demographic or socio-economic characteristics. The assumption is that the characteristics and collapsed data of this constructed representative individual would have been the data if we had been able to actually find that individual, survey, and follow him or her through time. Then these "fictitious" representative individuals are used in panel regressions to address whatever question this literature wants to ask.

Our methodology is very similar, what we do is expand on the three dimensional decile grid that we have used in the previous section. In generic terms, lets call the three dimensions $\{x, y, z\}$, and assume we rank in deciles along each. To do this properly we must rank z decile within each y decile and each x decile. The result is a homogenous grid of 1,000 partition cells ($10 \times 10 \times 10$) with an identical amount of firms. We then collapse the data in each partition to obtain stylized characteristics of the representative firm of each partition cell. In particular, we count the number of firms created in each cell, count the years and sectors that predominate in each cell, estimate the average $\{\pi, k, \phi\}$ that we assume to be the characteristics of the representative firm and execute the following OLS regression:

$$Creation = \alpha_1 \pi_d + \alpha_2 (1 - k_d) + \alpha_3 \phi_d + \beta_1 VSc + \beta_2 VYr \qquad (2.7)$$

Where *Creation* is the amount of firms created, π_d is the productivity decile of the cell, $1 - k_d$ is the financial dependency decile and ϕ_d is the size decile, VSc is a vector that counts the number of firms of each sector within each partition cell and VYr is a vector that counts the relative importance of observations of each year from the sample in the partition cell. Since each cell has the same number of firms we interpret the parameter as incidences of different characteristics of the "representative" firm of the partition cell.

Table 2.2 shows the results for the preferred regression as well as the results for the same regression for each subsample of creation during two consecutive years. The results indicate that, on average, creation of firms is more likely among smaller, less productive firms that tend to borrow a small proportion of their initial capital. We realize that this is not completely surprising, but it is important to remember, that most of the empirical literature treats size as a good proxy for restricted access to capital markets or even the quality of firm projects. This regression shows us that, at the very least, size and financial access are operating through different channels, and, hence, have their own significative effects. Moreover, even in our regression, and following the sense of our discussion in subsection 2.3.1 the direct interpretation of $1 - k$ is not clear. We could argue that is is a measure of financial dependency and hence fragility or a measure of financial access. In this case, in our view, the variable is indicating financial access. Finally the extended version of table 2.2 with the estimated parameters for all the dummies can be found in Table D.2 of Appendix D. Also, the results are extremely robust across different time spans, parameters continue to be very significant but approach in level towards cero indicating some loss of significance in the subsamples.

A crucial difference between the results in Table 2.2 and Table 2.1 is the robust significance of the $1 - k$ parameter across all time span subsamples. In the case of creation, it seems, $1 - k$ indicates financial access and

Table 2.2: Preferred Regressions: Amount of Creation

	full panel	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
π	-6.14	-1.05	-1.11	-1.10	-1.25	-1.21
	(0.27)***	(0.06)***	(0.07)***	(0.06)***	(0.06)***	(0.06)***
$1-k$	-1.49	-0.41	-0.24	-0.46	-0.43	-0.49
	(0.24)***	(0.05)***	(0.07)***	(0.05)***	(0.05)***	(0.05)***
ϕ	-12.80	-2.24	-2.48	-2.12	-2.33	-1.94
	(0.60)***	(0.15)***	(0.15)***	(0.12)***	(0.13)***	(0.12)***
Obs.	1,000	1,000	1,000	1,000	1,000	1,000
LogLike	-4305.75	-2987.63	-3070.15	-2976.80	-3000.91	-3005.87
R2	0.7739	0.5972	0.6092	0.6657	0.6479	0.6318

Note 1: Effect of increasing a decile on amount of creation, standard error in parenthesis.
Note 2: * is 90% significance, ** is 95% significance,*** is 99% significance.
Note 3: Dummy for micro firms, $Dsz(micro)$ has been dropped.

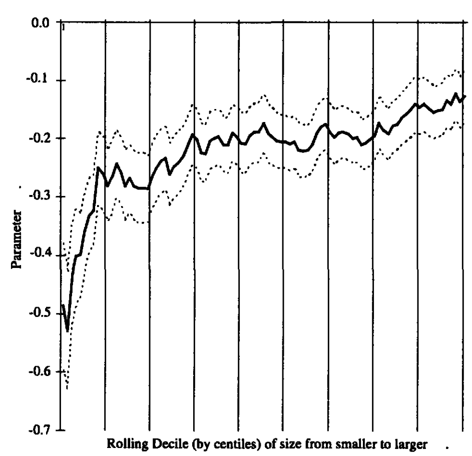


Figure 2.9: Parameter of $1-k$ on creation

not financial dependency, like it did for smaller firms in Figure 2.8. So, in this case, the most reasonable interpretation is that the parameter indicates that controlling for everything else, it is most likely that new firms rely on internal finance. In any case, motivated by the evidence of economically significant heterogeneity that we found in section 2.3.1 we do a similar exploration into heterogeneity in this section. We rank all firms according to size centile, and we then run preferred regression 2.6 and store the $1 - k$ parameter and significance band for each rolling decile. The result can be seen in Figure 2.9. As we can see the parameter is negative (with statistical significance) across all size sub samples just as it was for every year. It is interesting to note, though, that the absolute magnitude of the parameter falls with size. For smaller firms, it seems, financial restrictions are much more important determinants of the possibility if implementing a project. Finally, it is interesting to note the geometric symmetry between figures 2.8 and 2.9. The marginal effect of financial dependency on default probability is convex in the same way that the parameter on creation propensity is concave. This means that the smallest sizes of firms in our data base that turn out to be those for which a large $1 - k$ is not helpful in surviving crisis, are the same for which financial access is especially stringent for creation.

2.3.3 Performance

In the two previous subsections we have addressed the determinants of creation and destruction of firms. In this subsection we will study the determinants of performance measured as growth of the sales/assets ratio. Since the model presented in Chapter 1 of this dissertation is not a model of entrepreneurial performance but rather of entrepreneurial creation and destruction, it is important that we justify the relevance of this subsection for the questions that we are asking in this dissertation.

One way to interpret the model in Chapter 1 is that it is a model of entrepreneurial projects rather than a model of actual firms, with the exception, of course, of smaller single project firms, among which both interpretations are equivalent. Firms, under this interpretation, are intermediaries for entrepreneurs that work as staff inside them or units that have some level of administrative independence. Hence, the entrepreneurial unit inside the firm could face a similar information asymmetry and contracting problem as the entrepreneur of our model. In this case, the performance of firms could serve as an indicator of the success or failure of entrepreneurial projects within existing firms. Hence, wWe will estimate the following OLS regression:

Table 2.3: Preferred Regressions: Sales Performance

	full panel	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
π	3.38%	3.35%	3.38%	3.08%	3.34%	3.40%
	(0.41%)***	(0.09%)***	(0.10%)***	(0.09%)***	(0.09%)***	(0.08%)***
$1-k$	0.30%	0.26%	0.31%	0.29%	0.33%	0.38%
	(0.22%)***	(0.04%)***	(0.05%)***	(0.05%)***	(0.05%)***	(0.04%)***
ϕ	0.71%	0.76%	0.80%	0.71%	0.48%	0.86%
	(0.00%)***	(0.01%)***	(0.01%)***	(0.01%)***	(0.01%)***	(0.01)***
Obs.	862,798	192,249	159,782	174,075	174,119	162,573
LogLike	969933.25	219258.79	179237.31	196236.78	193210.28	182696.50
R2	0.0589	0.0667	0.0652	0.0585	0.0409	0.0786

Note 1: Effect of variable on sales growth, standard error in parenthesis.
Note 2: * is 90% significance, ** is 95% significance,*** is 99% significance.
Note 3: Dummy for micro firms, $Dsz(micro)$ has been dropped.

$$Performance_{t,i} = \beta_0 T + \alpha_1 \pi_{t,i} + \alpha_2(1 - k_{t,i}) + \alpha_3 \phi_{t,i} + \beta_1 DSc_i \qquad (2.8)$$

Where $Performance$ is the percentage increase in the sales/assets ratio for firm i in the year t, π is productivity, $1-k$ is financial dependency and ϕ is size, DSc is the sector dummy vector, and T is the year dummy vector.

The results of the preferred performance regressions can be seen in Table 2.3. The results are very robust across time and indicate that higher productivity, higher financial dependence, and size are predictors of sales performance. The extended regression with the estimated parameters for all the dummies can be found in Appendix D. In this case, it seems that $1-k$ is indicating financial access, and that firms with more external financing seem more likely to implement successfully their entrepreneurial projects and have good sales performances. Figure 2.10 shows the same heterogeneity exercise of Figures 2.8 and 2.9. Interestingly, for very small firms, the sign of the $1-k$ parameter is negative and very significative. It is very clear that the signs in Table 2.3 are a result of the weigh of 8 deciles worth of firms for which $1-k$ is an indicator of financial access. However, it seems very clear, just like it was for the destruction regressions of subsection 2.3.1 that for smaller firms it is really an indicator of financial dependency and constraints.

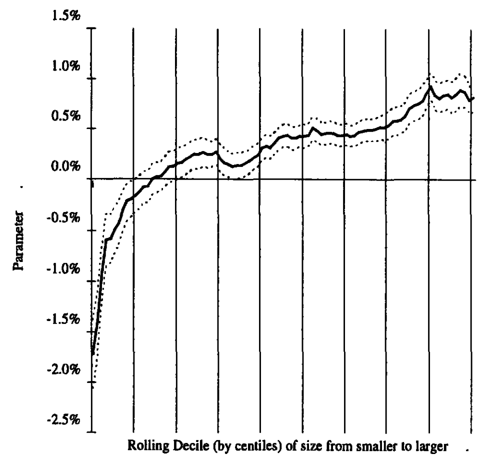


Figure 2.10: Parameter of $1-k$ on performance

2.4 Heterogeneity and Sensitivity to Shocks

One clear cut conclusion that one can extract from section 2.3 is that there is economically meaningful heterogeneity in the sensitivity of firm performance, survival and creation to different parameters. In particular, it seems that among the smallest firms, $1-k$ is an indicator of financial constraint rather than financial access. It seems, that among larger firms it is a good thing to be working with "other people's money" while it is a bad thing among smaller firms (although it could be inevitable). In this section we do two things. We explore heterogeneity in a more multidimensional way and we do so while testing for sensitivity to shocks.

Up to this point all that we have done is to predict financial behavior through firm characteristics. The estimated parameters that accompany $1-k$, π and ϕ in the regressions are reduced form parameters that describe the probability of different types of firms in general. It is important to note that the regressions of tables 2.1, 2.2 and 2.3 have sector and year dummies that, presumably, are capturing the incidence of macroeconomic and sector shocks faced by the firms of the Chilean economy. Hence, most of the information on the importance of shocks for different firms is contained in the levels and statistical significance of the estimated vector of dummy parameters.

One way of using these parameter vectors to estimate the importance of macroeconomic and sectoral shocks on different types of firms is to execute a Log Likelihood Ratio test on their statistical significance and to interpret the size of the statistic as an indicator of the relative importance of these shocks to different types of firms. Generically we estimate:

$$X_{t,i} = \beta_0 T + \alpha_1 \pi_{t,i} + \alpha_2 (1 - k_{t,i}) + \alpha_3 \phi_{t,i} + \beta_1 DSc_i \qquad (2.9)$$

and extract the log likelihood statistic for the complete regression, which we call ll_c; then we estimate the restricted regression:

$$X_{t,i} = \alpha_1 \pi_{t,i} + \alpha_2 (1 - k_{t,i}) + \alpha_3 \phi_{t,i} \qquad (2.10)$$

which is the same regression as 2.9 but without the year dummies (which we hypothesize are capturing the macroeconomic shocks of this economy) and the sector dummies (which capture the sector shocks). Again we extract the the log likelihood statistic, which we call ll_r. Finally we calculate:

$$LRT = -2(ll_r - ll_c) \sim X(n) \qquad (2.11)$$

where n is the total number of restrictions imposed in regression 2.10, which in this case is 14 (9 sectors and 5 year pairs). We estimate this statistic for subsets of the firms, and generically find that the dummy vectors are always statistically significant for all types of regressions (probits for destruction and OLS regressions for creation and performance).

Constructing the grid for the Creation regressions was slightly more convoluted, since, as we can recall from subsection 2.3.2 the methodology was already based on collapsing the database into a $10 \times 10 \times 10$ grid of the whole space of variables we are using. What we do is to restrict our attention to the two dimensional space that we want to graph (for example the $\{k,\pi\}$ space for the main result of this section). In each square of the grid we rank the firms into thousandiles and run the regression ignoring the parameter of the variable that we have used to rank and collapse the database of the square we are working on (in this case size ϕ). Of course the problem is that when we wish to repeat the exercise for a different space (as we do in Appendix D), we need to recalculate completely the database on which we run the regression. However, results are very robust, as we will illustrate in Section 2.5 and Appendix D.

Figure 2.11 shows the LR test of equation 2.10 for a 10×10 grid on the $\{k,\pi\}$ space. Each row has a pair of graphs constituted by a three dimensional surface and a contour graph with identical coloring. The first row shows the tests for the destruction probits of equation 2.6, the second row shows the test for the creation regressions of equation 2.7, and the third row shows the test for the performance regressions of equation 2.8.

The first thing to note is the heterogeneity in the levels of the LR tests for different types of firms. Destruction seems to peak in sensitivity along a diagonal that runs from high k low π firms to low k high π firms. This is also true in the performance regressions although the slope of the line of peaks is lower and the line runs at much higher productivity levels than for the destruction probits. It is interesting to note that this diagonal of peak sensitivity is exactly what is predicted by the model of Chapter 1, that is, the existence of sensitive margin of highly productive entrepreneurs that are mostly financed with external resources. The second row, however, shows that peak sensitivity in creation is clearly among high k, low π projects, that is, low productivity projects that have most of the resources to be implemented but require some finance. There is some insinuation of a diagonal in the creation contour, showing that there is a margin of increasingly productive firm creation projects with lower internal resources that is relatively sensitive to shocks, but it is less clear than among the destruction and performance regressions.

The same types of graphs for 10×10 grids on the $\{\phi,\pi\}$ and $\{\phi,k\}$ spaces can be found in Figures D.4 and D.5 of Appendix D respectively. In them we find sensitivity peaks for small and low productivity firms in creation (which is not surprising), but for mid productivity small firms in destruction. interestingly we find a diagonal in the performance regressions constituted by two peaks: a high productivity - small firm peak and a middle productivity - large firm peak. We find that smaller firms are more sensitive in destruction, larger firms are more sensitive in creation and large firms with middle productivity are more sensitive in performance. [11]

As an additional demonstration of the importance of heterogeneity we show in Figures D.6 to D.14 of Appendix D the parameters for the 10×10 grids on the three spaces. For the financial parameter $1-k$ we can see in Figures D.7 and D.8 the same fact that we have documented in figures 2.8 to 2.10, that is that there is a sign change in the parameter for smaller firms

[11] The creation regressions for Figures D.4, D.7 and D.10 are different from those used in Figures 2.11, D.6 and D.9. The first are run constructing thousandiles along k while the former are run constructing thousandiles along ϕ. Creation regressions of Figures D.5, D.8 and D.11 are run constructing thousandiles along π.

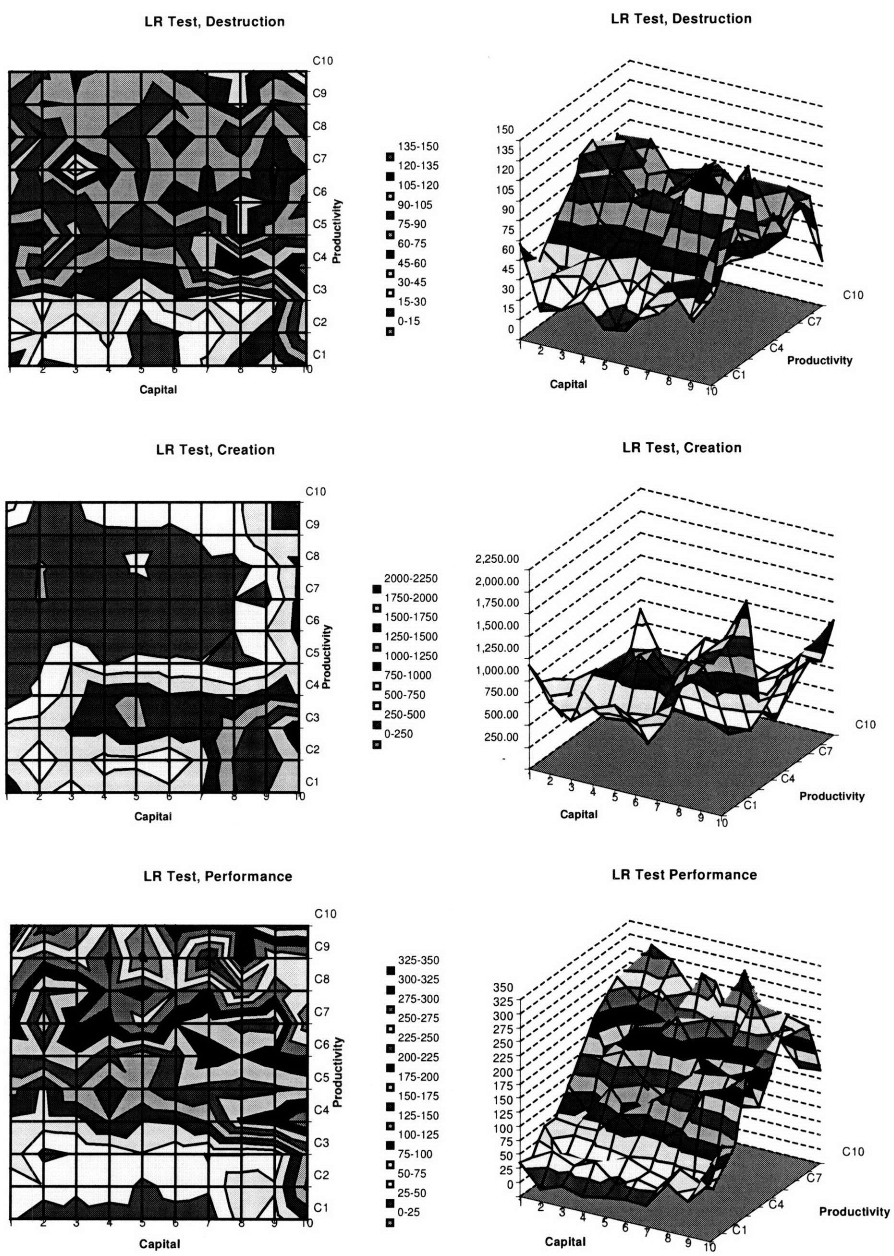


Figure 2.11: LR Tests for 10×10 grid on the $\{k,\pi\}$ space

in the case of the destruction probit and the performance regression, that the sign remains in the creation regression, but the parameter is stronger for smaller firms. However, we also find some new things. For example in figure D.7 we can see that there is an area of middle productivity firms with relatively small capital that have very high absolute $1 - k$ parameters both for destruction and performance. In the case of destruction, parameters are positive, while they are negative in the case of performance. It would seem that these firms are very financially constrained, and it is interesting that they are in the lower middle squares of our grid. Another interesting heterogeneity can be found in the surfaces and contours of Figure D.13 where we display the ϕ size parameter. Again, destruction and performance show a symmetry. Size enters as a negative parameter in destruction probits and as a positive parameter in performance regressions. However, the peak parameters, in both cases can be found in the low capital low productivity areas of the grid. On the other hand the size parameter peaks in the creation regression among high capital low productivity firms. Hence, it seems that size can be used as an attribute to substitute for deficits in other characteristics of a project. It is basically substituting productivity in all three types of regressions. However, for existing firms (to be destroyed or not) it is more important among financially dependent firms, and for potential firms (to be created or not) it is more important among high capital firms.

2.5 Who and Where are the Fragile Firms?

In this section we characterize the anonymous dummies that we have been using in sections 2.3 and 2.4, and try to illustrate the sectors and geographic distribution of our results on sensitivity to shocks. To do this, again, we estimate the LR tests on the dummy vectors from equation 2.11, only this time instead of sorting the data base on grids we sort them according to regions of the country and sectors. When we sort by sectors, of course, both the complete and restricted models of each type of regression lack sector dummies, so we only remove the year dummies as an indicator of macroeconomic shocks. The nine sectors we have used are described in Table A.2.2 of Appendix A.2. The regions of Chile, on the other hand are fairly easy to understand. They are numbered from I to XII in order from the arid northernmost region (I) to the southern patagonian region (XII). The exception is the capital Santiago which is usually called *Región Metropolitana* (Metropolitan Region) and is in the middle of the country between Region V and VI. Region V (Valparaiso and Viña del Mar) and VIII (Concepción and Talcahuano) contain the other two major urban concentrations of the country.

The first panel of Figure 2.12 shows the LR test for the different regions of Chile. To facilitate graphical presentation we have normalized the LR tests of the different regressions. Figure 2.12 presents is the ratio of the test of a given region to the average test for the country.[12] We present tests for the destruction probit, performance regression and creation regressions on the three dimensions (as explained in footnote 11) As we can see, by far, the most sensitive region to macroeconomic shocks is Santiago. It is followed by Regions V and VIII, and then Region X that also follows in urbanization. The second panel shows us four characteristics of the regions: their participation in value added, their participation in national population, their participation in the number of firms in our database and finally, the average of the relative LR tests of the first panel. As we can see sensitivity seems to be clearly correlated with urbanization. Moreover, the only exception is Region II where most of the largest capital intensive copper mines are. There, per capital value added is much higher, but still relative LR tests are at the level predicted by population and firm concentration.[13]

The natural question is then: what is going on in urban areas that makes them more sensitive? Section 2.4 insinuates part of the answer. Urban regions must contain most of this sensitive margin that is shown in the diagonal of Figure 2.11. In other words urban areas must contain most low productivity high capital firms, most high productivity low capital firms and most small firms. What sectors do these firms belong to? Figure 2.13 shows that it is mostly commerce and services that show large sensitivity to shocks. These sectors are clearly urban. Moreover, they are followed by construction and manufacturing which are also urban. Rural sectors like agriculture and forestry are relatively stable. Interestingly, the construction sector shows larger relative sensitivity in performance among existing firms while services shows very little sensitivity in performance but very high sensitivity in creation and destruction. In a nutshell: service sector firms churn rapidly, construction firms improve or worsen but survive, commerce does both. Also, although manufacturing (which is the sector used in most of the literature due to data availability) is the fourth most volatile sector in Chile.

[12]For example on average Region V shows slightly higher tests than the average of the country, Region RM shows tests that are 5 to 7 times the average of the country, and so forth.

[13]One of the reasons we show the LR tests for creation regressions in the different dimensions is to illustrate the robustness of the results across these different regressions.

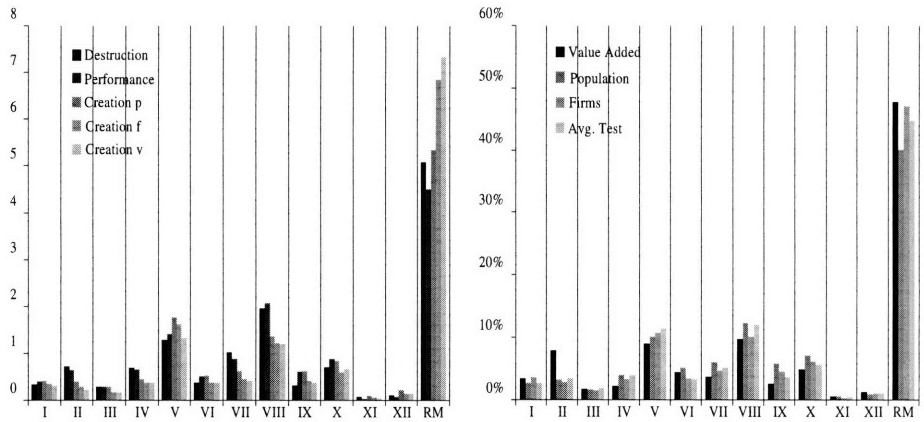


Figure 2.12: Relative LR Test for Shocks in Different Chilean Regions

As we explain in Appendix A.2, the nine sectors we use in the regressions are really aggregations of the available sector descriptions in the database. The reason we aggregate is to not consume the regressions in dummies and to be able to graph effectively. However, one last exercise we do is to unfold the 9 sectors into 42 subsectors and then run the LR sensitivity test for all of them. In Table 2.4 we show the most sensitive and the less sensitive subsectors for the destruction probit, the performance regression and the creation regression on the $10 \times 10 \times 10$ grid. We find that construction is one of the most sensitive sectors, but also retail clothing, foods and home improvement. On the other hand, among the less sensitive are some wholesale sectors, utilities, and less sumptuary retail like jewelry and furniture. What the table seems to show is that sectors that depend more on consumption demand are more sensitive to shocks, while sectors that depend more on investment demand or inventories are less sensitive. This is curious since investment demand is the more volatile component of aggregate demand. It must be that, by nature, these suppliers are larger, more productive and less financially dependent.

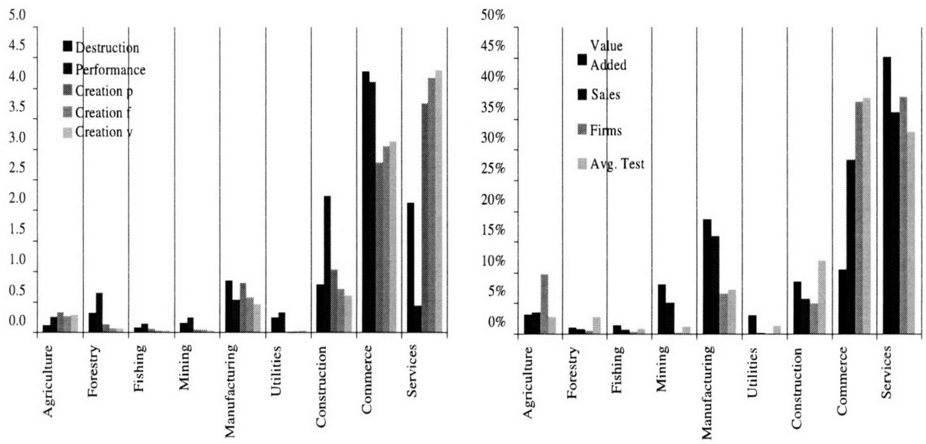


Figure 2.13: Relative LR Test for Shocks in Different Sectors of the Chilean Economy

Table 2.4: Subsector Sensitivity to Shock, Ranking of LR Tests

Most Volatile		Less Volatile	
Destruction			
1	Construction	42	Other Manufactures
2	Retail, clothing	41	Retail, office and school supplies
3	State and Social Services	40	Wholesale, textiles, clothing and leather
4	Retail, home improvement	39	Retail, jewelry, watches and apparel
5	Other Activities	38	Fishing
6	Restaurants and hotels	37	Retail, furniture
7	Technical and Professional Services	36	Mining, Quarrying, Gas and Petroleum Extraction
8	Agricultural Production	35	Transport
9	Retail, foods	34	Electricity, Gas and Water
10	Financial Services	33	Retail, garden products
Creation			
1	Retail, clothing	42	Wholesale, textiles, clothing and leather
2	Construction	41	Wholesale, agriculture, hunting, fishing and forestry
3	Retail, home improvement	40	Retail, jewelry, watches and apparel
4	Forestry	39	Other Manufactures
5	Retail, hunting and fishing apparel	38	Retail, machinery, motors and equipments
6	Retail, foods	37	Retail, leasing and renting goods
7	Financial Services	36	Agricultural Services
8	Retail, artifacts related to food services	35	State and Social Services
9	Retail, furniture	34	Retail, artifacts related to health services
10	Retail, bicycles	33	Retail, garden products
Performance			
1	Retail, clothing	42	Other Manufactures
2	Construction	41	Mining, Quarrying, Gas and Petroleum Extraction
3	Retail, home improvement	40	Electricity, Gas and Water
4	Technical and Professional Services	39	Retail, office and school supplies
5	State and Social Services	38	Wholesale commerce, textiles, clothing and leather
6	Restaurants and hotels	37	Fishing
7	Retail, gas stations	36	Retail, jewelry, watches and apparel
8	Other Activities	35	Wholesale, metallic, machines, equipment and motors
9	Retail, artifacts related to food services	34	Retail, garden products
10	Wood Manufactures and Paper	33	Agricultural Services

2.6 Conclusions

In this chapter we used FUNDES-SII panel database to characterize firm creation, destruction and performance in Chile. We have shown that, as expected, larger and more productive firms are less likely to be destroyed; and (also as expected) they are less likely to be created than smaller and less productive firms. However, they are more likely to perform better in sales. So, it seems they reflect the shocks of the economy on sales performance, or, as we interpret in this chapter, in the execution of individual entrepreneurial projects within the firm. For smaller and less productive firms shocks and changes are reflected in survival, destruction or creation. We have shown that "financial dependence" has different meaning for smaller firms, as reflected in a significant difference in sign of the corresponding parameter. For them it is an indicator of "financial constraint" and acts in our regressions as a predictor of firm destruction, of bad sales performance and a also as a stronger predictor of firm creation than for larger firms. All of this evidence seems to lend support to the general notion (and practice) in the literature that size can be used as a proxy of financial constraints, but only, it seems, for the smallest of firms.

We also show in this chapter that there is some evidence to support the theoretical predictions of Chapter 1. In particular, there does seem to be a margin of high productivity low capital firms that are very sensitive to shocks. We also illustrate, in this Chapter, the high degree of heterogeneity that lies behind our general regression results for the whole of the Chilean economy. Finally we characterize sensitivity of firm flows as a largely urban phenomenon that is mostly seen in the commerce and services sectors, in a distant second place we find construction and the sector that is most used by the literature: manufacturing.

Chapter 3

Fragility in Chile: The Job Side

3.1 Introduction

The FUNDES-SII data set used in Chapter 3 had many virtues: representativeness, financial data, and sheer size. However it had three central defects that make this chapter's estimations worthwhile. The first was that it was constructed on the basis of a legal and not an economic definition of firms, so we could be missing the most fragile parts of the economy. The second is that it had no data on labor, so we had no way of measuring the social effects of the firm flows documented. The third was thatdue to an administrative adjustment, the data set starts in 1999, right after the Asian Crisis and it is not possible (at this point) to splice the data set with the one used in Crespi (2003). So, not only is the data set relatively short in time, also it does not allow us to look at the major shock that the Chilean economy has suffered in the last 25 years.

In this chapter we document the effects on Chilean creation and destruction of firms of the Asian Crisis of 1998, from the viewpoint of job creation and destruction. I will do this by using a new database consisting of a moving panel of workers constructed from the National Employment Survey (NES) of the Chilean National Bureau of Statistics (Instituto Nacional de Estadísticas, INE). The most innovative aspect of this section lies in the construction and use of this new information drawn from the NES of Chile, which allows us to estimate job creation and job destruction for the very first time, since it is the very first panel-like database of this magnitude (in time and observations) for Chile.

In this data set the object we will analyze is "jobs" or "workplaces" rather than firms. One advantage is that jobs are defined subjectively by surveyed workers rather than legally by a government agency. This allows us to capture much smaller and potentially more fragile firms, as well as firm-like arrangements between economic agents. A serious limitation that this data set has for the purposes of this dissertation is that it has very few characteristics of these firms: only a very coarse measure of size and the economic sector. Still, we will attempt to further our understanding of economic churning and fragility in Chile by squeezing out as much information as we can from this database, as the following sections will show: this turns out to be quite a lot.

The Chapter is organized in the following way: Section 3.2 discusses the data, its origins, advantages and limitations. It also presents the basic stylized facts on Chilean job flows, more of which can be found in Appendix A.1. Section 3.3 presents our main results on the differential propensity of small firms to the destruction and creation of jobs, as well as bankruptcy (which is a surprising bonus that we get out of this database). Section 3.4 tries to characterize the workers that are involved in this workplace fragility and the sectors of the economy where it happens. We end with the conclusions in Section 3.5. Also Appendices A.1 and E contain detailed descriptions of the data and extended results that correspond to this chapter.

3.2 Stylized Facts on Job Flows

The first attempt to construct a panel from the INE database can be found in Bravo et al. (2005) (we will call by the acronym BFL). In that version of the paper the series of job creation and destruction are in quarterly frequency, while now we have been able to disentangle them into a monthly frequency. Hence, one of the main advantages of the INE-BFL panel: in Chapter 2 we had six points in time (six years) from which we could derive five changes. Now we have 111 points in time (37 quarters from 1996.1 to 2005.1 times 3 months per quarter) from which we can derive 108 changes. Also, the time span includes the Asian Crisis, so we can infer some of the effects that this mayor macroeconomic event had on the most fragile events. As it turns out, from the viewpoint of smaller firms we have an additional relevant macroeconomic event: the international liquidity squeeze that followed 9/11.

3.2.1 The Data Set

On average for a pair of consecutive quarters we have data entrances for 72,000 individuals interviewed from 19,000 households (in a country with a labor force of roughly 6.3 million).[1] The data is representative of the Chilean national job market and is properly weighted when calculations are made.[2]

Using this type of data has advantages and disadvantages in comparison to the traditional approach of using data from manufacturing surveys. The first advantage, of course, is representativeness. The broadest definition of manufacturing accounts for just over 17% of Chilean GDP, 6% of Chilean firms and around 13% of employment. This survey allows us to observe all sectors of the economy, not only manufacturing. A second mayor advantage is that the survey places the definition of "what is a firm" or "what is a job" in the hands of the surveyed household, while industrial surveys rely on legal definitions of what is a job, what is a firm and what is a plant. For example, in this survey, informal firms (even ilegal), micro firms and self employed workers are surveyed as job creators (although we will not count self employment as jobs). The main disadvantage of using this type of data is that there will be no financial information on the firms so we will have to use size as a proxy for financial constraints. Moreover, in this particular case we will only dispose of a very coarse measure of size. We will be able to separate the database into self employed jobs (that we will not count), jobs in firms with up to five workers (that we call micro), jobs in firms with five to ten workers (that we call small) and jobs in firms with more than ten workers (that we call medium to large). Modern definitions of what is called a micro firm are based on sales rather than workers, but it used to be frequent to call micro a firm with less than 10 workers. In this database we basically two types of micro firms and the rest. In all the results of this chapter we group the 0-5 workers category with the 5-10 workers category and call "smaller" firms those that have less than 10 workers.

The INE by law deletes the identities of the individuals of each household

[1]The original database has interviewes to approximately 32,000 households per quarter and as data entrances for approximately 120,000 individuals. As Appendix ?? shows, the loss of data due to the splicing of two quarters and the extraction of the short panel is approximately 60%, but the resulting unemployment rate for Chile on the restricted data set is almost identical to the original and official number for the country. This is a good sign that the inevitable biases introduced by our methodology are not so significant as to distort our econometric results.

[2]A more extensive explanation of the construction of the database, its virtues and its defects, can be found in Bravo et al. (2005) and are summarized in A.1.

that is interviewed, but keeps the addresses. Each household is interviewed six times in a period of eighteen months. We follow Blanchard and Diamond (1990) and recover a series of short panels using the NES by statistically matching individuals from participating households. The exercise allows us to construct a series of short panels that enables us to calculate job creation and destruction for different types of firms. Since the survey does not identify the firm where the worker is employed, we can only estimate minimum job destruction and creation. We will be able to count as a job created an observation that shows a worker that transits from unemployment, self-employment or absence from the labor force to employment; or that changes the economic sector of his firm. We will be able to observe as job destruction a worker that transits from a job to unemployment, self-employment or absence from the labor force; or that changes the economic sector of his firm. These two measures clearly underestimate job flows, since it is entirely possible, and in fact quite likely, that there is a significant segment of workers that change firms that will be identical from our point of view. On the other hand, they are the first measures of this type for the Chilean economy, and it is the best we can do for micro firms in this country.

3.2.2 The Stylized Facts

Panel (a) of Figure 3.1 shows the growth of the Chilean economy[3] and the unemployment rates for all quarters since 1996. Panel (b) shows raw minimum job creation and job destruction as estimated from the NES with our methodology.[4] What we have calculated, for each month is the number of jobs created and destroyed during the following quarter. So, for example, if in panel (b) reports for January 1997 a 26% job destruction rate, it means that 26% of dependant jobs existing in January had been destroyed in April.

As we can see in the first panel, there is a significant fall in the growth rate of the economy during 1998-99 as a result of the Asian Crisis that significantly deteriorated both the terms of trade and the interest rates faced by the country. The economy enters a recession during the year spanning

[3]Chile has a monthly indicator of GDP called the Monthly Index of Economic Activity (IMACEC) that is constructed by the Statistics Department of the Central Bank. The table shows the cyclical component of the index that is calculated and reported as official by the bank. More information can be found in the Central Bank of Chile's website: http://www.bcentral.cl.

[4]We only include data up to and including all months of 2004 since the data for splicing the 2005 quarters is not available yet. The data for the first three months of 2005 was used to construct the flows for the months of the last quarter of 2004.

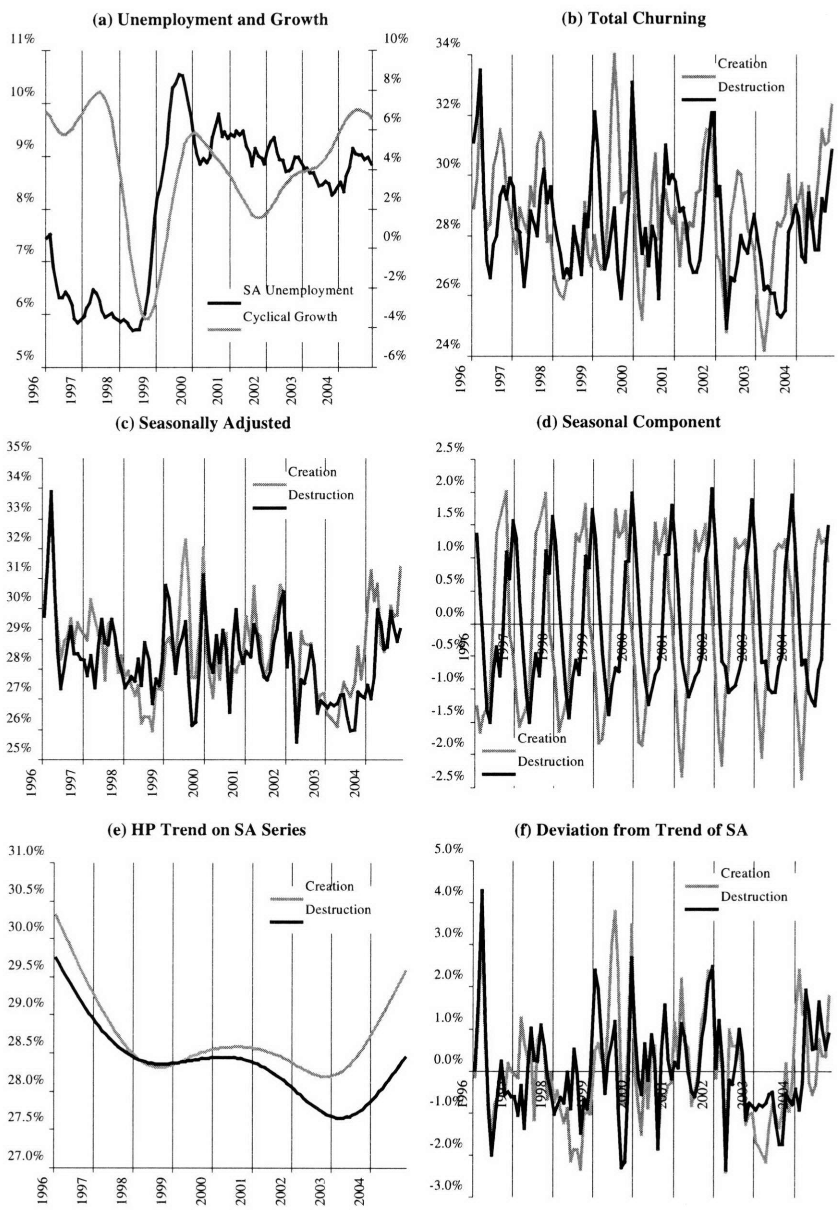


Figure 3.1: Economic Cycle and Job Flows in Chile

from mid 1998 to mid 1999. However, the effect of this shock on job flows is slightly more lasting.[5] In the second panel we see that the events of 1998 and 1999 does not seem to have created a significant and permanent change in gross labor market flows as hypothesized by some. Unfortunately we only have data from 1996, but it seems that, if anything, job churning fell during the 1998-2003 period and seems to be back up. The Asian Crisis seems to have impacted especially on job creation rather than job destruction, a stylized fact that we can see (in a lower scale) during the post 9/11 months. During the disappointing 2002 and 2003 we see a sharp fall in churning that reverts as the economy recovers during 2004.

On average quarterly job creation and destruction for Chile seem to fluctuate around 28%. These are very high rates of job creation and destruction by any comparison, but still in a range that can be believed if compared to international evidence. For example Hall (2005) shows that on average since 2000, anything between 3%-7% of jobs in the US are separated every month depending on the database source, which would give quarterly separation rates of 9%-21%. Anderson et al. (1994) show that 23% of jobs are separated each quarter and, more relevantly to our results, this rate goes up to 27% among firms with less than 20 employees (13% among firms with more than 2000 employees) and up to 36% for firms with an annual payrolls of less than US$4,000 per worker. Still, our data shows a Chilean job market that is very fluid on average, a result that is consitent with other recent studies.[6]

[5]The permanence of the increased unemployment rate drove some analysts to state that the Chilean economy had endured a "structural" change in the job market. The Asian Crisis and the Labor Reforms of 1999 were supposed to be the culprits. During 2005 (not included in the graph) there has been a significant fall in the unemployment rate, an significant growth of the labor force and a sustained rhythm of dependant job creation. As a result, the spin on a structural change of the Chilean job market has lowered in volume. Also note that this period was characterized by an increase in the flow of self employed and meso-formal workers transiting towards better quality and formal jobs. Hence, the paradoxical increase in the unemployment rate and the number of jobs churned.

[6]Ferrada and Reinecke (2005) use a dataset of formal and relatively large firms that are affiliated to the Chilean Security Asociation (workplace hazard insurance) to find that 26% of jobs are churned every year. This is much lower than we estimate, but, then again, their database is composed of very formal and relatively large firms. On the other hand, the newly established Chilean unemployment insurance system is already revealing that every year 800 to 950 thousand jobs are churned, which confirms that our methodology tends to underestimate job flows for Chile and that they are substantial. Each database has its biases, in this case they are due to the fact that only new employees have to be hired with unemployment insurance. In any case, the numbers seems extreemly large. The mainstream hypothesis being spined however, is that there statistics are largely due to an increasing number of firms that hire the same workers for repeated short periods with the objetctive of minimizing the costs involved in a long term labor market relationship

Panels (c) and (d) show the X12 seasonally adjusted series and seasonal components of creation and destruction for Chile. As we can see, there is significant seasonality. In particular, job creation increases during the second half of each year and is followed by an increase in job destruction that usually happens in the transition from one year to the other. Visually there seems to be an interesting symmetry in Panel (d): for creation, the relative height of the high creation season seems to have fallen through time while the depth of the low creation season seems to have increased in time. For destruction it seems to have gone in the exact opposite direction although the effect on the high destruction season is less clear. Finally Panels (e) and (f) show the Hodrick-Prescott trend ($\lambda = 14,400$) for creation and destruction and the deviation from this trend. This seems to indicate that churning was depressed during the low growth years of the middle of the sample and seems to increase during the high growth periods (beginning and end of the sample). However, we cannot be very categorical about this stylized fact since we only observe one macroeconomic cycle in our data set.

Panels (a) and (b) of Figure 3.2 show the original series and the seasonally adjusted series for creation and destruction in Chile for smaller firms (less than 10 workers) and larger firms (more than 10 workers). There is clear difference in the level of job churning among different sizes of firms. Among medium to large firms, approximately 25% of the jobs are churned quarterly. Among small firms it goes up to 35% which is strikingly similar to the smallest size category in Anderson et al. (1994). It is also striking how robust the difference between the two type firms is. The other interesting feature is that for smaller firms churning seems to be much more volatile and sensitive to the economic cycle. Panel (c) shows the Hodrick-Prescott trend ($\lambda = 14,400$) for the flow series of panel (b). Panel (d) shows the standard deviation around the HP trend for a centered mobile year.[7] Both the creation and destruction of workplaces among smaller firms is more volatile than for larger firms. Also, among smaller firms creation is clearly the more volatile series. It is important to remember that we are showing stylized volatility and not "sensitivity" or "fragility". To estimate these more causal categories we need to do some econometrics. We do so in section 3.3.

We now exploit a useful question of the NES survey. The questionnaire asks unemployed people when was the last time they worked, and if why

and evading social security contributions. I am not aware of any evidence to support this hypothesis.

[7]Call $\tilde{x}_t$ the HP trend and x_t the series submitted to the filter. To calculate the series of panel (d) first calculate $y_t = (x_t - \tilde{x}_t)^2$ and then take the square root of a moving anual average of y_t.

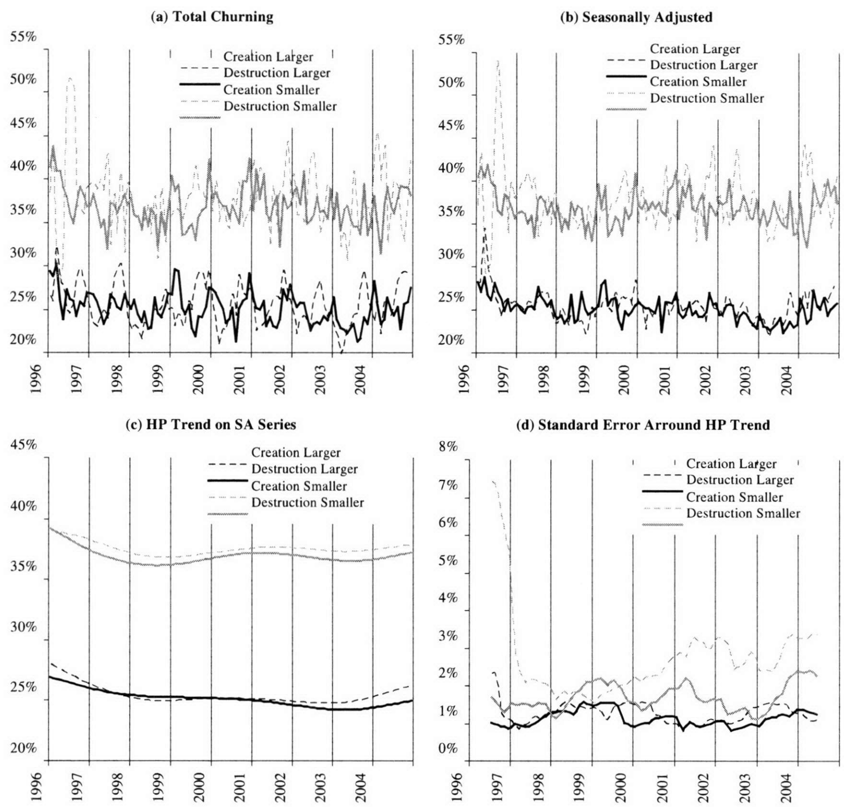


Figure 3.2: Job Churning in Chile by Size of Firms

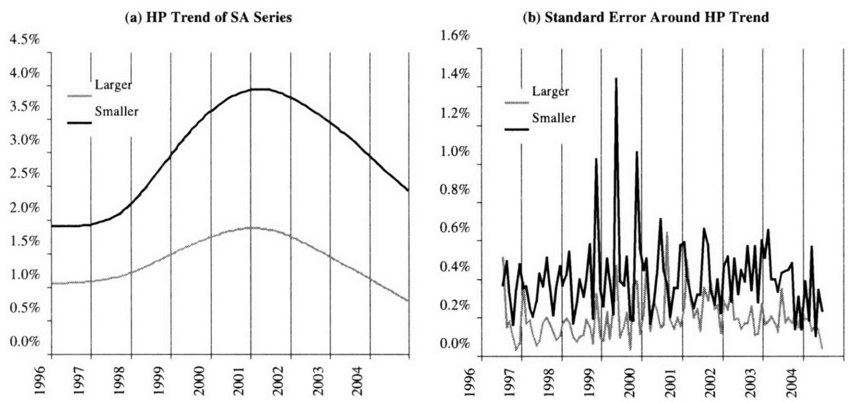


Figure 3.3: Destruction due to Bankruptcy in Chile

they lost their job. They are given four options: that the firms went broke, that it downsized, personal reasons and other. We do not use the first question to construct flows because of the very low answer rates (i.e. most people answer the year but not the month). We do exploit the second question, that has a higher answer rate, although much lower than the standard unemployment survey questions.[8] This will of course, lower the robustness and significance of the econometric results when compared to the other series we have constructed. Still, we find some very striking empirical regularities.

In Figure 3.3, once again we decompose a HP trend and a cycle around it that we summarize with a standard deviation for a centered twelve month window. The number reported in Panel (a) of the figure is the percentage of jobs that were destroyed due to bankruptcy. As we can see, before the Asian Crisis the proportion of job loss due to bankruptcy was roughly double among smaller firms than among larger firms. The Asian Crisis clearly makes them both increase but the increase is much more dramatic among smaller firms. Before the crisis roughly 1.8% of jobs destroyed in smaller firms were due to bankruptcy, since job destruction at that point was roughly 36%, we can say that approximately 0.7% of smaller firms jobs

[8]The NES is answered, about half the time by the housewife or mother of a household. This may explain why this question is not answered so frequently. She might know if the members of the household are or not employed, but not necessarily why they lost or changed their last jobs.

were being destroyed by bankruptcy. At the peak post crisis effect in late 2001 bankruptcies were accounting for 4% of destruction among small firms which means that around 1.5% of smaller firm jobs were being destroyed by bankruptcies. Among larger firms these incidences were much smaller. Instead of going from 1.8% to 4%, bankruptcies increased from 1% to 1.7% and since destruction among these firms is around 25%, bankruptcy destruction among larger firms went from 0.3% to 0.5%. We acknowledge that our measure probably underestimates the levels of job destruction that can be associated to bankruptcy. However, we have no reason to think that the level difference of panel (a) or that the evolution of the two series could be distorted. Moreover, there are reasons to think that firm bankruptcy is even greater among micro firms when compared to medium to large firms, since, the average micro firm has less workers. In panel (b) awe show the standard error of the seasonally adjusted series around the HP trend. Destruction due to bankruptcy volatility seems to be robustly larger among smaller firms.

The stylized facts of this section give us some reason to believe in the predictions of the model of Chapter 1 that workplaces in smaller firms are more sensitive to macro and sector shocks, and that destruction of firms (bankruptcy) is much more likely, more sensitive and more volatile among small firms. From the results of this section alone, however, we will never be able to infer what it is size is a proxy for. For that we must refer back to Chapters 1 and 3 of this dissertation. However, it could still be the case that this reflects sector effects rather than any other characteristic of the firm. In the next section we will submit this stylized fact to econometric testing and find that it survives quite robustly.

3.3 Workplace Fragility and Small Firms

In this section we attempt to identify the effect of being a small or micro firm on the probability for creating and destroying jobs. As we have already pointed out the advantage of the INE panel we have constructed is that it classifies as a job whatever surveyed individuals call a job. It can be a job in a completely informal (even illegal) enterprise, it may be a working relationship that has no legal or contractual expression, as long as it is considered a job by the surveyed individual (and he does not consider himself to be self employed) it will show up in our panel as a job that is either being created, destroyed or is surviving a certain period of time.

3.3.1 The Framework

Conceptually we are assuming a Schumpeterian economy much like the ones we can find in Caballero and Hammour (1996) and subsequent papers by these two authors. These papers are constructed by modeling matches between labor and capital, rather than matches between ideas with capital, which is what most economists relate to models of entrepreneurship. Chapter 1 of this dissertation presents a model of entrepreneurship, but not the model of matching of capital and labor that is most suited for the estimations of this section. The simplest Caballero and Hammour model has a new matching being feasible if there it is able to cover the returns to capital and labor.[9] Hence, it is efficient to create a job if

$$y(\pi, \phi, k, \theta) \geq w_k + w_l \tag{3.1}$$

where y is the value added to be allocated between the to factors, and $\{w_k, w_l\}$ are the outside options available to capital and labor. We also inherit for the model of Chapter 1 three determinants of the surplus that is being divided between the factors: the productivity of the entrepreneurial project into which the worker is being matched π, the size ϕ of the entrepreneurial project, k the proportion of investment that is covered by internal resources of the entrepreneur, and θ a vector of characteristics of the worker.

The central question of the Caballero and Hammour models is to study how the specificity of capital, labor market institutions and regulations affect the efficiency of Schumpterian creative destruction. This is not the central issue that we study in this dissertation. However, the mechanics of the model require a rigidity so that creative destruction is not instantaneous and the churning of resources becomes what the authors call "sclerotic" or slow. We need to believe that there is some level of sclerosis in the economy for creation, destruction and churning to be interesting objects that we regress against characteristics of either the firms or the workers. In the name of simplicity we assume that capital is completely "specific" to a particular matching, and, once committed, looses all of it's opportunity cost. Since labor is assumed to have no specific properties, the matching process generates rents of

$$s = y(\pi, \phi, k, \theta) - w_l \tag{3.2}$$

[9]For the purposes of this chapter we choose to sketch the simplest Caballero and Hammour model. Fully fledged models with complete discussions and specifications can be found in their papers.

for a representative match. Assume that these rents are Nash bargained and that λ represents the relative negotiation power of capital. Then, the returns to capital and labor in match j are

$$\begin{aligned} w_k^j &= \lambda s \\ w_l^j &= w_l + (1-\lambda)s \end{aligned} \tag{3.3}$$

and matches only become jobs if

$$\lambda s \geq w_k \tag{3.4}$$

which, considering equation 3.2, implies

$$y(\pi, \phi, k, \theta) \geq \frac{w_k}{\lambda} + w_l \tag{3.5}$$

and we will be interested in the object

$$P(Creation) = P\left(y(\pi, \phi, k, \theta) - \frac{w_k}{\lambda} - w_l \geq 0\right) \tag{3.6}$$

The simplest way to understand the scrapping of matches in the Caballero and Hammour model is to consider the opportunity cost of labor that is already involved in an enterprise. In a job market that presents unemployed workers with a probability p of finding a job, the opportunity cost of labor is

$$p w_l^j + (1-p) w_l \tag{3.7}$$

where w_l^j is the wage in a matched enterprise while w_l is the outside option (unemployment benefits or home production). Hence, as long as the value added of a preexisting unit is smaller than 3.7, that firm will be scrapped. The main result of the model (which is not central to this Chapter) is that the participation of labor in quasi-rents elevates the value of w_l^j over the outside revenue of labor w_l for any representative firm, and hence, makes the scrapping threshold more demanding. For us it suffices to notice that equations 3.5 and 3.7 imply that a match will be scrapped if

$$y(\pi, \phi, k, \theta) \leq (1-\lambda)ps) + w_l \tag{3.8}$$

hence, we will be interest in the object

$$P(Destruction) = P\left(y(\pi, \phi, k, \theta) - (1-\lambda)ps - w_l \leq 0\right) \tag{3.9}$$

Finally we will also be interested in the particular case (of probability p) of individuals that are churned automatically by the system from one job to another. We will call this Schumpeterian churning.

3.3.2 The Probits

We have to remember that the origin of the data constraints the practical specification that we can give to the equation to be estimated. Since the origin of the data is the Chilean national employment survey we only have a rough measure of size ϕ, and a relatively complete measure of the characteristics of the worker θ. However, we do not have any direct information on π or k. Moreover, as we have pointed out in section 3.2, the survey has only three alternatives for the size of a firm: 0-5 workers,5-10 workers and more than 10 workers. Moreover, the middle category (5-10) has very few observations when compared to the other two. We choose to aggregate and create a broader category of firms with less than 10 workers, the parameter we estimate for this dummy will be the critical object in this subsection. Hence, for equation 3.6 we estimate

$$P(Creation)_{t,f,i} = F\left(\beta_0 Yr + \beta_1 Mth + \beta_2 \theta_{t,i} + \beta_3 DSc_{t,f} + \beta_4 DSz_{t,f}\right) \tag{3.10}$$

for firm f, individual i at time t. Our database has monthly data so have year dummies Yr that we hope will capture some of the macroeconomic fluctuations faced by the Chilean economy, and month Mth dummies that we hope will capture some of the seasonality of the job market. We include a vector of nine sector dummies DSc and a dummy for small firms DSz. With vector θ we exploit the main characteristic of the database: the extensive characterization of the worker. Vector θ includes years of schooling, potential experience, potential experience squared, and a female dummy. Since we do not have a measure of actual experience, we have to choose between including a measure of potential experience (age minus schooling minus 5) or age, and live with the fact that the interpretation is ambiguous. Since we treat this variable as if it was experience we also include it's square to allow for a concavity in the returns to schooling.

Similarly for equation 3.9 we estimate

$$P(Destruction)_{t,f,i} = F\left(\beta_0 Yr + \beta_1 Mth + \beta_2 \theta_{t,i} + \beta_3 DSc_{t,f} + \beta_4 DSz_{t,f}\right) \tag{3.11}$$

only in this case the size dummy and sector dummy correspond to the characteristics of the firm where the job was created while in equation 3.10 it corresponds to the firm where the job was destroyed. This is a relevant distinction since there is a substantial number of observations where workers are churned from one job to another, so they have firm characteristics both for the destroyed and created workplaces. Moreover, we estimate a specific regression for jobs schumpeterian churning that has the same functional form:

$$P(Churning)_{t,f,i} = \beta_0 Yr + \beta_1 Mth + \beta_2 \theta_{t,i} + \beta_3 DSc_{t,f} + \beta_4 DS_{t,f} \quad (3.12)$$

Table 3.1 presents parameter $\hat{\beta}_4$ for regressions 3.10, 3.11 and 3.12. The complete output of the preferred regressions for the complete sample spanning all years can be found in Appendix E. To check for robustness the table also presents the estimated parameters for yearly sub samples. those regressions are identical to the ones for the complete sample only we drop the year dummy.

Table 3.1 shows an extraordinarily high and robust level of significance for our estimations (each parameter comes from the estimation of the model for a different sample). For the whole of our sample we can say that a job in a small firm has a 12.4% increased chance of being destroyed. From columns 2 and 3 we can see that there is a 3.7% lower chance of creating jobs in a small firm and a 2.1% lower chance that a job is destroyed without leaving the worker unemployed. Hence, Table 3.1 leaves us with three empirical regularities for the Chilean economy. First, workplaces at smaller firms are significantly and intrinsically more fragile, even when we control by economic sector. Second, smaller firms find it harder to create workplaces. Third, destruction of a workplace in smaller firms is more likely to create unemployment, so that not only are smaller firms more fragile, but also workers at small firms are fragile, and it is less likely that the job was destroyed because the worker churned into a more profitable position in the market.

If we glance at the results by year sub sample we find that $\hat{\beta}_4$ does seem to have increased after 2001, but does not seem to change after 1998. The parameter does seem to increase towards the second half of our sample. In any case, the highest level for the parameter is 13.1% in 2003 and the lowest is 11.5% in 1999. The $\hat{\beta}_4$ parameter for the creation regression (column 2) also seems to increase (in absolute magnitude) in the second half of the sample. The $\hat{\beta}_4$ parameter for the churning regression (column 3) does not

Table 3.1: Parameter $\hat{\beta}_4$ from Destruction, creation and Schumpeterian Churning from Weighted Probits (complete sample and year sub samples)

Sample	Workplace Destruction	Workplace Creation	Schumpeterian Churning	Destruction by Bankruptcy
All years	12.36%	-3.67%	-2.12%	2.47%
	(0.18%)***	(0.01%)***	(0.12%)***	(0.02%)***
1996	12.81%	-3.70%	-3.14%	1.97%
	(0.56%)***	(0.05%)***	(0.39%)***	(2.14%)
1997	11.66%	-3.60%	-1.52%	2.07%
	(0.55%)***	(0.05%)***	(0.39%)***	(1.80%)
1998	11.64%	-3.49%	-2.34%	4.64%
	(0.55%)***	(0.05%)***	(0.38%)***	(1.84%)***
1999	11.53%	-3.55%	-2.49%	4.76%
	(0.57%)***	(0.05%)***	(0.39%)***	(2.30%)**
2000	12.67%	-3.42%	-1.90%	-0.08%
	(0.54%)***	(0.04%)***	(0.35%)***	(1.70%)
2001	11.93%	-3.63%	-2.00%	-1.06%
	(0.53%)***	(0.04%)***	(0.35%)***	(2.02%)
2002	13.10%	-3.51%	-1.61%	5.07%
	(0.52%)***	(0.04%)***	(0.35%)***	(1.74%)***
2003	13.17%	-3.78%	-1.85%	3.80%
	(0.52%)***	(0.05%)***	(0.34%)***	(1.92%)***
2004	12.73%	-4.31%	-2.39%	2.58%
	(0.55%)***	(0.05%)***	(0.37%)***	(1.69%)*

Note 1: table reports marginal effects of variables in a probit regression, with standard errors in parenthesis.
Note 2: * is 90% significance,** is 95% significance,
*** is 99% significance.
Note 3: Re-weighting is done by rescaling the observations of the database to preserve the number of observations so that standard errors are not underestimated by artificially increasing the size of the sample ("aweight" command in Stata).

seem to have a any clear trend. In any case it seems that these parameters are quite structural since they show so much robustness through time.

Table 3.1 could seem to indicate that employment in small and micro firms is in retreat during the period being analyzed. This is in fact not so, there is no trend at all and the importance of small and micro firms in our panel seems to constantly hover around 26% once we take into account sample weights and expansion factors. Since the regressions of Table 3.1 (and in fact all regressions in this chapter) are weighted, this cannot be the explanation.[10] The explanation for the apparent discrepancy is twofold: first the bases of columns 1 and 2 are completely different. The base of column 1 is total workplaces for workers that have survived into our panel, the base of column 2, on the other hand is total unemployed, self employed and inactive workers, which is a much larger number. In fact the proportion of workplaces to non placed workers in our database is 2 to 1. So, the parameters of column 2 should be doubled to be compared with column 1. In any case, this still seems to show that workplace creation is less likely among small and micro firms. This, in fact, is a wrong interpretation of the parameters, which are saying that given a workplace creation it is less likely that it occurs in a small or micro firm *controling for everything else.* It is possible, and in fact quite likely that the nature of business in some sectors (like commerce and services) requires the creation of small and micro firms. moreover, any Jovanovic (1982) style mechanical model of entrepreneurial learning will predict that firms will tend to start small. Hence, the economy will be creating small and micro firm jobs constantly. What Table 3.1 is telling us is that creation in small firms will be more difficult *ceteris paribus.*

We also exploit econometrically a useful question from the survey where people are asked why they lost their last job. This is the question we use to construct Figure 3.3 in Section 3.2 where we suggest that smaller firms seem to have had a greater sensitivity to the Asian Crisis shock, and that this greater sensitivity is expressed in a larger percent of job destruction caused by bankruptcies. We will now attempt to see if this result survives a regression where we control for all other factors. So, we estimate

[10]It is important to point out that we are not counting as "jobs" the activities of self employed workers. If we did that, and counted these workplaces as micro and small firms we would find that 40%-50% of our workplaces were small or micro, which is a number that is closer to public policy folklore that believes that small and micro firms employ 80% of the workforce. It is also important to remember that in this chapter we are defining small and micro firms by the number of workers. Folklore classifies firms according to sales as we did in Chapter 2

$$P(Bkr/Dest)_{t,f,i} = F\left(\beta_0 Yr + \beta_1 Mth + \beta_2 \theta_{t,i} + \beta_3 DSc_{t,f} + \beta_4 DS_{t,f}\right) \tag{3.13}$$

Where $P(Bkr/Dest)$ is the probability of having been fired because of bankruptcy, conditional on having lost a job. Despite its usefulness, one of the problem that this question of the survey has is that it is answered by very few workers. Of a total of 666,825 possible observations[11] we only have 60,957 that answer this question. This accounts for a sharp fall in the estimated standard errors and the significance of the parameters of Table 3.4.

The fourth column of Table 3.1 shows us that bankruptcy is 2% more likely as a cause for workplace destruction among smaller firms. This difference is significant with a confidence level of 99% and is on the higher range of the differences we could infer from the stylized facts of Figure 3.3. However, what is most interesting is to look at the evolution of parameter $\hat{\beta}_4$. It seems clear that the regression for the whole sample draws it's significance from the post crisis years of 1998-99 (the Asian Crisis) and 2002-03 (9/11 Credit Squeeze). In those years the difference between smaller and larger firms increased into the 4%-5% range which is much higher than what can be inferred from Figure 3.3.

3.4 Who and Where Are the Fragile Workers?

3.4.1 Where are They?

In this section we try to characterize job creation, destruction and churning in Chile across sectors using the INE panel database. In Chapter 2 we have shown some evidence that most of the sensitivity to macro shocks is explained by creation, destruction and performance of firms in commerce, construction and services. First we try to measure sensitivity to shocks of different sectors by setting up likelihood ratio tests similar to those of Section 2.4 of Chapter 2. The test is set up by estimating:

$$P(Event)_{t,f,i} = F\left(\beta_0 Yr + \beta_1 Mth + \beta_2 \theta_{t,i} + \beta_4 DS_{t,f}\right) \tag{3.14}$$

[11]Total observations in the database amount to 2,646,228. However, to be elegible for this regression an observation has to correspond to a worker that has been matched in two consecutive quarters and is working in the first of the two.

Table 3.2: Likelihood Ratio Test on Year Shock Dummies

Sample	Workplace Destruction		Workplace Creation		Destruction by Bankruptcy	
Agriculture, Forestry, Fishing	24.87	***	74.98	***	23.63	***
Mining, Quarrying	39.39	***	12.90		28.35	***
Manufacturing	34.88	***	44.08	***	25.97	***
Utilities	9.11		25.18	***	6.70	
Construction	133.61	***	87.46	***	33.10	***
Commerce, Hotels, Dinning	161.80	***	63.34	***	17.61	**
Transport, Communications	46.56	***	37.00	***	11.22	
Financial, Prof. Services	70.85	***	24.41	***	22.52	***
Non Financial, Pers. Services	68.85	***	72.75	***	17.90	**

Note: * is 90% significance, ** is 95% significance,*** is 99% significance.

for events in each sector and extract the log likelihood statistic for the complete regression, which we call ll_c; then we estimate the restricted regression:

$$P(Event)_{t,f,i} = (\beta_1 Mth + \beta_2 \theta_{t,i} + \beta_4 DS_{t,f}) \tag{3.15}$$

which is the same regression as 3.14 but without the year dummies (which we hypothesize are capturing the macroeconomic shocks of this economy). Again we extract the the log likelihood statistic, which we call ll_r. Finally we calculate:

$$LRT = -2(ll_r - ll_c) \sim X(n) \tag{3.16}$$

and this is what we report in Table 3.2. We will interpret the sign of this test as an indicator of sensitivity of sector to shocks. The variables that will represent shocks will be the year dummies, the importance of their absence in the regression an indicator of sensitivity to macro shocks. The month dummies will remain in the restricted probit to avoid measuring differential seasonality, which, given the results reported in panel (d) of Figure 3.1 that seasonality of job creation and destruction is a mayor feature of the Chilean economy. In the table we observe that the year dummies are significant at some level for almost all sectors in almost all probits. Interestingly, both commerce and non financial and personal services are among the most sensitive sectors to macro shocks across all types of probits. Construction seems to be relatively sensitive in destruction and creation but not so much in churning. All in all, there is some coherence between the results of Table 3.2 and the results found in Chapter 2. However, there are some discrepancies. It seems that one of the most sensitive sector in workplace creation and Schumpeterian churning is Agriculture, Forestry and Fishing. This was not observed in the firm panel of the previous chapter. Moreover, in that database, firms from rural sectors were quite insensitive to shocks. This means that firms in these sectors tend to be insulated in these sectors but not necessarily the jobs they offer.

Table 3.3 reports the estimated $\hat{\beta}_4$ parameters for the three types of probits for which we run a model of the sort described in equation 3.14 for each sector sub sample. The table shows that the small firm dummy is highly significant in almost all sectors for predicting the probability of workplace destruction. However, it also shows that the 11.3% marginal effect that we estimate for the whole of the sample is actually an average across highly heterogeneous sectors. For example, in Mining and Quarrying small firms are 23% more likely to destroy jobs, while in agriculture, forestry and fishing this marginal effect falls to 4.7%. Interestingly, this last sector is quite volatile in job creation, and also has small firms being 75% less likely to create jobs. Finally, the services sector seems to be the place were being a smaller firms determines a very high propensity towards workplace destruction and a very low propensity to creation. This is consistent with the results of Chapter 2 that show services as one of the most sensitive sectors with most firm fragility. Meanwhile manufacturing, which was also a relatively volatile sector in the results of Chapter 2 is the sector where firms have the highest relative probability of destroying jobs because of bankruptcy.

3.4.2 Who are they?

The nature of this database allows us to study the demographic and socioeconomic characteristics of the workers that are being subjected to the fragility of workplaces in the Chilean economy. We will address this by studying three characteristics of workers: (i) sex, (ii) age, (iii) years of schooling. We report the results in Table 3.4.

The first row of Table 3.4 shows the full sample estimation for the female dummy parameters. Table E.2 of Appendix E has the robustness check for year sub samples and from it we can infer that the results are very robust. Being occupied by a female does not make a dependant workplace more likely to be destroyed or more fragile. However, if a job is created it is less likely that it will be assigned to a female (controlling for characteristics of the worker, see full regression in Appendix E). If destroyed it is less

Table 3.3: Parameter $\hat{\beta}_4$ from Destruction, creation and Schumpeterian Churning Probits (complete sample and sector sub samples)

No.	Sample	Workplace Destruction	Workplace Creation	Destruction by Bankruptcy
	All sectors	12.36% (0.18%)***	-3.67% (0.01%)***	2.47% (0.02%)***
1.	Agriculture, Forestry and Fishing	5.08% (0.33%)***	-75.75% (0.20%)***	-1.73% (1.18%)*
2.	Mining and Quarrying	25.75% (2.40%)***	1.63% (0.36%)***	-3.09% (4.30%)
3.	Manufacturing	15.79% (0.56%)***	-0.08% (0.13%)	7.35% (2.18%)***
4.	Utilities	3.28% (2.74%)	-1.61% (0.93%)**	4.72% (9.40%)
5.	Construction	19.91% (0.81%)***	0.64% (0.17%)***	-1.84% (1.96%)
6.	Commerce, Hotels and Restaurants	7.99% (0.42%)***	1.15% (0.08%)***	5.66% (1.27%)***
7.	Transport, Storage and Communications	11.81% (0.63%)***	-0.39% (0.13%)***	4.39% (1.86%)***
8.	Financial and Professional Services	13.05% (0.81%)***	-58.39% (0.70%)***	6.36% (3.73%)**
9.	Non Financial and Personal Services	15.82% (0.36%)***	-67.75% (0.30%)***	-0.67% (1.28%)

likely that it was motivated by efficient reallocation and less likely that it was motivated by bankruptcy. We anticipated these last two results since females are expected to leave workplaces voluntarily to breed progeny. Still, the result in column 2 indicates that firms do resist themselves to occupy vacancies with females workers, but column 1 seems to indicate that they are not noticeably discriminated against when deciding to destroy a workplace.

Schooling clearly makes workers less fragile (less probabilities of destruction and more probabilities of creation), although, curiously, schumpeterian churning becomes less likely and bankruptcy more so. The effects of schooling on fragility are very strong. Schooling is a continuous variable that is denominated in years, so Column 1 indicates that, for example, 5 years of additional schooling lower the probability of workplace destruction in 4%.

Finally we show the effect of experience, which, in our specification is captured by a level and a quadratic variable. Since the marginal effect of experience is not linear we must represent it as a function. to understand how we construct it represent the generic probit corresponding to any given column of Table 3.4 as

$$P(Event) = F\left(\alpha + \theta_1 X + \theta_2 X^2\right) \tag{3.17}$$

where α represents everything else that enters the regression. We are interested in the marginal effect of experience which is

$$\nu_c = \left(\frac{\partial P(Event)}{\partial X}\right)_{complete} = \frac{\partial F}{\partial X}\left(\theta_1 + 2\theta_2 X\right) \tag{3.18}$$

and we know that the marginal effect of the linear component of experience (by itself) is

$$\nu_p = \left(\frac{\partial P(Event)}{\partial X}\right)_{partial} = \frac{\partial F}{\partial X}\theta_1 \tag{3.19}$$

and both ν_p and θ_1 are outputs that we can infer from the probit. Hence we can calculate

$$\nu_c = \frac{\nu_p}{\theta_1}\left(\theta_1 + 2\theta_2 X\right) \tag{3.20}$$

We find that potential experience diminishes the probability of loosing a job up to 32 years. Since average schooling in Chile is still only around 8 years, this means that, on average, people minimize their probability of loosing a job (their workplace fragility) in Chile at 45. On the other hand, the probability of entering into a new workplace is maximized at 26 years of experience implying an age of 39. It seems quite clear that the concavity of this variable is a result of it combining to different effects: age and experience, and is a undesired result of not having actual experience and being forced to use potential. Experience is probably always a plus. What our results are saying is that the net effect of experience and age net each other out at 45. After that age, each year makes the worker more and more fragile.

3.5 Conclusions

In this chapter we used the INE-BFL panel database to characterize job creation and destruction in Chile. We have shown, as expected, that smaller firms have a significantly increased probability of destroying jobs and a lower probability of creating them. we have shown that when jobs are destroyed in small firms it is less likely to have been caused by a schumpeterian reallocation of workers and more likely to have been caused by bankruptcy. We also show that this differential propensity to bankruptcy is clustered in periods that follow major macroeconomic shocks.

We show evidence that most of the creation and destruction volatility is concentrated in urban industrias such as construction, manufacturing, commerce and services which is consistent with the evidence from the FUNDES-SII database of Chapter 2, and that job creation is especially weak in small service firms. We show that females are not more fragile workers, but are discriminated against in job creation. We show that schooling significantly diminishes fragility and that experience seems to have a net positive effect (discounting the effect of age) on diminishing fragility up to and around 45 years of age (32 years of experience).

Table 3.4: Marginal Effect of Female Dummy, Schooling and Experience on Destruction, Creation and Schumpeterian Churning from Weighted Probits (complete sample and year sub samples)

Sample	Workplace Destruction	Workplace Creation	Schumpeterian Churning	Destruction by Bankruptcy
Female Dummy	1.36%	-2.80%	-4.93%	-2.47%
	(1.86%)	(0.03%)***	(0.12%)***	(0.00%)***
Schooling	-0.79%	0.16%	-0.12%	0.33%
	(0.02%)***	(0.00%)***	(0.01%)***	(0.09%)***
Marginal Effect of Experience (ν_c) at:				
0 Years	-1.03%	0.26%	-0.18%	0.17%
10 Years	-0.71%	0.16%	-0.17%	0.16%
20 Years	-0.39%	0.06%	-0.17%	0.15%
30 Years	-0.07%	-0.04%	-0.16%	0.14%
40 Years	0.24%	-0.13%	-0.15%	0.13%
50 Years	0.56%	-0.23%	-0.14%	0.12%
60 Years	0.88%	-0.33%	-0.13%	0.11%
Peak Full Sample	32.32	26.39	192.04	161.65

Note 1: table reports marginal effects of variables in a probit regression, with standard errors in parenthesis.
Note 2: * is 90% significance,** is 95% significance, *** is 99% significance.
Note 3: Re-weighting is done by rescaling the observations of the database to preserve the number of observations so that standard errors are not underestimated by artificially increasing the size of the sample ("aweight" command in Stata).

Appendix A

Details on the Construction of the Chilean Data Sets

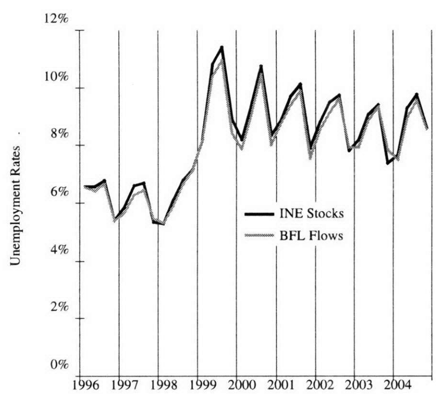
A.1 Job Flow Data Set

The NES is a survey that measures the situation of working-age people in the workforce in Chile (15 years and over). It is carried out on a monthly basis by the Chilean National Bureau of Statistics (Instituto Nacional de Estadísticas, INE) using the following procedure. The sample is divided in to sixths that are equally representative of the Chilean labor market. Each sixth of sampled households is interviewed six times during a period of eighteen months. The sets of sample households are rotated so that, every time a set has been in the sample for eighteen months it is dropped and replaced by a new sample. Therefore the same household can be observed six times (spaced quarterly) for a period of one and a half years.

Households are first uniquely identified by address and then the members within a household are identified by relationship, sex and age. The information does not make individuals uniquely identifiable over time, since two problems persist: different people with the same characteristics (which we term twins) and individuals with variables that have changed over time in more than an acceptable measure. Twins are individuals within households with identical values for the variable characteristics relationship, sex and age. If this effect is not considered, different people could be matched as though they were the same person. In order to avoid this problem, twins are eliminated from the matching process. The second problem is solved by controlling for non-plausible changes in the same person over time in sex, age and schooling. As such, if the variables age or schooling change by 2 units or the sex variable changes, they are immediately eliminated from the matching process. The NES database is monthly, however, at this stage we only have it as a quarterly database. In future work we will process this database in a monthly frequency.

Table A.1.1: Percentages of observations recovery over time

Quarters Ahead	1	2	3	4	5	6
Observations	73888	59760	47112	36079	25835	16965
Percentage Recovered	0.61	0.49	0.39	0.30	0.21	0.14



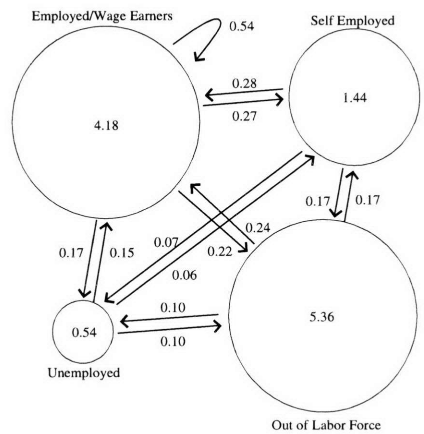


Figure A.1.1: Unemployment Calculated From the INE Stock Database and the BLF Flow Database and Quarterly Labor Market Flows for 1994 (in millions) calculated from BLF

The whole process involves the loss of a significant amount of households. Table 1 shows the recovery rates (percentage of successful matchings in consecutive periods). The period analyzed stretches from the quarter January-March 1996 to January-March 2004 and the recoveries are calculated for the subsequent 3, 6, 9, 12, 15 and 18 months (quarters 1, 2, 3, 4, 5 and 6, respectively). The average recovery rate for one quarter is 61%, dropping to 14% in 6 quarters. The recovery would be 83% if all people were in the survey in both quarters. It should be pointed out that the recoveries are consistent when different groups of individuals are analyzed, for example, by sex, age, geographical region, etc. We must recognize that the loss of households through the statistical matching process is probably not neutral. It's very likely that households that either improve or deteriorate their labor situation significantly will change residence. We will just have to live with this problem and be mindful of it.

Undoubtedly this process introduces some biases. It is highly likely that households that either perform very well or very bad in the job market will change their address and, hence, drop out of our database. Also, households that change their structure very much will look to us as a different family and we will drop them, although performance in the job market may determine important changes in the composition of the household (the children moving out or in for example). A more extensive discussion of the biases introduced in this methodology can be found in Bravo et al. (2005): BFL. It is basically impossible to check on this so, to see if the resulting data set is still representative of the economy we calculate the national unemployment rates and compare them with the official INE ones. This comparison can be seen in the first panel of Figure A.1.1. The unemployment rates from the BFL flow database are slightly lower than the official numbers, but very close. The fact that they are lower indicates that the predominant bias is that households move or are substantially modified when there is an adverse job shock. So the household that survive our calculations tend to be slightly better job market performers.

The second panel of Figure A.1.1 shows average labor market flows for Chile. It is important to emphasize that this is the first formal paper that shows these calculations for Chile. One stylized fact that worries policymakers in the country is the enormous proportion of the working age population that is out of the labor force (47%), this absent labor force is mainly concentrated among females and has become a major policy subject in the country. Another characteristic is the high percentage of self employed workers (12.5%). Also note that the flows to and from self

Table A.2.1: Firm Flows by Year

From	To	Created	Survived	Destroyed
1999	2000	51,565	629,877	42,170
2000	2001	38,905	639,451	64,356
2001	2002	39,711	653,977	46,172
2002	2003	80,946	630,875	43,520
2003	2004	43,297	630,933	60,539

employment are almost as large as those in and out of the labor force and almost double those in and out of employment.

A.2 Firm Flow Data Set

The data set of section 1.3 is composed of all firms that have filed in tax forms between the years 1999 through 2004. The Internal Revenue Service (IRS) has doted them with fictitious identities that are consistent through time. Firms that do not fill in tax forms are assumed to have ceased to exist. Legally, the IRS keeps them active for three years in case their legal identities have been traded and are to be reused in other context. We count as a dead firm a firm that either reports no sales or does not report at all. According to this criterium, the general flows of the database are represented in the following table:

The database has the firms grouped by sector, as declared by the owner. Three things must be pointed out. The first is that it is conceivable that a firm has activities in several sectors of the economy. We reasonably asume, although it is not formally established anywhere, that the entrepreneur will report the "predominant" sector localization of the firm. Second, some firms change their sector from year to year (very few). We assume that this is just another expression of the previous problem. Firms do several things, and, as the evolve and learn, they may change the "predominant" activity that they do. Third, the original database reports 14 mayor sectors and disaggregates commerce into 13 varieties of wholesale and 48 varieties of retail. In order to control by the sector shock we aggregate into 9 sectors in the following way:

The aggregation of sectors we have chosen reflects those made in the official Chilean National Accounts (CNA) with two mayor exceptions. First, in the CNA Agriculture and Forestry are aggregated, so, for the sake of this table, we have separated them according to their participation in sales in our database. Second, in the CNA commerce is usually aggregated with restaurants and hotels. We have separated them, again for the sake of this table, using as weights sales from our database, and reaggregation them by adding restaurants and hotels to services and leaving commerce alone.

Table A.2.2 shows the differences that arise from counting firms or quantifying sales, as well as the differences when counting value added. Agriculture and Commerce seems to be a sector of more firms than sales or value. Mining, Manufacturing, Utilities, Construction and Services are clearly the other way around: few firms, lot's of sales and a large value (particularly in mining).

Table A.2.2: Aggregation of Sectors for Control and Stylized Descriptors

From	To	Firms	Sales	Value Added
		average proportion		
Agriculture Production Agriculture Services	Agriculture	9.8%	3.6%	3.2%
Forestry	Forestry	0.6%	0.9%	1.1%
Fishing	Fishing	0.4%	0.8%	1.5%
Mining, Oiling and Stonemasonry	Mining	0.2%	5.2%	8.1%
Foods, drinks and tobacco Textiles and Leather Woodworks and Paper Chemicals, Oil Derivatives, Rubber Metal Manufactures Machinery and Instruments Other Manufactures	Manufacturing	6.7%	16.0%	18.7%
Electricity, Gas and Water	Utilities	0.1%	0.2%	3.1%
Construction	Construction	5.0%	5.8%	8.6%
13 varieties of wholesale 48 varieties of retail	Commerce	37.9%	28.4%	10.6%
Restaurants and Hotels Transportation Financial Services Technical and Professional Services State and Social Services Leisure and Free Time Personal and Homestead Services Other Services	Services	38.8%	36.2%	45.2%

Appendix B

Proofs for Heterogenous Productivity Model

B.1 Derivation of Equations (1.4)-(1.9)

First notice that the cost of effort in the high effort incentive compatibility constraint is $c - fq$ which is the technological cost of effort minus the expected fine from shirking. In both the high effort participation constraints and in the low effort incentive compatibility constraint the cost of effort is only c, since in those constraints we are not considering the possibility of cheating.

Incentive compatibility to exert effort is satisfied if the firm is willing to expend effort at const $c - fq$ to increase the probability of success from p_l to p_h, given that the firm has signed a contract on the zero profit rate for high effort rp_h^{-1}, hence:

$$\left(\pi W - (1-k)\, rp_h^{-1}\right) p_l \leq \left(\pi W - (1-k)\, rp_h^{-1}\right) p_h - (c - fq) \tag{B.1.1}$$

another way to see this condition is to say that R_{ich}, the maximum interest rate at which a hypothetical bank would be willing to lend to project $\{k, \pi\}$, believing that the incentives of the entrepreneur are aligned with high effort is:

$$R_{ich} = \frac{\pi W - (c - fq)(p_h - p_l)^{-1}}{1-k} \tag{B.1.2}$$

or that, at zero profit interest rate rp_h^{-1} for high effort, the minimum productivity at which the bank will believe effort is expended is:

$$\pi_{ich} = \frac{(1-k)rp_h^{-1} + (c - fq)(p_h - p_l)^{-1}}{W} \tag{B.1.3}$$

which is our equation (1.9).

Participation compatibility within a high effort contract is satisfied if the net result of expending effort and reaping the higher expected value is larger than the outside option of depositing in the riskless interest rate, hence:

$$rk \leq \left(\pi W - (1-k)\, rp_h^{-1}\right) p_h - c \tag{B.1.4}$$

another way to see this condition is to say that R_{pch}, the maximum interest rate at which a hypothetical entrepreneur owning project $\{k, \pi\}$, would be willing to engage in a high effort contract is:

$$R_{pch} = \frac{\pi W - (\delta k + c)p_h^{-1}}{1 - k} \tag{B.1.5}$$

or that, at zero profit interest rate rp_h^{-1} for high effort, the minimum productivity at which the bank will believe effort is expended is:

$$\pi_{pch} = \frac{(r + c)p_h^{-1}}{W} \tag{B.1.6}$$

which is our equation (1.4).

Participation compatibility within a low effort contract is satisfied if the result of executing the project with no effort is larger than the outside option of depositing in the riskless interest rate, hence:

$$rk \leq \left(\pi W - (1 - k)\, rp_l^{-1}\right) p_l \tag{B.1.7}$$

another way to see this condition is to say that R_{pcl}, the maximum interest rate at which a hypothetical entrepreneur owning project $\{k, \pi\}$, would be willing to engage in a low effort contract is:

$$R_{pcl} = \frac{\pi W - rkp_l^{-1}}{1 - k} \tag{B.1.8}$$

or that, at zero profit interest rate rp_h^{-1} for low effort, the minimum productivity at which the bank will believe effort is expended is:

$$\pi_{pcl} = \frac{rp_h^{-1}}{W} \tag{B.1.9}$$

which is our equation (1.5).

Incentive compatibility within a low effort contract is satisfied if the result of executing a low effort project is greater than executing a high effort project:

$$\left(\pi W - (1 - k)\, rp_h^{-1}\right) p_h - c \leq \left(\pi W - (1 - k)\, rp_l^{-1}\right) p_l \tag{B.1.10}$$

another way to see this condition is to say that R_{bl}, the minimum interest rate at which a hypothetical entrepreneur owning project $\{k, \pi\}$, would be willing to prefer a low effort contract to a high effort contract is:

$$R_{bl} = \frac{\pi W - c(p_h - p_l)^{-1}}{1 - k} \tag{B.1.11}$$

or that, at zero profit interest rates for high and low effort, the maximum productivity at which an entrepreneur will prefer a low effort contract to a high effort contract is:

$$\pi_{bl} = \frac{c(p_h - p_l)^{-1}}{W} \tag{B.1.12}$$

which is our equation (1.6).

B.2 Derivation of $\bar{k}$ and $\bar{\bar{k}}$ with related proofs.

First, from equations (1.4) and (1.6) we can see that a sufficient condition for low effort contracts to never be preferred over high effort contracts is:

$$c(p_h - p_l)^{-1} \leq (r + c)p_h^{-1} \tag{B.2.1}$$

which ends up implying

$$\frac{c}{r} \leq \frac{p_h - pl}{p_l} \tag{B.2.2}$$

or that the financial cost of effort is lower than the financial gain from effort.

Second, from equations (1.4) and (1.5) we can see that a sufficient condition for there to never be a two tier economy in the absence of information asymmetry is that:

$$rp_l^{-1} \leq (r + c)p_h^{-1} \tag{B.2.3}$$

which ends up implying (B.2.2).

Third, from equations (1.4) and (1.9) we derive equation (1.10) retyped here:

$$\bar{k} = \left(\frac{c}{r}\right)\left(\frac{p_l}{p_h - p_l}\right) - \left(\frac{fq}{r}\right)\left(\frac{p_h}{p_h - p_l}\right)$$

so that for there to be a dual margin economy condition (B.2.2) must be satisfied.

Fourth, although it is redundant given our three previous steps, it is interesting to note that from equations (1.5) and (1.6) we can see that a sufficient condition for the BL roof to be lower than the PCL floor is:

$$c(p_h - p_l)^{-1} \leq rp_l^{-1} \tag{B.2.4}$$

which implies condition (B.2.2).

So summarizing, either $\pi_{pch} \geq \pi_{pcl} \geq \pi_{bl}$ and $\bar{k} \geq 1$, and/or $\pi_{bl} \geq \pi_{pch} \geq \pi_{pcl}$ and $\bar{k} \leq 1$. Hence if condition (B.2.2) is satisfied we will have an economy such as panel (a) in Figure B.2.1, with the possibilities of a dual and tripe margin economies and tiers of firms. If not, we will have an economy such as panel (c) in Figure B.2.1, with a unique participation constrained low effort margin, two tiers, and the potential for a dual tier margin. Finally, panel (b) shows the case where the financial cost of effort is exactly equal to the financial effect of effort. In this case there is no dual margin, but rather a tier margin with a slope where it becomes easier for richer entrepreneurs to qualify for low interest rates.

In panels (a) and (b), the kink in the tier margin $\bar{\bar{k}}$ is the intersection of (1.5) and (1.9) and is

$$\bar{\bar{k}} = 1 + \frac{cp_h}{r(p_h - p_l)} - \frac{p_h}{p_l} \tag{B.2.5}$$

and in panels (b) and (c) the tier margin $\bar{\bar{k}}$ is the intersection of (1.6) and (1.9) and is

$$\bar{\bar{k}} = 1 - \frac{fqp_h}{r(p_h - p_l)} \tag{B.2.6}$$

so that as $fq \to 0$, and condition (B.2.2) is satisfied as an equality, $\bar{\bar{k}}$ in both (B.2.5) and (B.2.6) converges to 1.

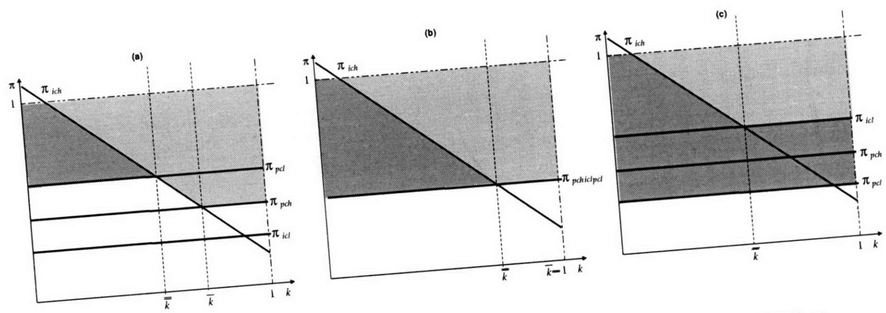


Figure B.2.1: Alternative Levels of Relative Financial Relevance of Effort

B.3 Derivation of effect of taxes and controls on capital flows.

Consider an ad-valorem tax on capital outflows for residents of t_{out} and an ad-valorem tax on capital inflows of t_{in} for non-residents. The ICH equation of (B.1.1) is recast as

$$\left(\pi W - (1-k)(1+t_{in})rp_h^{-1}\right)p_l \leq \left(\pi W - (1-k)(1+t_{in})rp_h^{-1}\right)p_h - (c-fq) \qquad \text{(B.3.1)}$$

which means that (1.9) is now

$$\pi_{ich} = \frac{(1-k)(1+t_{in})rp_h^{-1} + (c-fq)(p_h-p_l)^{-1}}{W} \qquad \text{(B.3.2)}$$

and is not affected by the outflow tax, since the ICH constraint compares two options that are realized inside the economy. At $k=0$ equation (B.3.2) is identical to equation (1.9), but not at $k=1$, hence the pivoting movement shown in Figure 1.4. The slope of (B.3.2) is $-(1+t_{in})r(p_hW)^{-1}$.

The PCH equation of (B.1.6) is recast as

$$(1-t_{out})rk \leq \left(\pi W - (1-k)(1+t_{in})rp_h^{-1}\right)p_h - c \qquad \text{(B.3.3)}$$

which means that (1.4) is now

$$\pi_{pch} = \frac{((1-t_{out})r + c - rk(t_{out}+t_{in}))p_h^{-1}}{W} \qquad \text{(B.3.4)}$$

and is affected by both taxes since it compares options inside and outside of the economy. The slope of (B.3.4) is $-(t_{out}+t_{in})r(p_hW)^{-1}$. Hence, both ad-valorem taxes affect the slope of the constraint in the same way, what changes is the point on which the constraint pivots. In the case of the outflow tax it pivots on $k=1$, in the case of the inflow tax it pivots on $k=0$.

The PCL equation of (B.1.10) is recast as

$$(1-t_{out})rk \leq \left(\pi W - (1-k)(1+t_{in})rp_l^{-1}\right)p_l \qquad \text{(B.3.5)}$$

which means that (1.5) is now

$$\pi_{pcl} = \frac{((1-t_{out})r - rk(t_{out}+t_{in}))p_l^{-1}}{W} \tag{B.3.6}$$

and is also affected by both taxes since it compares options inside and outside of the economy. The slope of (B.3.6) is $-(t_{out}+t_{in})r(p_l W)^{-1}$. The PCL constraint is affected in the same way that the PCH constraint only amplified by the fact that $p_l^{-1} > p_h^{-1}$.

B.4 Derivation of effect of microfinance policy α.

Consider an economy with a tax on capital inflows t. The ICH constraint with a microfinance policy consisting of a gift of $\alpha(1-k)$ to every entrepreneur of capital k is

$$(c - fq) \leq \left(\pi W - (1-k)(1+t)(1-\alpha)rp_h^{-1}\right)(p_h - p_l) \tag{B.4.1}$$

which means that (1.9) is now

$$\pi_{ich} = \frac{(1-k)(1+t)(1-\alpha)rp_h^{-1} + (c-fq)(p_h-p_l)^{-1}}{W} \tag{B.4.2}$$

and a marginal increase in α relaxes the constraint in

$$\frac{\partial \pi}{\partial \alpha} = -\frac{(1-k)(1+t)rp_h^{-1}}{W} \tag{B.4.3}$$

so, the effect is larger for lower k.

The PCH constraint in this economy is now

$$rk \leq \left(\pi W - (1-k)(1+t)(1-\alpha)rp_h^{-1}\right)p_h - c \tag{B.4.4}$$

if the development agency is capable of verifying that the entrepreneur will use the subsidy to complement his own funds in implementing the project. Otherwise, the PCH constraint will be

$$r(k + k(1-\alpha)) \leq \left(\pi W - (1-k)(1+t)(1-\alpha)rp_h^{-1}\right)p_h - c \tag{B.4.5}$$

and the PCL will be either

$$rk \leq \left(\pi W - (1-k)(1+t)(1-\alpha)rp_l^{-1}\right)p_l \tag{B.4.6}$$

or

$$r(k + k(1-\alpha)) \leq \left(\pi W - (1-k)(1+t)(1-\alpha)rp_l^{-1}\right)p_l \tag{B.4.7}$$

which means that the effect of a marginal increase in α on the PCS $S \in \{H, L\}$ constraint is now either

$$\frac{\partial \pi}{\partial \alpha} = -\frac{(1-k)(1+t)rp_s^{-1}}{W} \tag{B.4.8}$$

if investment is verifiable to the development agency, or

$$\frac{\partial \pi}{\partial \alpha} = -\frac{(1-k)trp_s^{-1}}{W} \tag{B.4.9}$$

if it is not. Hence, the effect is lower and the development agency will have to either expend resources verifying investment or make gifts to fewer entrepreneurs if it cannot verify the investment. Moreover, if there are no taxes or distorted access to international banking markets there is no effect on the PC constraints in the nonverifiable case, and the only effects on this economy are those created by the relaxation of the ICH constraint. Note that in this case (t=0) both participation constraints acquire positive slope when $\alpha > 0$.

B.5 Proofs and derivations of effects of international shocks.

Notice that all constraints have the following general form

$$\pi_x = \frac{\theta_x}{W}; \forall x \in \{ich, pch, pcl, icl\} \tag{B.5.1}$$

which implies that

$$\frac{\partial \pi_x}{\partial W} = -\frac{\pi_x}{W} \tag{B.5.2}$$

since all firms in this economy share W, any shock to W will have a larger effect on the margin composed by firms of higher productivity π. Since, in the three margin two tier economy PCL is higher than PCH, we show in panel (a) of Figure (1.7) a larger contraction (upward shift) of PCL. Moreover, ICH will contract more than constraint PCX whenever it is above and less when it below. We know then, that ICH will shift upward in the same distance than PCH at $\bar{k}$ and in the same distance as PCL at $\bar{\bar{k}}$. These two points indicate the new position of ICH.

From equations (1.4), (1.5) and (1.9) we can derive the comparative static effects of the interest rate hike as

$$\begin{aligned} \frac{\partial \pi_{ich}}{\partial r} &= \frac{(1-k)p_h^{-1}}{W} \\ \frac{\partial \pi_{pch}}{\partial r} &= \frac{p_h^{-1}}{W} \\ \frac{\partial \pi_{pcl}}{\partial r} &= \frac{p_l^{-1}}{W} \end{aligned} \tag{B.5.3}$$

so that both PC constraints will move up in parallel to their original positions, the PCL constraint will move more than the PCH constraint and the ICH constraint will move the same as the PCH constraint at $k = 0$ and will pivot on $k = 1$.

Appendix C

Proofs for Extensions and Generalizations

C.1 Effect on ICH, PCH and PCL of amplifications of risk.

We can rewrite equation (1.14), by grouping the deterministic and random terms in the following way:

$$EU(s,z) = EU\begin{pmatrix} p_s\left(\pi(W-(1-k)rp_z^{-1}\right) - kr - qf(z,s) \\ -c_s + p_s\pi\nu_w - (p_s(1-k)p_z^{-1} + k)\nu_r \end{pmatrix} \tag{C.1.1}$$

Notice that when $s = z$ this reduces to:

$$EU(s,s) = EU\begin{pmatrix} p_s\left(\pi(W-(1-k)rp_z^{-1}\right) - kr \\ -c_s + p_s\pi\nu_w - \nu_r \end{pmatrix} \tag{C.1.2}$$

, so we can see that the effect of international credit risk ν_r is the same on both PC constraints, no matter what the choice of effort s is, and the same for marginal firms of any productivity level π that are the property of entrepreneurs of any wealth k. Now, an identical amplification of risk will have a lower effect if it is applied on a higher initial level of expected utility. So, it is important to remember that the base expected utility levels on the PCL and PCH curves are the same, that is, zero. For this reason, the effect on both constraints of the amplification of international credit risk will be the same. In the case of domestic institutional risk ν_c, only the PCH tightens since, since $c_l = 0$. The effect of domestic productivity risk will be larger on the PCH constraint since it is amplified by p_h rather than p_l. In the case we study in section 3.1, there is no slope on the PC constraints, so all marginal firms will have the same productivity π, and the constraints will shift in a parallel way and remain horizontal.

Now consider the case where $s \neq z$, which only makes sense when the entrepreneurs promises more effort than he is willing to deliver, hence $s = l$ and $z = h$. In this case, the term that accompanies the international credit risk random variable ν_r is $(p_l p_h^{-1}(1-k)+k)$ which is smaller than 1. Hence the effect of interest rate risk on EU(h,l) is smaller than the effect either on EU(h,h) or EU(l,l) (remember, they are the same). The difference between these amplifications will increase as the technological importance of effort increases. The implication is that the ICH constraint tightens (since EU(h,h) falls more than EU(h,l)), but less than the PCH or PCL constraints.

Another difference is that these constraints are not amplified by the level of k while the effect on EU(h,l) is. This means that for higher k, EU(h,l) falls more relative to EU(h,h) and hence the PCH constraint will tighten less. Since $\lim_{k \to 1}(p_l p_h^{-1}(1-k)+k) = 1$ the ICH constraint will, in fact, pivot on $k = 1$ as the interest rate risk amplifies, while the PCH and PCL constraints will tighten in a parallel way.

Consider now the effect of the amplification of the domestic productivity shock ν_w. The amplified risk will be larger if high effort is chosen, also if productivity of the firms is higher. Hence, all three constraints will increase their slope, the PCH constraint will tighten more than the PCL, and the ICH constraint will tighten less than the PCH constraint since the fall in EU(h,h) is, in this case, ameliorated by the fall in EU(l,h).

C.2 Effect of Size on ICH with non proportional effort and fines.

Consider the ICH constraint of equation array (1.23). The effect on π_{ich} of an increase in size ϕ is:

$$\frac{\partial \pi_{ich}}{\partial \phi} = \frac{r p_h^{-1} k - (c - fq)(p_h - p_l)^{-1}}{W\phi^2} \tag{C.2.1}$$

it is only positive if $k \geq \left(\frac{c-fq}{r}\right)\left(\frac{p_h}{p_h - p_l}\right)$, a point that we have labeled $\check{k}$ and does not change with ϕ. Hence, above $\check{k}$ the constraint will tighten, and below it will loosen. Now compare $\check{k}$ to $\bar{k}$ of equation (1.10) retyped here:

$$\bar{k} = \left(\frac{c}{r}\right)\left(\frac{p_l}{p_h - p_l}\right) - \left(\frac{fq}{r}\right)\left(\frac{p_h}{p_h - p_l}\right)$$

hence, the ICH constraint will only tighten with size for entrepreneurs that are participation constrained.

Appendix D

Complete Tables and Figures for Firm Side Probits

Table D.1: Preferred Probit Regressions Over Existing Firms: Probability of Destruction, Extended Table

	full panel	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
π	-6.13% (0.08%)***	-5.53% (0.18%)***	-7.09% (0.20%)***	-6.56% (0.21%)***	-5.65% (0.18%)***	-6.07% (0.18%)***
$1-k$	-0.00% (0.06%)	0.29% (0.12%)**	-0.28% (0.13%)**	0.10% (0.15%)	0.13% (0.13%)	-0.12% (0.12%)
ϕ	-2.23% (0.01%)***	-2.02% (0.02%)***	-2.67% (0.02%)***	-2.33% (0.02%)***	-2.02% (0.02%)***	-2.20% (0.02%)***
Dsc $(forestry)$	2.40% (0.36%)***	2.39% (0.74%)***	3.45% (0.93%)***	2.71% (0.87%)***	1.28% (0.69%)**	2.32% (0.83%)***
Dsc $(fishing)$	2.73% (0.53%)***	1.26% (1.05%)	2.99% (1.29%)*	2.97% (1.26%)*	3.48% (1.14%)***	2.98% (1.15%)**
Dsc $(mining)$	4.29% (0.72%)***	3.29% (1.37%)**	6.34% (1.91%)***	3.81% (1.70%)*	5.06% (1.60%)***	3.79% (1.56%)**
Dsc $(manufacturing)$	-0.05% (0.14%)	-0.10% (0.32%)	-0.37% (0.38%)	-0.16% (0.35%)	-0.31% (0.28%)	-0.14% (0.31%)
Dsc $(utilities)$	1.84% (0.63%)***	1.21% (1.34%)	5.45% (2.15%)***	0.48% (1.33%)	1.41% (1.17%)	1.52% (1.27%)
Dsc $(construction)$	3.82% (0.22%)***	3.15% (0.48%)***	4.42% (0.58%)***	4.06% (0.54%)***	3.65% (0.45%)***	4.01% (0.49%)***
Dsc $(commerce)$	-1.06% (0.13%)***	-1.44% (0.29%)***	-1.94% (0.33%)***	-2.01% (0.32%)***	-1.98% (0.26%)***	-1.93% (0.28%)***
Dsc $(services)$	1.93% (0.15%)***	1.63% (0.33%)***	2.17% (0.38%)***	1.88% (0.36%)***	1.87% (0.30%)**	2.23% (0.33%)***
t_{2000}	0.68% (0.06%)***	. .	. .	. .	. .	. .
t_{2001}	0.31% (0.06%)***	. .	. .	. .	. .	. .
t_{2002}	-0.04% (0.06%)	. .	. .	. .	. .	. .
t_{2003}	-2.23% (0.01%)***	. .	. .	. .	. .	. .
Obs.	938,561	206,727	174,049	189,510	191,384	176,895
LogPLike	-199066.85	-41440.224	-37193.162	-42660.072	-39368.965	-38050.662
Pseudo R2	0.2095	0.2099	0.2464	0.2026	0.2018	0.1910

Note 1: Marginal effects on the probability of destruction, standard errors in parenthesis.
Note 2: * is 90% significance, ** is 95% significance,*** is 99% significance.
Note 3: Dummy for micro firms, $Dsz(micro)$ has been dropped.

Table D.2: Preferred Least Squares Regressions Over Collapsed Panels: Amount of Creation, Extended Table

	full panel	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
π	-6.14	-1.05	-1.11	-1.10	-1.25	-1.21
	(0.27)***	(0.06)***	(0.07)***	(0.06)***	(0.06)***	(0.06)***
$1-k$	-1.49	-0.41	-0.24	-0.46	-0.43	-0.49
	(0.24)***	(0.05)***	(0.07)***	(0.05)***	(0.05)***	(0.05)***
ϕ	-12.80	-2.24	-2.48	-2.12	-2.33	-1.94
	(0.60)***	(0.15)***	(0.15)***	(0.12)***	(0.13)***	(0.12)***
Dsc	-3.40	-0.06	-0.18	-0.15	-0.27	-0.07
$(agriculture)$	(2.03)*	(0.04)	(0.05)***	(0.05)**	(0.05)***	(0.05)
Dsc	-2.54	0.17	0.43	0.22	0.18	0.15
$(forestry)$	(2.07)	(0.11)	(0.16)*	(0.11)*	(0.11)	(0.13)
Dsc	-0.94	0.73	0.81	0.73	0.36	0.42
$(fishing)$	(2.04)	(0.19)***	(0.22)***	(0.16)***	(0.17)**	(0.15)*
Dsc	-2.59	0.07	0.35	0.20	0.20	0.10
$(mining)$	(2.00)	(0.21)	(0.24)	(0.22)	(0.21)	(0.29)
Dsc	-2.82	0.11	-0.02	0.05	0.03	0.05
$(manufacturing)$	(2.03)	(0.02)***	(0.03)	(0.03)*	(0.02)	(0.03)
Dsc	-2.79	0.48	0.31	0.25	-0.55	-0.21
$(utilities)$	(2.08)	(0.25)	(0.27)	(0.23)	(0.21)*	(0.30)
Dsc	-2.74	0.13	0.16	0.26	0.27	0.24
$(construction)$	(2.02)	(0.02)***	(0.03)***	(0.03)***	(0.03)***	(0.02)***
Dsc	-3.00	-0.04	-0.12	-0.03	-0.05	-0.03
$(commerce)$	(2.02)	(0.00)***	(0.01)***	(0.01)**	(0.01)***	(0.01)***
Dsc	-2.80	0.13	0.05	0.15	0.11	0.11
$(services)$	(2.02)	(0.01)***	(0.01)***	(0.01)***	(0.01)***	(0.01)***
t_{2000}	-0.24	.	.	.	.	.
	(0.04)***	.	.	.	.	.
t_{2001}	0.04	.	.	.	.	.
	(0.04)	.	.	.	.	.
t_{2002}	-0.05	.	.	.	.	.
	(0.02)*	.	.	.	.	.
t_{2003}	-0.03	.	.	.	.	.
	(0.02)	.	.	.	.	.
Obs.	1,000	1,000	1,000	1,000	1,000	1,000
LogLike	-4305.75	-2987.63	-3070.15	-2976.80	-3000.91	-3005.87
R2	0.7739	0.5972	0.6092	0.6657	0.6479	0.6318

Note 1: Effect of increasing a decile on amount of creation, standard error in parenthesis.
Note 2: * is 90% significance, ** is 95% significance,*** is 99% significance.
Note 3: Dummy for micro firms, $Dsz(micro)$ has been dropped.

Table D.3: Preferred Least Squares Regressions Over Existing Firms: Sales Performance, Extended Table

	full panel	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
π	3.38% (0.41%)***	3.35% (0.09%)***	3.38% (0.10%)***	3.08% (0.09%)***	3.34% (0.09%)***	3.40% (0.08%)***
$1-k$	0.30% (0.22%)***	0.26% (0.04%)***	0.31% (0.05%)***	0.29% (0.05%)***	0.33% (0.05%)***	0.38% (0.04%)***
ϕ	0.71% (0.00%)***	0.76% (0.01%)***	0.80% (0.01%)***	0.71% (0.01%)***	0.48% (0.01%)***	0.86% (0.01)***
Dsc $(fishing)$	-1.48% (0.12%)***	-2.06% (0.27%)***	-1.17% (0.27%)***	-0.87% (0.24%)***	-1.48% (0.26%)***	-1.65% (0.28%)***
Dsc $(mining)$	-1.30% (0.15%)***	-0.93% (0.34%)***	-1.37% (0.36%)***	-1.24% (0.33%)***	-1.46% (0.35%)***	-1.49% (0.29%)***
Dsc $(manufacturing)$	-2.12% (0.21%)***	-2.45% (0.41%)***	-2.71% (0.58%)***	-1.66% (0.45%)***	-2.49% (0.50%)***	-1.19% (0.46%)**
Dsc $(fishing)$	0.31% (0.05%)***	0.17% (0.11%)	1.42% (0.13%)	0.43% (0.12%)***	0.51% (0.13%)***	0.25% (0.12%)**
Dsc $(utilities)$	-0.00% (0.18%)	0.66% (0.34%)*	-0.91% (0.45%)**	0.30% (0.41%)	-0.40% (0.40%)	0.41% (0.37%)
Dsc $(construction)$	-2.27% (0.06%)***	-2.82% (0.13%)***	-2.43% (0.14%)***	-2.16% (0.13%)***	-1.83% (0.14%)***	-2.12% (0.13%)***
Dsc $(commerce)$	1.19% (0.05%)***	1.03% (0.10%)***	1.08% (0.11%)***	1.26% (0.11%)***	1.32% (0.11%)***	1.20% (0.10%)***
Dsc $(services)$	0.25% (0.05%)***	-0.29% (0.11%)***	-0.47% (0.12%)***	-0.25% (0.11%)**	-0.08% (0.12%)	-0.19% (0.11%)*
t_{2000}	0.15% (0.02%)***	. .	. .	. .	. .	. .
t_{2001}	0.28% (0.02%)***	. .	. .	. .	. .	. .
t_{2002}	0.18% (0.02%)***	. .	. .	. .	. .	. .
t_{2003}	0.18% (0.02%)***	. .	. .	. .	. .	. .
Obs.	862,798	192,249	159,782	174,075	174,119	162,573
LogLike	969933.25	219258.79	179237.31	196236.78	193210.28	182696.50
R2	0.0589	0.0667	0.0652	0.0585	0.0409	0.0786

Note 1: Effect of variable on sales growth, standard error in parenthesis.
Note 2: * is 90% significance, ** is 95% significance,*** is 99% significance.
Note 3: Dummy for micro firms, $Dsz(micro)$ has been dropped.

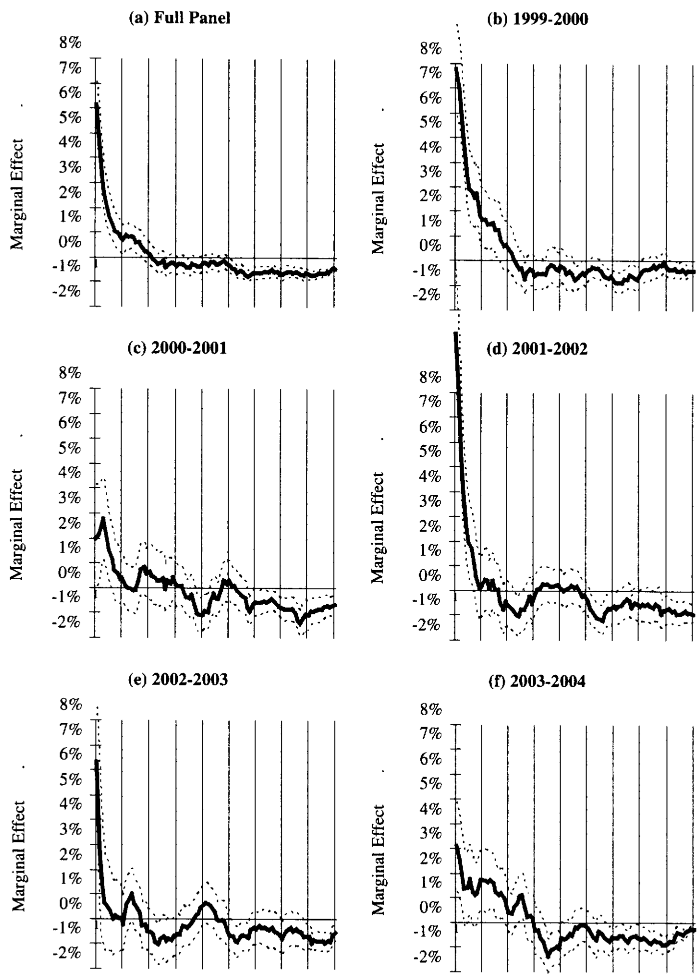


Figure D.1: Marginal Effect of $1 - k$ on the probability of default

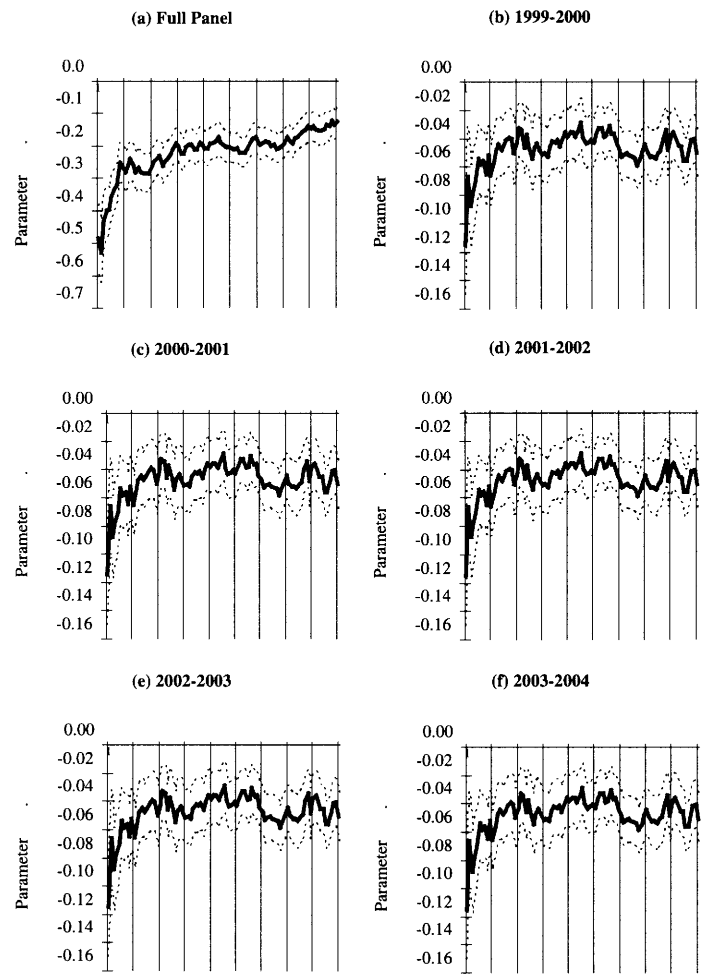


Figure D.2: Marginal Effect of $1 - k$ on creation

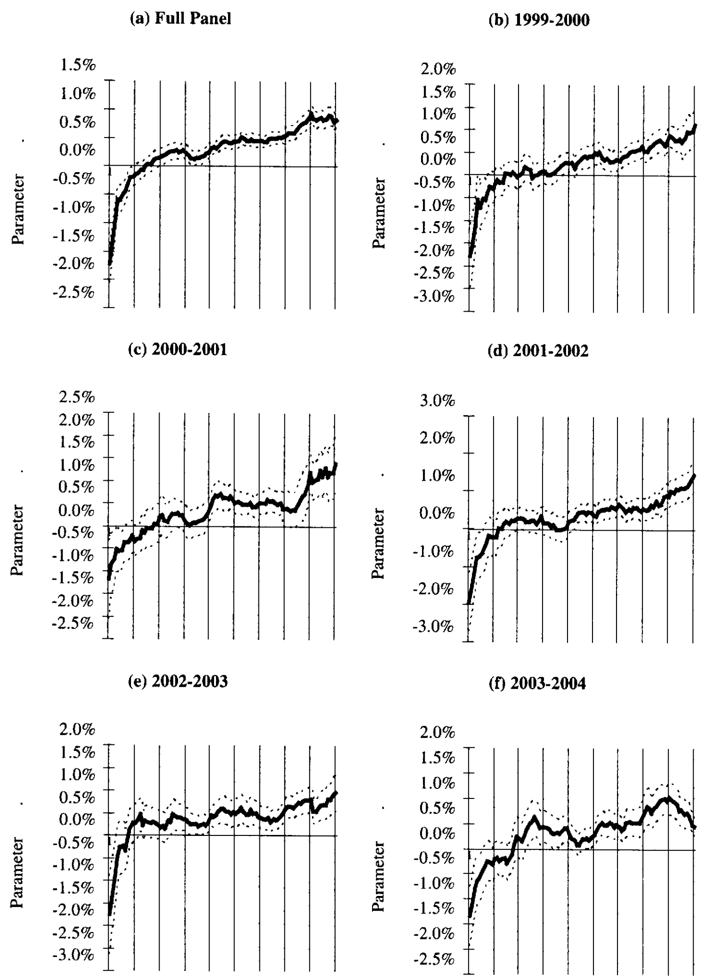


Figure D.3: Marginal Effect of $1 - k$ on performance

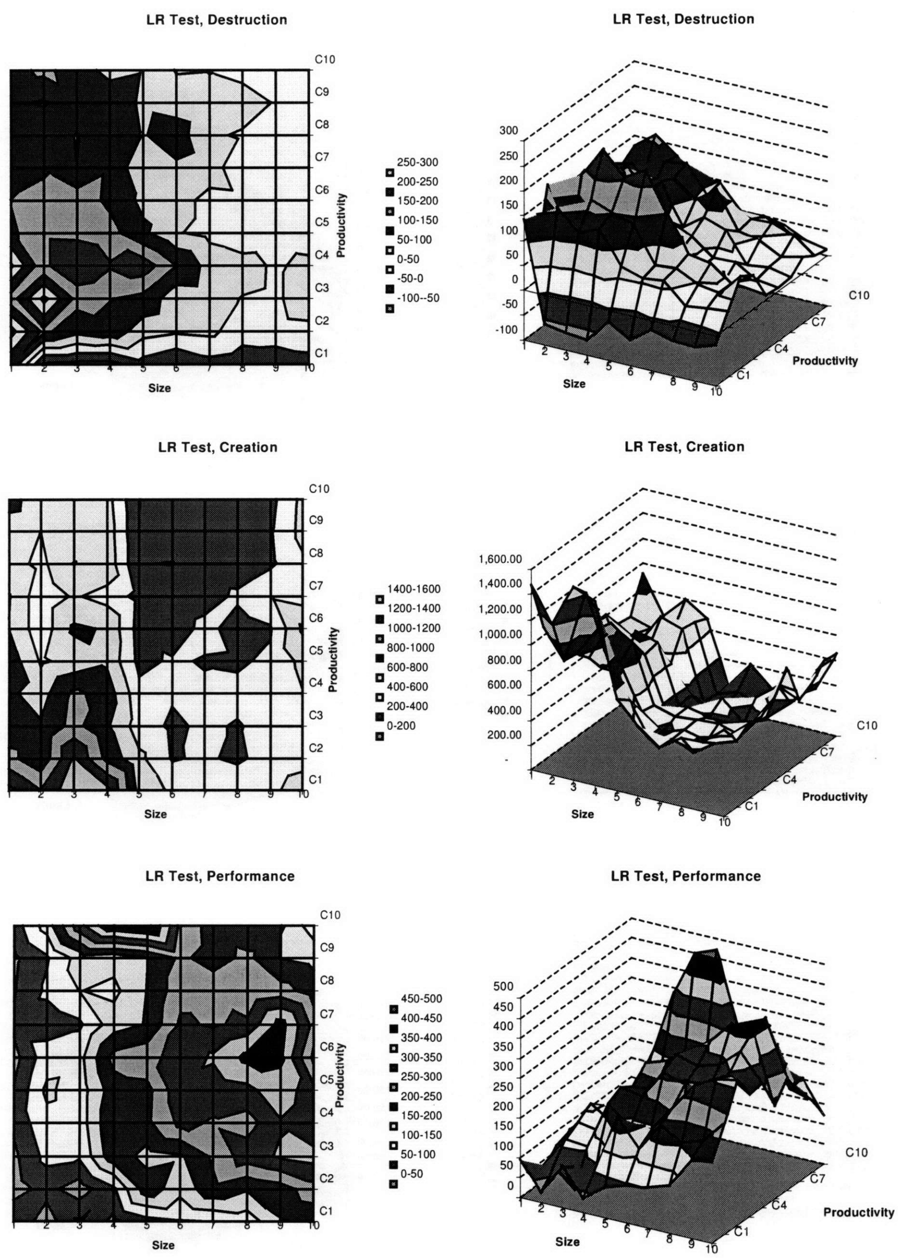


Figure D.4: LR Tests for 10×10 grid on the $\{\phi,\pi\}$ space

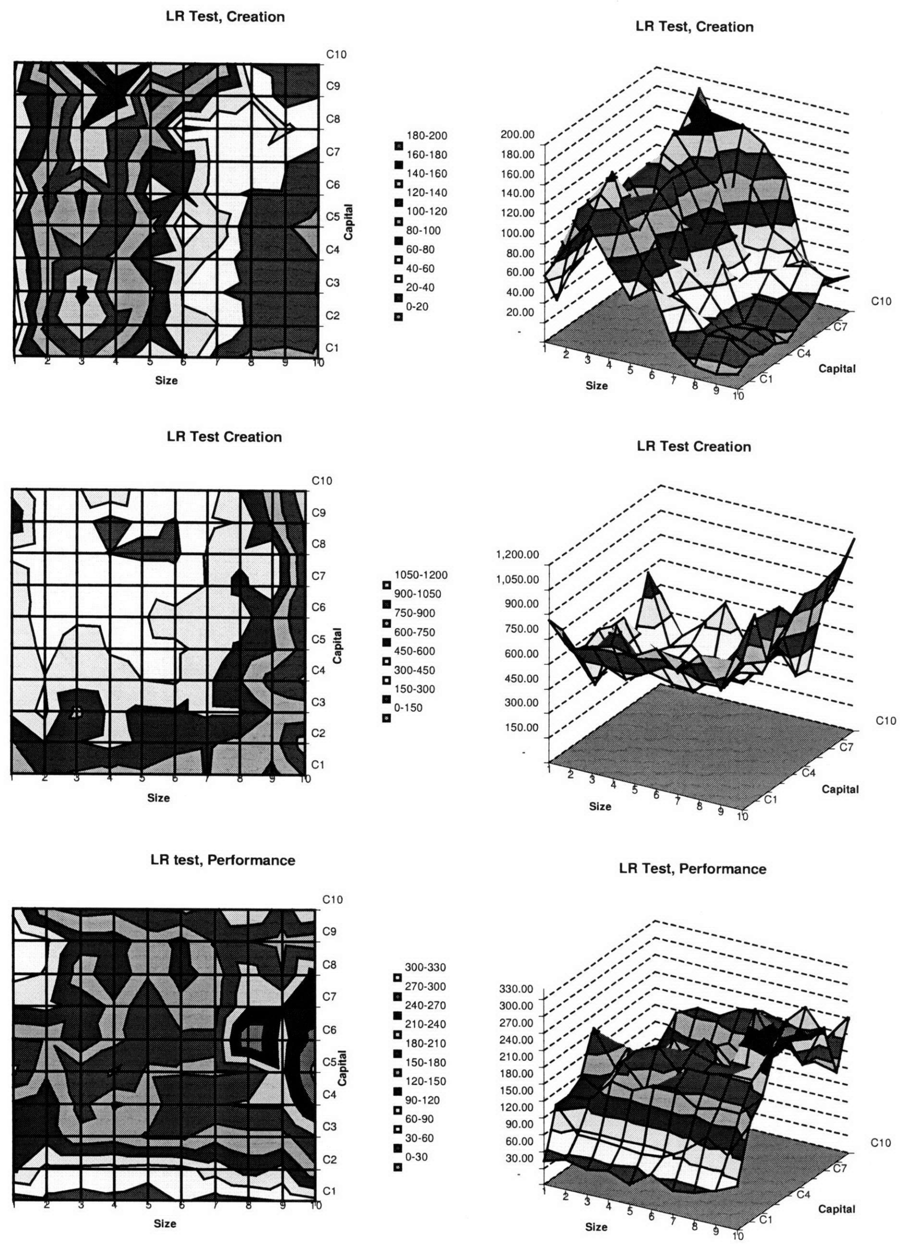


Figure D.5: LR Tests for 10 × 10 grid on the $\{\phi,k\}$ space

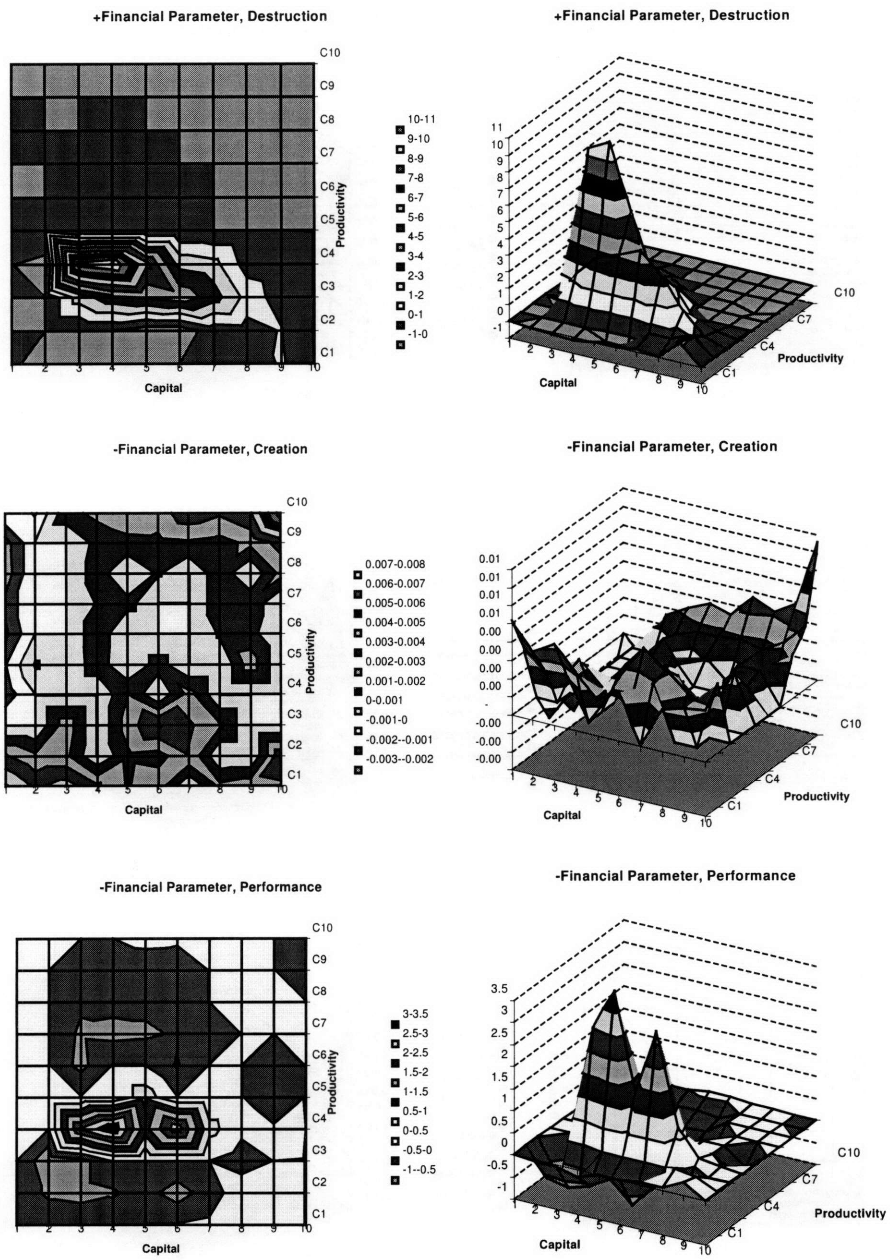


Figure D.6: $1-k$ parameter for 10×10 grid on the $\{k,\pi\}$ space

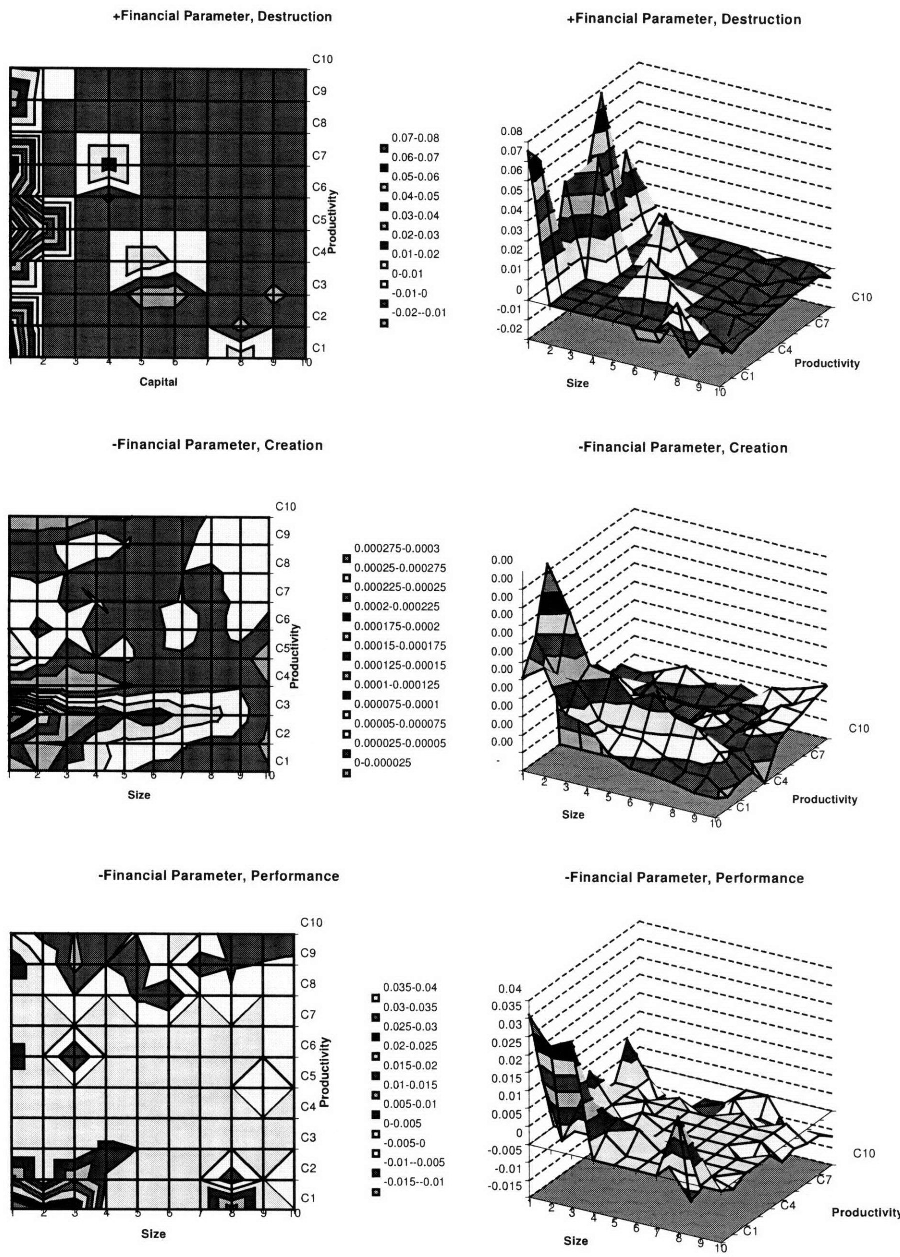


Figure D.7: $1-k$ parameter for 10×10 grid on the $\{\phi,\pi\}$ space

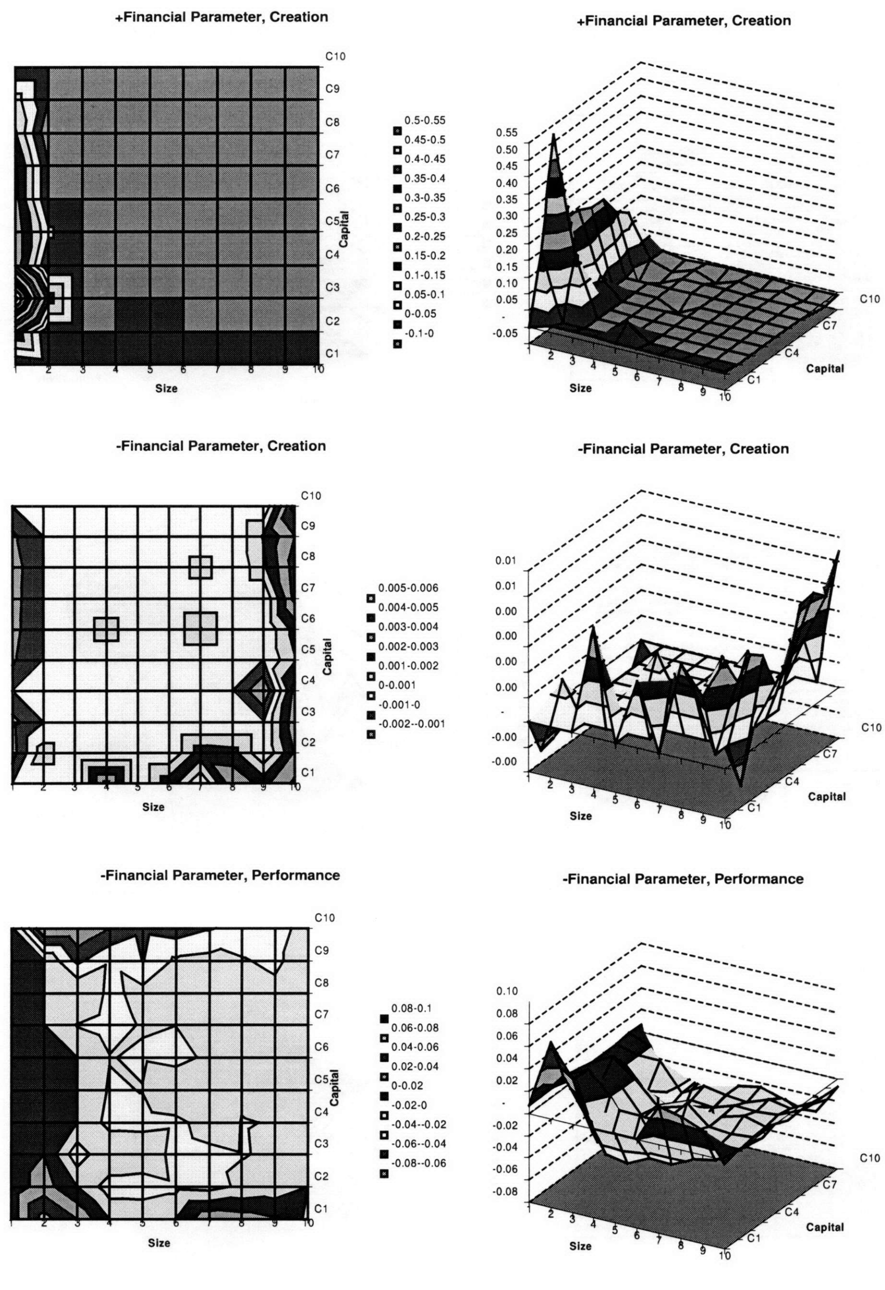


Figure D.8: $1 - k$ parameter for 10×10 grid on the $\{\phi, k\}$ space

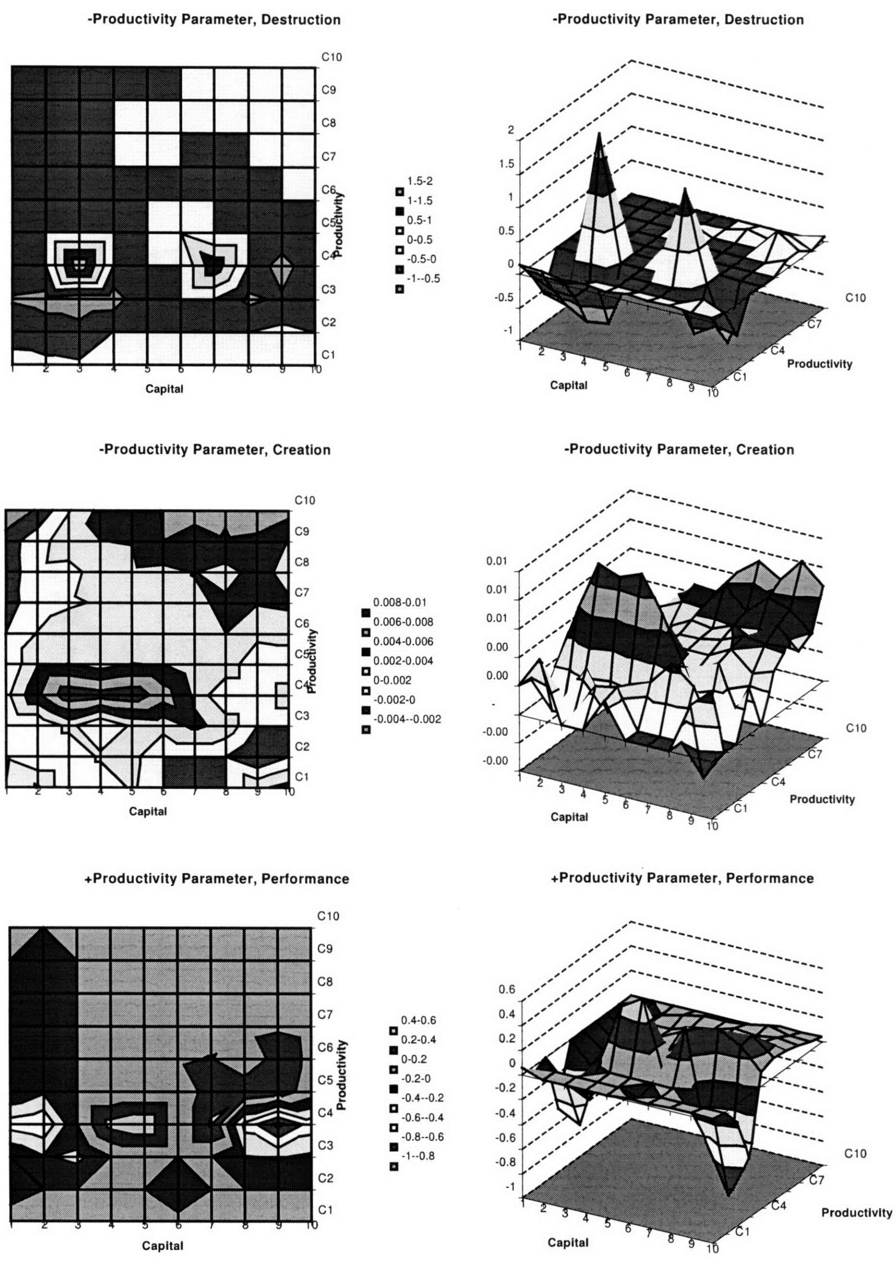


Figure D.9: π parameter for 10×10 grid on the $\{k,\pi\}$ space

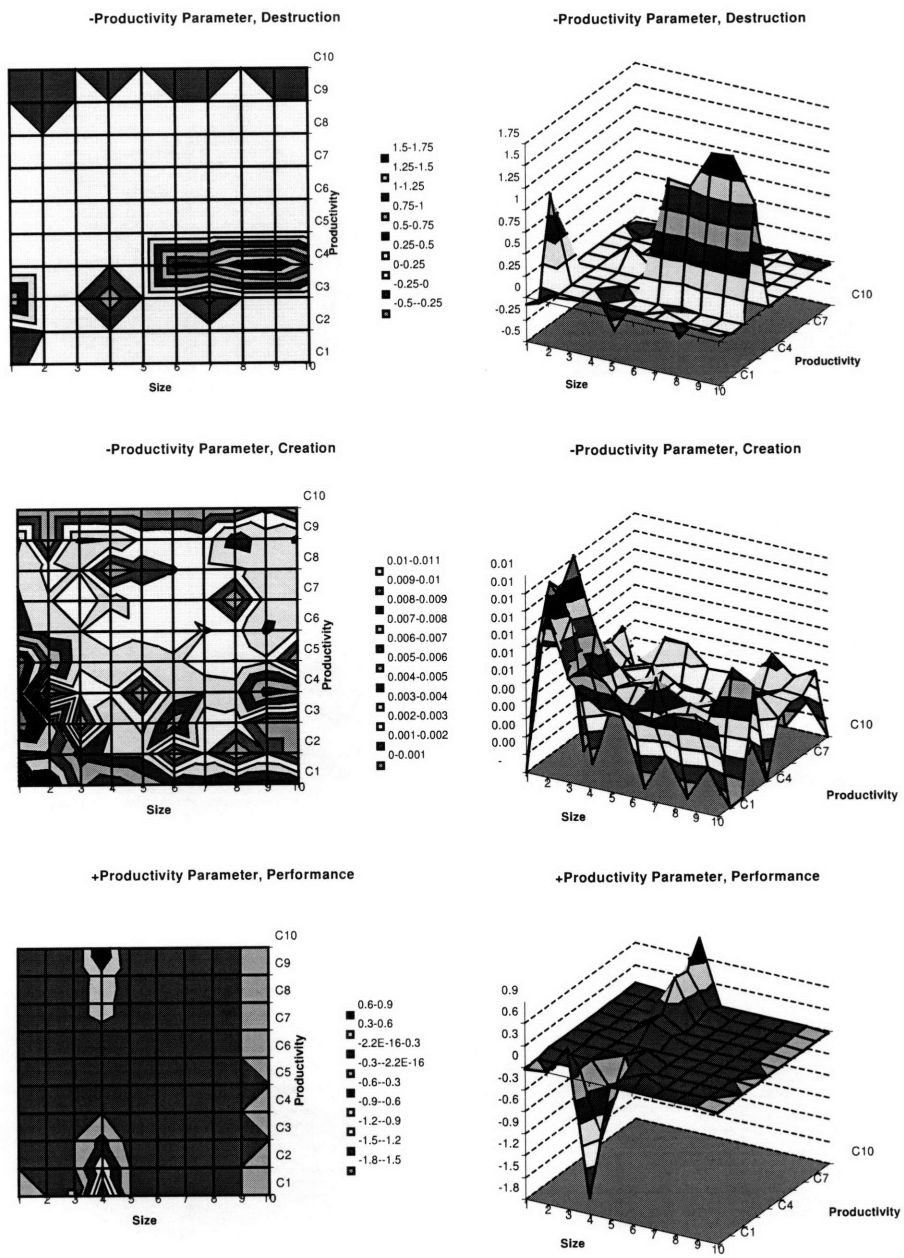


Figure D.10: π parameter for 10×10 grid on the $\{\phi,\pi\}$ space

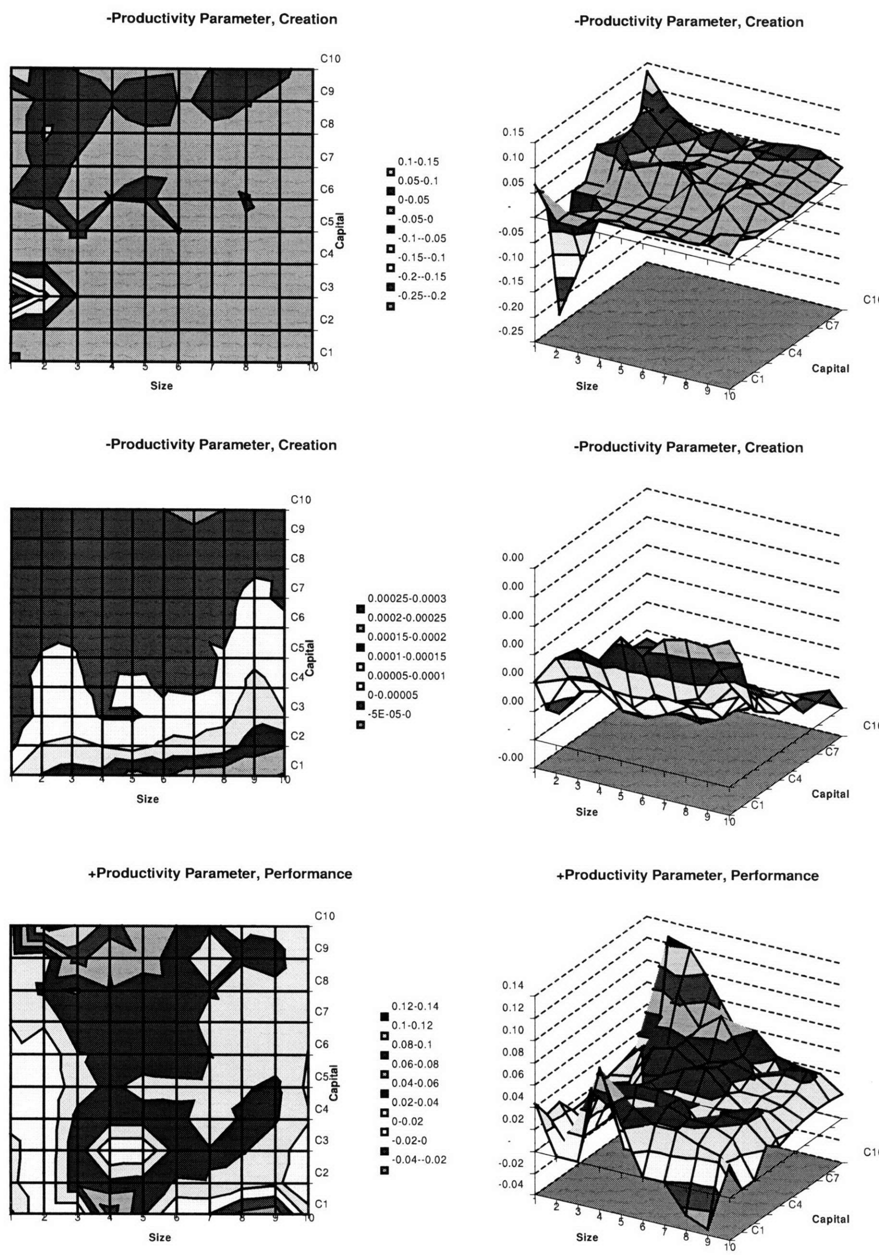


Figure D.11: π parameter for 10×10 grid on the $\{\phi,k\}$ space

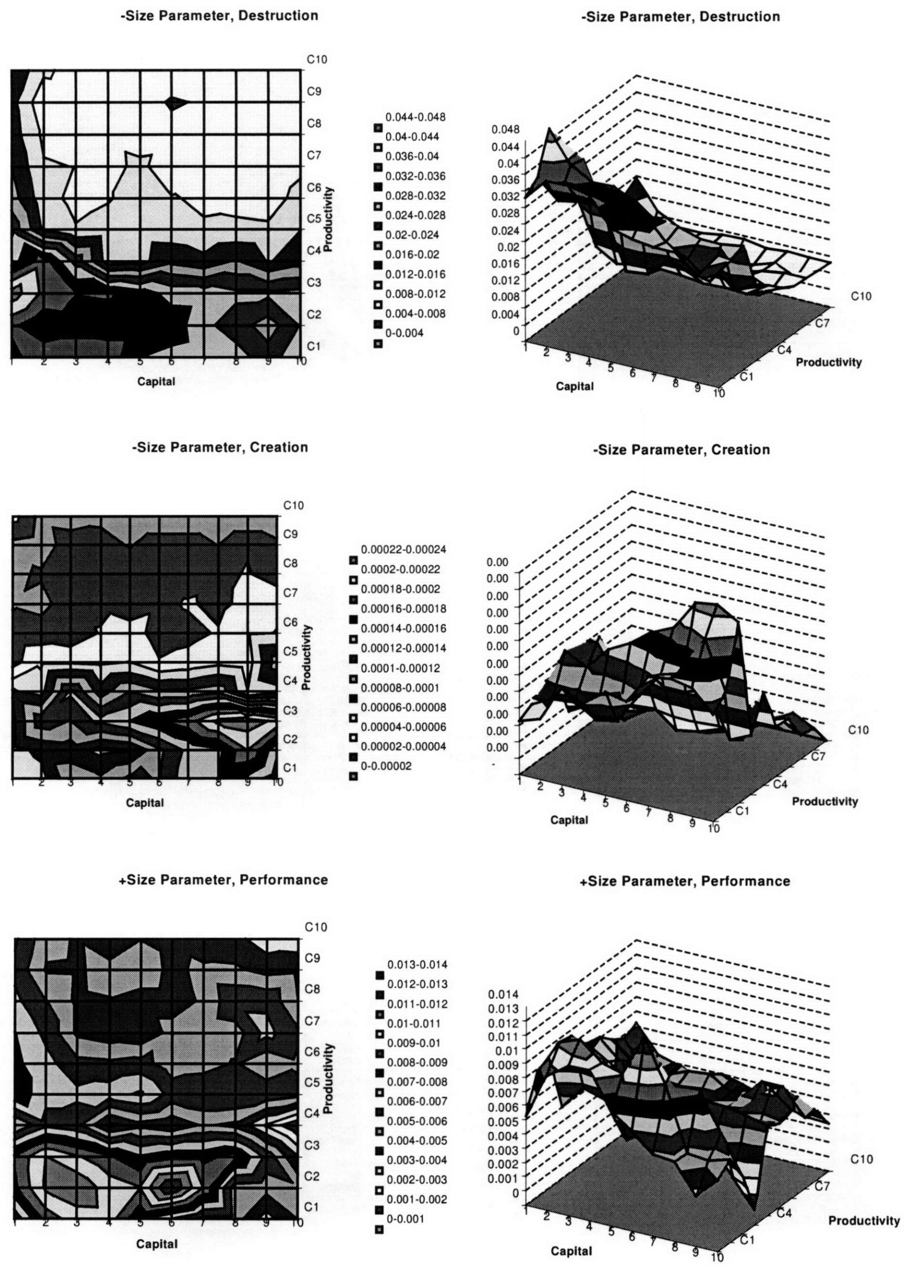


Figure D.12: ϕ parameter for 10×10 grid on the $\{k,\pi\}$ space

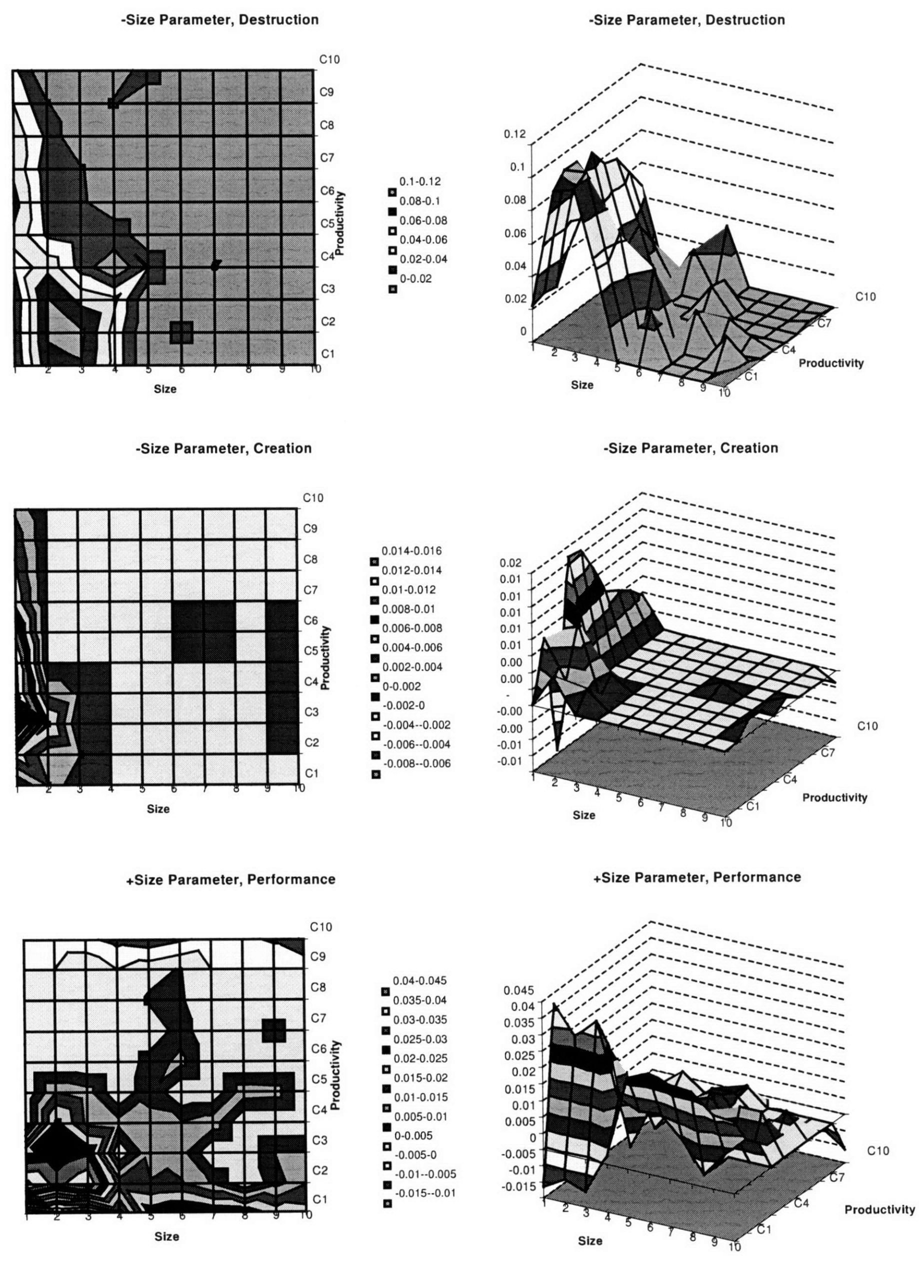


Figure D.13: ϕ parameter for 10×10 grid on the $\{\phi,\pi\}$ space

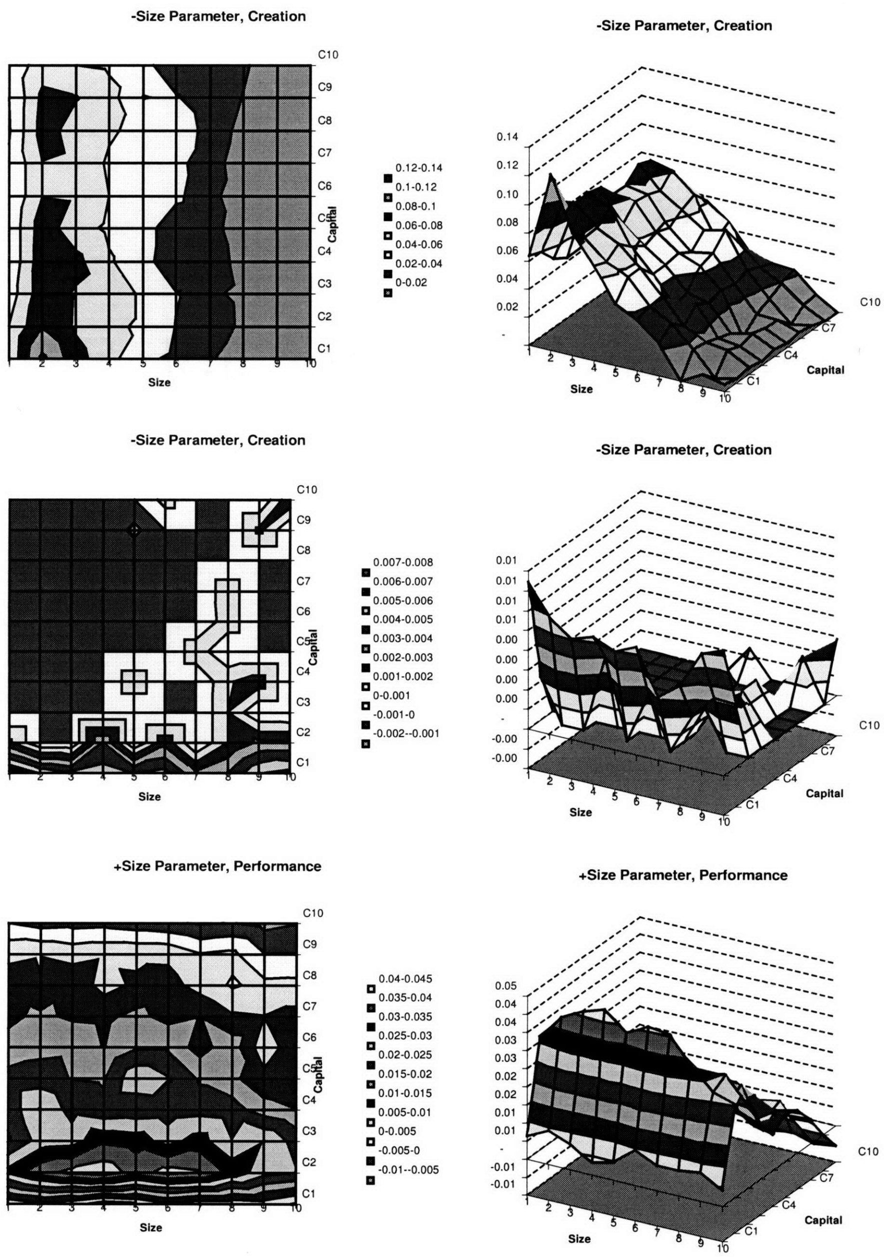


Figure D.14: ϕ parameter for 10×10 grid on the $\{k,\pi\}$ space

Appendix E

Complete Tables for Job Side Probits

Table E.1: Full Output of Preferred Weighted Probits (for the full sample)

Dependent Variable:	Workplace Destruction	Workplace Creation	Schumpeterian Churning	Destruction by Bankruptcy
size dummy	12,36%	-3,68%	-2,14%	2,48%
	(0.18%)***	(0.01%)***	(0.12%)***	(0.69%)***
schooling	-0,80%	0,16%	-0,13%	0,33%
	(0.02%)***	(0.00%)***	(0.01%)***	(0.09%)***
experience	-1,03%	0,26%	-0,18%	0,17%
	(0.01%)***	(0.00%)***	(0.01%)***	(0.06%)***
experience^2	0,02%	0,00%	0,00%	0,00%
	(0.00%)***	(0.00%)***	(0.00%)	(0.00%)
female	-0,14%	-2,81%	-4,94%	-2,48%
	(0.18%)	(0.03%)***	(0.12%)***	(0.66%)***
sector 2	1,93%	81,42%	9,47%	4,02%
(mining and quarrying)	(0.49%)***	(0.51%)***	(0.47%)***	(2.32%)**
sector 3	3,04%	73,74%	8,54%	0,93%
(manufacturing)	(0.27%)***	(0.29%)***	(0.25%)***	(0.97%)
sector 4	13,01%	94,84%	20,35%	-4,50%
(utilities)	(0.91%)***	(0.38%)***	(0.89%)***	(1.79%)**
sector 5	15,17%	71,68%	10,03%	5,21%
(construction)	(0.35%)***	(0.35%)***	(0.31%)***	(1.04%)***
sector 6	3,42%	65,61%	7,88%	-1,54%
(commerce, hotels and restaurants)	(0.28%)***	(0.34%)***	(0.27%)***	(0.92%)
sector 7	5,02%	63,90%	8,34%	-2,24%
(transport, storage and communications)	(0.34%)***	(0.42%)***	(0.32%)***	(1.01%)**
sector 8	7,87%	79,78%	13,42%	-0,67%
(financial and professional services)	(0.38%)***	(0.35%)***	(0.38%)***	(1.26%)
sector 9	-7,98%	71,81%	-0,51%	-1,46%
(non financial and personal services)	(0.24%)***	(0.32%)***	(0.21%)***	(0.95%)
1997 dummy	-1,41%	-0,16%	-0,35%	-2,71%
	(0.31%)***	(0.05%)**	(0.22%)	(1.05%)**
1998 dummy	-2,22%	-0,45%	-1,17%	-2,27%
	(0.31%)***	(0.05%)***	(0.21%)***	(1.01%)**
1999 dummy	-0,58%	-0,46%	-1,11%	-0,60%
	(0.33%)***	(0.05%)***	(0.22%)***	(1.14%)
2000 dummy	-0,20%	-0,63%	-1,37%	0,44%
	(0.31%)	(0.04%)***	(0.21%)***	(1.12%)
2001 dummy	-0,52%	-0,61%	-1,36%	1,90%
	(0.31%)**	(0.04%)***	(0.21%)***	(1.25%)
2002 dummy	-1,03%	-0,76%	-1,49%	-1,27%
	(0.31%)***	(0.04%)***	(0.21%)***	(1.04%)
2003 dummy	-2,13%	-0,96%	-2,05%	-1,12%
	(0.30%)***	(0.04%)***	(0.20%)***	(1.07%)
2004 dummy	-0,17%	-0,66%	-0,76%	-3,57%
	(0.32%)	(0.04%)***	(0.22%)***	(0.96%)***
February dummy	-0,21%	-0,08%	-0,07%	-1,47%
	(0.36%)	(0.06%)	(0.26%)	(1.08%)
March dummy	-1,23%	-0,31%	-0,49%	-1,65%
	(0.35%)***	(0.06%)***	(0.26%)*	(1.08%)
April dummy	-1,82%	-0,24%	-0,48%	-2,52%
	(0.35%)***	(0.06%)***	(0.26%)*	(0.97%)**
May dummy	-2,41%	-0,11%	-0,34%	-0,45%
	(0.35%)***	(0.06%)*	(0.26%)	(1.26%)
June dummy	-2,58%	-0,03%	-0,47%	-1,76%
	(0.35%)***	(0.06%)	(0.26%)*	(1.07%)
July dummy	-2,14%	0,03%	-0,10%	-0,04%
	(0.36%)***	(0.06%)	(0.26%)	(1.25%)
August dummy	-2,45%	0,18%	0,14%	-0,80%
	(0.35%)***	(0.06%)***	(0.26%)	(1.23%)
September dummy	-2,71%	0,28%	-0,12%	-1,13%
	(0.35%)***	(0.06%)***	(0.26%)	(1.19%)
October dummy	-1,11%	0,35%	0,45%	0,26%
	(0.36%)***	(0.07%)***	(0.27%)*	(1.32%)
November dummy	-1,30%	0,24%	0,35%	-0,24%
	(0.36%)***	(0.07%)***	(0.27%)	(1.24%)
December dummy	0,10%	0,07%	0,53%	0,57%
	(0.37%)	(0.06%)	(0.27%)**	(1.29%)
Observations	666,823	2,060,682	666,823	22,715
Log Pseudo Like	-380260.66	-306569.35	-244230.15	-7457.7476
Pseudo R2	0.04	0.52	0.04	0.02

Note 1: dummies for January, 1996 and sector 1: agriculture, forestry and fishing are dropped to avoid collinearity.
Note 2: table reports marginal effects of variables in a probit regression, with standard errors in parenthesis.
Note 3: * is 90% significance,** is 95% significance, *** is 99% significance.
Note 4: Re-weighting is done by rescaling the observations of the database to preserve the number of observations so that standard errors are not underestimated by artificially increasing the size of the sample ("aweight" command in Stata).

Table E.2: Parameter for Female Dummy from Destruction, creation and Schumpeterian Churning from Weighted Probits (complete sample and year sub samples)

Sample	Workplace Destruction	Workplace Creation	Schumpeterian Churning	Destruction by Bankruptcy
All years	1.36%	-2.80%	-4.93%	-2.47%
	(1.86%)	(0.03%)***	(0.12%)***	(0.00%)***
1996	-0.07%	-3.54%	-5.80%	-5.85%
	(0.58%)	(0.10%)***	(0.40%)***	(2.71%)**
1997	0.09%	-3.30%	-5.43%	2.47%
	(0.58%)	(0.10%)***	(0.40%)***	(2.05%)
1998	1.16%	-3.01%	-4.63%	-1.71%
	(0.68%)**	(0.10%)***	(0.40%)***	(1.79%)
1999	-0.29%	-3.16%	-5.22%	-5.86%
	(0.61%)	(0.10%)***	(0.41%)***	(1.76%)**
2000	-1.00%	-2.69%	-5.29%	-4.53%
	(0.54%)**	(0.09%)***	(0.35%)***	(1.71%)**
2001	-0.25%	-2.70%	-4.84%	-4.50%
	(0.55%)**	(0.09%)***	(0.35%)***	(2.14%)**
2002	-0.54%	-2.37%	-4.34%	-3.30%
	(0.52%)	(0.09%)***	(0.35%)***	(1.50%)**
2003	0.07%	-2.26%	-3.64%	-1.33%
	(0.52%)	(0.09%)***	(0.35%)***	(1.74%)
2004	-0.32%	-2.45%	-5.36%	-2.47%
	(0.54%)	(0.10%)***	(0.36%)***	(1.51%)

Note 1: table reports marginal effects of variables in a probit regression, with standard errors in parenthesis.
Note 2: * is 90% significance,** is 95% significance,
*** is 99% significance.
Note 3: Re-weighting is done by rescaling the observations of the database to preserve the number of observations so that standard errors are not underestimated by artificially increasing the size of the sample ("aweight" command in Stata).

Table E.3: Parameter for Schooling Variable from Destruction, creation and Schumpeterian Churning from Weighted Probits (complete sample and year sub samples)

Sample	Workplace Destruction	Workplace Creation	Schumpeterian Churning	Destruction by Bankruptcy
All years	-0.79%	0.16%	-0.12%	0.33%
	(0.02%)***	(0.00%)***	(0.01%)***	(0.09%)***
1996	-0.55%	0.20%	-0.16%	0.45%
	(0.07%)***	(0.01%)***	(0.05%)***	(0.28%)*
1997	-0.54%	0.17%	0.00%	0.30%
	(0.07%)***	(0.01%)***	(0.05%)	(0.24%)
1998	-0.80%	0.17%	-0.10%	0.43%
	(0.07%)***	(0.01%)***	(0.05%)***	(0.23%)*
1999	-0.88%	0.17%	-0.10%	0.10%
	(0.07%)***	(0.01%)***	(0.05%)***	(0.27%)
2000	-0.87%	0.13%	-0.15%	0.62%
	(0.07%)***	(0.00%)***	(0.05%)***	(0.26%)**
2001	-0.96%	0.14%	-0.20%	0.13%
	(0.07%)***	(0.00%)***	(0.05%)***	(0.28%)
2002	-0.96%	0.13%	-0.18%	0.25%
	(0.07%)***	(0.00%)***	(0.05%)***	(0.22%)
2003	-0.75%	0.14%	-0.13%	0.05%
	(0.07%)***	(0.00%)***	(0.05%)***	(0.24%)
2004	-0.86%	0.17%	-0.13%	0.45%
	(0.07%)***	(0.01%)***	(0.05%)***	(0.21%)**

Note 1: table reports marginal effects of variables in a probit regression, with standard errors in parenthesis.
Note 2: * is 90% significance,** is 95% significance,
*** is 99% significance.
Note 3: Re-weighting is done by rescaling the observations of the database to preserve the number of observations so that standard errors are not underestimated by artificially increasing the size of the sample ("aweight" command in Stata).

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