

Essays on Entrepreneurship, Venture Capital and Innovation

by

Augustin Landier

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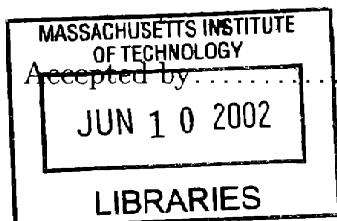
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Signature of Author
/ Department of Economics
May 2002

Certified by
Daron Acemoglu
Professor of Economics
Thesis Supervisor

Certified by
Olivier Blanchard
Chairman, Class of 1941 Professor of Economics
Thesis Supervisor



.....
Peter Temin
Elisha Gray II Professor of Economics,
Chairman, Departmental Committee on Graduate Studies

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Abstract

The first chapter studies Entrepreneurship and the Stigma of Failure. Entrepreneurial activity varies substantially across countries and sectors and appears to be related to the stigma of failure. To understand this phenomenon, I present a multiple-equilibrium model based on endogenous stigma of failure. Using private information, entrepreneurs choose whether to continue a project or to abandon it and raise funds to undertake a new project. Project outcomes depend on luck and ability, and the cost of capital for failed entrepreneurs is determined by the market's expectations about their ability. In the conservative equilibrium failed entrepreneurs face a high cost of capital and thus good entrepreneurs are reluctant to terminate a project. The resulting low quality of the pool of failed entrepreneurs justifies in turn the high cost of capital. The reverse is true in the experimental equilibrium where good entrepreneurs are more willing to start again and the cost of capital for failed entrepreneurs is low. The equilibria differ in the level and nature of entrepreneurial activity, with riskier projects undertaken in the experimental equilibrium. I discuss the relative efficiency of the two equilibria and study from this perspective the role of financial structure and legal environment such as bankruptcy rules and fresh start policy.

The second Chapter examines institutions and contracts for start-up finance. I develop a model in which entrepreneurs and investors can hold-up each other once the venture is under way: investors can deny further funding, and entrepreneurs can withdraw from the venture. The entrepreneurs' exit option determines which party needs protection. If the exit option is good, venture capital financing protects the investor through technological monitoring, control rights, and staged financing. If the exit option is bad, bank debt protects the entrepreneur as it involves little technological monitoring, limited control rights, and committed finance. The exit option depends on the legal environment and on the stigma of failure, endogenized in a career concern model. When entrepreneurs can choose project risk, multiple equilibria arise with different financial institutions. Venture capital prevails in the high-risk equilibrium and bank debt in the low-risk equilibrium. The paper investigates why the forms of start-up financing differ across sectors, regions and countries. It offers an explanation for why venture capital has been more prevalent in the US than in Europe. The theory has implications for policy, e.g., regarding the efficiency of non-compete agreements and bankruptcy law.

The third chapter, cowritten with Olivier Blanchard, addresses the question of the welfare effects of partial flexibilization of the labor market. Rather than decrease firing costs across the board, a number of European countries have allowed firms to hire workers on fixed-term

contracts. At the end of a given term, these contracts can be terminated at little or no cost. If workers are kept on however, the contracts become subject to normal firing costs. We argue in this paper that the effects of such a partial reform of employment protection may be perverse. The main effect may be high turnover in entry-level jobs, leading in turn to higher, not lower, unemployment. And, even if unemployment comes down, workers may actually be worse off, going through many spells of unemployment and entry-level jobs, before obtaining a regular job. Looking at French data for young workers since the early 1980s, we conclude that the reforms have substantially increased turnover, without a substantial reduction in unemployment duration. If anything, their effect on the welfare of young workers appears to have been negative.

Thesis Supervisor: Daron Acemoglu

Title: Professor of Economics

Thesis Supervisor: Olivier Blanchard

Title: Chairman, Class of 1941 Professor of Economics

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¹This chapter is coauthored with Olivier Blanchard.

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Chapter 1

Entrepreneurship and the Stigma of Failure

“If you start a company in London or Paris and go bust, you have just ruined your future; do it in Silicon Valley and you have simply completed your entrepreneurial training.”

The Economist, 1998.

“In Europe, a serious social stigma is attached to bankruptcy. In the USA bankruptcy laws allow entrepreneurs who fail to start again relatively quickly and failure is considered to be part of the learning process. In Europe those who go bankrupt tend to be considered as “losers”. They face great difficulty to finance a new venture.”

Communication by the European Commission, 1998.

1.1 Introduction

The entrepreneurial dynamism of the US economy is in sharp contrast to the relatively low levels of firm creation in Western Europe and Japan. A survey on entrepreneurship conducted in 2000 reports that while an estimated 10% of a representative sample of the US working population stated that they were “currently engaged in the process of creating a nascent business,” this

figure is below 2% for Japan and France, and below 4% for most European countries.¹ Within the US, striking differences in entrepreneurial activity are also observed: while Route 128 and Silicon Valley had very similar technological potentials in the early 80's, the level of start-up investment in the latter area during the last two decades has been much higher.²

How can such large discrepancies exist and persist between economies at similar levels of development? Common explanations invoke exogenous cultural differences such as different levels of risk aversion or different institutional constraints (e.g. taxes, labor market regulation or administrative costs). In contrast, I offer an economic explanation based on the endogeneity of social norms. In my model, multiple equilibria can arise, corresponding to different attitudes of entrepreneurs and the capital market towards liquidation and exhibiting different levels of entrepreneurial activity.

Our model's features are as follows. Entrepreneurs raise funds to finance projects, the outcomes of which depend on two factors: entrepreneurial ability and luck. Entrepreneurs receive a private signal about the quality of their current project and decide whether to continue the project or abandon it in favor of a new one. Their decision depends on the cost of starting a new venture and, in particular, on the cost of capital after failure.

I show that several equilibria can arise. Suppose that the cost of capital for failed entrepreneurs is high. In this case, entrepreneurs only abandon projects with very poor prospects. This makes it less likely that good entrepreneurs fail, and decreases the quality of the pool of failed entrepreneurs. This in turn justifies a high cost of capital for failed entrepreneurs. In such an equilibrium – which I call conservative – the probability that a project will be liquidated (conditional on ability) is low and accordingly, the average value of new ventures is also quite low because mediocre projects persist.

By contrast, assume that the cost of capital for failed entrepreneurs is relatively low. Because financing a new project is cheap, entrepreneurs only continue projects with high prospects. As a consequence, the the pool of failed entrepreneurs is of higher quality, which justifies a low cost of capital for the new projects of failed entrepreneurs. In such an equilibrium, which I call experimental, entrepreneurs fail more often and this higher level of experimentation leads to the creation of more firms with high prospects.

¹Global Entrepreneurship Monitor (2000 Executive Report).

²AnnaLee Saxenian (1994) describes the divergent entrepreneurial path of both regions.

In other words, the two types of equilibria are characterized by different levels of stigmatization of failure. In “conservative equilibria”, an entrepreneur is highly stigmatized for his failure, to the detriment of his credit conditions whereas in “experimental equilibria”, the perception of an entrepreneur by the credit market (or the job-market) is only slightly worsened by failure.

This formalization of endogenous social norms allows us to analyze several dimensions of entrepreneurship.

First, the model predicts which sectors are more likely to be in one equilibrium or the other and allows us to compare the social efficiency of the two equilibria. Depending on parameters, each type of equilibrium can dominate the other. The virtue of the experimental equilibrium, compared to the conservative equilibrium, is that good entrepreneurs are willing to experiment, which increases their chances of creating a high value venture. However, this also increases the cost of capital for first-time entrepreneurs (as they are more likely to abandon their project) as well as the number of projects undertaken by bad entrepreneurs. Due to this lower sorting out of bad entrepreneurs, the experimental equilibrium can be the less efficient one. Near the technological frontier, the value of entrepreneurial projects lies more in outcomes that are both high and improbable. Experimentation is therefore socially efficient. For sectors in which entrepreneurship is essentially an imitative activity (so that success depends more on ability than luck), the conservative equilibrium might be preferable instead.

Second, the model explains how the characteristics of projects differ in the two equilibria. Entrepreneurs are willing to undertake more aggressive growth strategies in the experimental equilibrium because failure is less costly whereas they favor safe projects in the conservative equilibrium. This endogenous risk conservatism distinguishes the nature of entrepreneurial activity in the two equilibria.

Third, I show that the level of entrepreneurial activity is maximized if the efficient equilibrium obtains, be it the conservative or the experimental. If the conservative equilibrium is not efficient, it is also characterized by a smaller number of workers choosing to become entrepreneurs. For example, the leadership of the US economy in the high-technology sectors might be due to the experimental nature of entrepreneurial activity in this country, contrasting with Europe’s conservative equilibrium, which is more adapted to less risky sectors. This result also provides a criterion based on entrepreneurial migrations to test empirically whether an economy is in the efficient equilibrium.

Finally, I discuss how institutions such as bankruptcy laws and fresh start policy, the existence of venture capital equity markets and the liquidity of the resale market affect the likelihood of each equilibrium. I show in particular that softer bankruptcy rules make the experimental equilibrium more likely and discuss the implications for the choice of optimal bankruptcy rules.

This paper is related to the career concern literature initiated by Holmstrom (1982, 1999) where managers take into account the impact of their decisions on their reputation. Boot (1992) presents a model of divestitures and takeovers where managers are concerned by the way in which the market will interpret the termination of investments they have initiated. As in our model, this can lead to the inefficient continuation of projects. More recently, Baker (2000) applies this idea to venture capitalists. The novelty of our model is to endogenize the outside option of the entrepreneur in general equilibrium, which leads to multiple equilibria. Our effect is related to earlier contributions in labor economics such as Acemoglu and Pishke (1998). In their model, due to asymmetric information, workers care about what separation from their employer signals to potential future employers about their ability. Gromb and Scharfstein (2001) have a model of entrepreneurship where managerial incentives are determined by the career prospects in the event of a project's failure which in turn depends on the type of organization where the project failed (intrapreneurial vs. entrepreneurial). Managers who fail an internal venture can be redeployed by their firms into other jobs which has costs in terms of incentives whereas failed entrepreneurs must seek employment at other firms. While their focus is on organizational choice, ours is on capital markets for start-up finance.

The paper is organized as follows. Section 2 provides an empirical motivation for the theory. Section 3 presents the basic model and section 4 finds the possible equilibria. Section 5 compares the two equilibria and section 6 describes results on welfare. Section 7 discusses the effect of bankruptcy law. Section 8 shows how preferences over projects differ in the two equilibria. Section 9 studies the level of entrepreneurship and entrepreneurial migrations and provides an empirical criterion to test efficiency. Section 10 discusses the effect of the legal and institutional environment. Section 11 concludes. All mathematical proofs are in the appendix.

1.2 The Stigma of Failure: Some Evidence

The premise of our analysis is that the stigma associated with failure is an important determinant of entrepreneurial activity. It influences not only the decision to become an entrepreneur, but also the choice of projects and the decision to terminate a project. A large body of anecdotal evidence suggests that failure is highly stigmatized in Europe and in certain Asian countries, whereas the American social norms are more forgiving: failing is just a step in a process of experimentation. Within the US, substantial differences also exist. Saxenian (1994) shows that Silicon Valley's entrepreneurship is characterized by an exceptional climate of tolerance for failure, while New England is more conservative for that matter.

In this section I first compare quantitatively the stigma of entrepreneurial failure on the French and American labor markets and show that it is much more important on the French market. I then document the fact that the stigma of failure is an important determinant of entrepreneurial activity with a body of anecdotal evidence.

1.2.1 Failure and the Labor Market

To quantify the "stigma of failure", I use wage information in labor market data. Two studies based on US data, Evans and Leighton (1989) and Hamilton (2000), establish that American entrepreneurs returning to employment earn slightly higher wages than other workers with similar characteristics.³

To my knowledge, no such study exists for France. I run my own regressions, using *Enquête-Emploi*, an annual survey of 1/300 of the French population. I find that French entrepreneurs returning to paid employment earn significantly lower wages than other workers. To control for transitions between self-employment and employment, I construct a sequence of two-year panel data. Given year t and $t + 1$, I know the employment status of each individual for both years: employed, self-employed, unemployed or out of the labor force. I also know the wage w_t of

³Evans and Leighton (1989), relies on the National Longitudinal Survey of Young Men (1966-1981) and finds that "workers who fail at self-employment return to wage work at roughly the same wages they would have received had they not tried self-employment". Each additional year of self-employment experience increases the mean wages of males aged 29-39 by 4.5%, as compared with an increase of 3.1% for an extra year of wage experience. Hamilton (2000) uses the Survey of Income and Program Participation (1984) and finds that "entrepreneurs returning to paid employment actually earn a higher wage than employees with the same observed characteristics".

employees, but not the income of the self-employed. Given this restriction, I run the following regression⁴ in order to “estimate” the stigma of failure is:

$$\ln(w_{t+1}) = X'_{t+1}\beta + \alpha SE_t + \epsilon,$$

where X_{t+1} is the vector of observable characteristics of employed individuals in year $t + 1$, and SE_t , a dummy variable equal to 1 if the individual is self-employed in year t . The coefficient α estimates the percentage wage premium for individuals who made the transition from self-employment in year t to employment in year $t + 1$. I run this regression from 1990 to 2000. I find that in contrast to what prevails in the US, self-employed who become employees earn significantly less than other employees. The wage discount is -13% on average over the period (yearly tables are given in the appendix).

This wage discount can reflect that leaving self-employment is a bad signal to the labor-market. Alternatively, however, it could reflect a selection effect, i.e., self-employed are of a relatively low type with regard to the rest of the population, in a way that the market but not the econometrician observes. To control for this effect, I run the following regression on all paid employees of period t :

$$\ln(w_t) = X'_t\beta + \delta SE_{t+1} + \epsilon,$$

where SE_{t+1} is a dummy variable equal to 1 if the individual has become self-employed at time $t + 1$. The coefficient δ estimates whether workers who make the transition from paid employment to self-employment have relatively low wages vis-a-vis the rest of the population⁵. It turns out that it is not the case: δ is only -0.017 on average over the period and insignificant for most years. This confirms that the discount α is not due to selection and thus can be interpreted as a proxy for the stigma of failure. This estimation allows us to conclude that the wage discount α captures mostly the “stigma of failure”.

In summary, the picture that emerges from these empirical results confirms that the French and US labor markets react differently to the termination of entrepreneurial activity. In contrast with the US labor market, the French labor market penalizes heavily those who quit self-employment for employment.

⁴On the set of individuals employed in year t .

⁵Before making the transition and controlling by observable characteristics.

1.2.2 Failure and the Credit Market

I now turn to the credit-market. Evidence suggests that the US credit market does not penalize heavily failed entrepreneurs. Only two studies have tried to address quantitatively the question of the proportion of individuals able to start a new business after failure. A first pilot study of the Small Business Administration shows that among the owners of a representative sample of business owners who filed for Chapter 7 between 1989 and 1993, about 50% had resumed a new business in 1993. Another study funded by the National Endowment of the National Conference of Bankruptcy Judges runs a survey that shows that the vast majority of a cohort of self-employed filing for Chapter 7 start new ventures within five years. On the other side, policymakers in Asia and Europe, worrying about the ways to foster entrepreneurship frequently mention the “stigma of failure” as a major impediment to entrepreneurship. Moreover, the view that the stigma is due to social norms and not only laws is often asserted in government reports, political speeches and journal articles. A few extracts are worth mentioning.

“There is also a Japanese stigma against failure, which discourages risk-taking activities. It is often said that there is no second chance for Japanese; an American can fail two or three times before succeeding. There has been imbalance between big risk and little reward in Japan”.

K. Nakagawa, Former Vice-Minister, MITI Japan, June 2000.

“If you fail in Britain, you carry the tag with you always. This attitude stifles people from going out a second time. And it means that a huge learning experience goes to waste.”

Sunday Times, London, March 2000

“To embrace the spirit of risk-taking, we need to accept failure as a possible outcome of technopreneurship. A sustainable technopreneurial environment not one that promises no failures but one that copes with those who fail, and encourages technopreneurs to continue to pursue their dreams”.

Chong Lit Cheong, Managing Director, National Science and Technology Board, Singapore, May 2000.

“An important factor underlying Europe’s poor record on entrepreneurship is the

stigma of failure. Many would-be entrepreneurs and good ideas are put-off by the fear that if you fail once, you will lose everything. This must change. Failure can be regarded as part of the learning curve. We must change mentalities. Failure is not accepted in Europe. An entrepreneur must have a second chance. Changing business culture is the toughest challenge”.

E.A. Liikanen, Commissioner for Enterprise and Information Society at the European Commission, June 2000.

Within the US, failure stigmatization is said to vary across regions:

“The culture in Southeastern Virginia is that there is still a lot of stigma attached to failure. Business people in this area are very conservative.”

W. Donaldson, President of Strategic Venture Planning, 1999.

Saxenian (1994) provides evidence that the business climate in Silicon Valley is much more tolerant towards failure than Massachusetts’ Route 128. In conclusion, empirical and anecdotal evidence both suggest massive differences in the stigma of failure across regions.

1.3 The Model

The model has three dates, $t = 0, 1, 2$. All agents are risk-neutral and the risk-free rate is normalized to zero.

At $t = 0$, there is a continuum of entrepreneurs, each with a project requiring an investment outlay I and generating a single cash flow at $t = 2$, that can take two values, 0 or $X > 0$. The project’s outcome depends on entrepreneurial ability, which is good with probability θ , and bad otherwise, and on luck as will be described shortly. Each entrepreneur’s ability is unknown to all agents, including himself. Entrepreneurs are wealthless and thus need to raise I from competitive investors. Their reservation value is normalized to zero along all periods.

At $t = 1$, each entrepreneur observes privately a signal allowing him to reassess his project, i.e., the probability p that it will generate the cash flow X . Good entrepreneurs reassess their project’s prospects as high ($p = p_H$) with probability π_H , mediocre ($p = p_M < p_H$) with

probability π_M , and low ($p = 0$) otherwise ($\pi_L = 1 - \pi_M - \pi_H$). Bad types always observe $p = 0$.

Each entrepreneur can run only one project at a time. However, entrepreneurs can choose to abandon their initial project after reassessing its prospects and start a new project, i.e. become a second-time entrepreneur. In that case, the initial project is terminated and its liquidation value is normalized to 0. The new project is as before: it requires an investment outlay I at $t = 1$ and has the same distribution of outcomes (over 0 and X) at $t = 2$.

Finally, we need to describe the financial contracting environment. We exclude contracts involving more than one project, in the following sense: an investor financing a first-time entrepreneur has no claim on the cash-flows of this entrepreneur's future projects⁶, nor can the investor commit to the terms of financing of future projects.

This market imperfection, which we take as given, could arise for several reasons. When a fresh start policy exists, the entrepreneur cannot pledge his future cash-flows. Conversely, commitment from the investor for unknown future projects are likely to generate large moral hazard problems.⁷

Given this restriction on the possible contracts and the binary structure of outcomes, contracts can be described with one variable: the repayment conditional on success. If the project is abandoned or generates cash flow 0 at $t = 2$, the repayment is 0.⁸ Therefore, we will only need to characterize the repayment for the first-timers and second-timers (an entrepreneur who abandoned his first project and starts again), R and R' . Finally, I assume that the average project has a positive net present value at $t = 0$.

Assumption 1 $I < \theta(\pi_H p_H + \pi_M p_M)X$.

⁶This is akin to the so-called "fresh-start" rule, which guarantees to entrepreneurs the right to start again, free from previous debt claims. As an extension, we discuss fresh start vs. other arrangements in section 6.

⁷Overconfidence can also be at the root of this market imperfection. Entrepreneurs who underestimate the risk of failure are reluctant to pay today for the option of a better post-failure rate.

⁸These contracts can be interpreted as debt or equity. We extend the model to discuss differences in section 6. More generally, we can consider a transfer $\alpha \geq 0$ from the financier to the entrepreneur in case of default. α has to be positive or zero, since the entrepreneur doesn't have personal wealth. Under risk-neutrality, $\alpha = 0$ is not restrictive. In particular, we show later that α can not be used to separate between different types in our set-up. When the entrepreneur abandons a project, whether the investor can seize it or not is irrelevant since it has a zero liquidation value. We relax this assumption later. Control rights will be an issue in this context.

1.4 Entrepreneurship and the Stigma of Failure

In this section I show that two pure strategy equilibria are possible and determine under what conditions they coexist. I discuss the main intuitions, leaving a more complete treatment for the appendix.

As a benchmark, consider the first-best situation, which would arise if the entrepreneur were self-financed or if there were no credit market imperfections. An entrepreneur with high prospects ($p = p_H$) continues his initial project, since prospects cannot be higher. An entrepreneur with mediocre prospects ($p = p_M$) continues if the expected value of continuing exceeds that of starting again, i.e., if $p_M X > (\pi_H p_H + \pi_M p_M) X - I$. An entrepreneur with bad prospects ($p = 0$) stops his initial project. He is of the good type with probability $\frac{\pi_L \theta}{\pi_L \theta + (1-\theta)}$ to be of the good type. He starts again only if the expected value of continuing is positive, i.e., if $\frac{\pi_L \theta}{\pi_L \theta + (1-\theta)} (\pi_H p_H + \pi_M p_M) X - I > 0$.

In our set-up – characterized by the need to raise external finance in an imperfect capital market – the entrepreneur’s decisions can differ from the first-best case in equilibrium.

Consider a first-time entrepreneur’s decision to continue or abandon his initial project at $t = 1$. If the entrepreneur observes $p = 0$, he will abandon his project.⁹ If he observes $p = p_H$, he continues in any equilibrium.¹⁰ As we have seen, these two decisions are first-best.

The continuation abandonment decision when $p = p_M$, is more complex, as it depends on the cost of capital for failed entrepreneurs, R' . An entrepreneur who observes $p = p_M$ knows he is good (he would otherwise observe $p = 0$), but cannot credibly transmit this information to investors.

For a given R' , the entrepreneur continues if the expected value from continuation is larger than that of starting again, i.e., if $p_M (X - R) > (\pi_H p_H + \pi_M p_M) (X - R')$. The higher R' , the more likely this inequality is to hold.

In turn, R' depends on the decision rule of entrepreneurs who observe $p = p_M$. If they abandon their initial projects, more good entrepreneurs are in the pool of failed entrepreneurs, the prospects of second timers are better, and therefore R' is smaller.

⁹To be more precise, this strategy is strictly dominant only when the market is willing to finance projects of failed entrepreneurs. Otherwise, the entrepreneur is indifferent between continuing or not. An arbitrarily small (opportunity) cost of continuation makes it dominant to abandon.

¹⁰Otherwise, a first-time project never delivers positive cash flows and therefore won’t be financed in the first place.

Therefore, an equilibrium is determined by the strategy (continuation or abandon) of a “first-time” entrepreneur when $p = p_M$, and by the cost of capital, R and R' , to first time and second time entrepreneurs.¹¹ There are only two potential equilibria: a conservative equilibrium in which entrepreneurs with $p = p_M$ continue, and an experimental equilibrium in which they choose to fail and restart. I now turn to the existence and characterization of each equilibrium.

Conservative Equilibrium

Let us first consider the “conservative equilibrium”, in which entrepreneurs with mediocre prospects ($p = p_M$) continue. In this case, good types fail only when $p = 0$, and the fraction of good types among failed entrepreneurs is:

$$\theta'_C = \frac{\pi_L \theta}{\pi_L \theta + (1 - \theta)}.$$

The numerator is the proportion of entrepreneurs who fail despite being good, and the denominator is the total proportion of entrepreneurs who fail. Naturally, θ'_C is less than θ and increases with θ and π_L : a higher proportion of good entrepreneurs at $t = 0$, or a higher probability for them to draw a low prospect project both increase the presence of good types in the pool of failed entrepreneurs.

The probability of success of a second-timer’s project is $\theta'_C(\pi_{HPH} + \pi_{MPM})$. Therefore, in a competitive financial market, risk-neutral investors break even by setting:

$$R'_C = \frac{I}{\theta'_C(\pi_{HPH} + \pi_{MPM})}.$$

Similarly, the repayment R_C required for first-timer is:

$$R_C = \frac{I}{\theta(\pi_{HPH} + \pi_{MPM})}.$$

Note that $R_C < X$ from Assumption 1. The incentive compatibility constraint ensuring

¹¹We give a more formal definition of an equilibrium in the appendix and show that the equilibrium has to be pooling (i.e., all failed entrepreneurs face the same interest rate).

that good entrepreneurs with mediocre prospects choose not to fail is:¹²

$$p_M(X - R_C) > (\pi_{HPH} + \pi_{MPM})(X - R'_C).$$

In equilibrium, second-timers can finance their projects only if $R'_C < X$. Otherwise, no feasible repayment allows the investor to break even. If $R'_C > X$, failed entrepreneurs are not refinanced and the incentive compatibility constraint can then be written as: $p_M(X - R_C) > 0$, which holds from Assumption 1. The market does not allow failed entrepreneurs to start again. This form of the conservative equilibrium arises when the expected value of the project of a failed entrepreneur is negative, i.e. $\theta'_C(\pi_{HPH} + \pi_{MPM})X < I$, so that there is simply no credit supply for post failure projects. I will refer to this case through the notation $R'_C = +\infty$.

Lemma 2 *A conservative equilibrium exists if*

$$p_M(X - R_C) > (\pi_{HPH} + \pi_{MPM})(X - R'_C).$$

If $R'_C > X$, failed entrepreneurs do not start a new project at $t = 1$.

Experimental Equilibrium

Consider now the case where good entrepreneurs fail when prospects are mediocre ($p = p_M$). The proportion of good entrepreneurs in the pool of failed entrepreneur is:

$$\theta'_E = \frac{(\pi_M + \pi_L)\theta}{(\pi_M + \pi_L)\theta + (1 - \theta)}.$$

The numerator is the proportion of entrepreneurs who fail despite being good – only those with $p = p_H$ do not – and the denominator is the total proportion of entrepreneurs who fail. The repayment required from second timers is still given by:

$$R'_E = \frac{I}{\theta'_E(\pi_{HPH} + \pi_{MPM})},$$

¹²This constraint implies a fortiori that entrepreneurs with high prospects will continue, which is needed for equilibrium.

while for first-timers, it is now given by:

$$R_E = \frac{I}{\pi_{HPH}\theta},$$

The incentive compatibility constraint ensuring that good entrepreneurs with mediocre prospects, abandon and try again is:

$$p_M(X - R_E) < (\pi_{HPH} + \pi_{MPM})(X - R'_E).$$

For the experimental equilibrium to exist, it is also necessary that an entrepreneur with high prospects does not prefer to start again:

$$p_H(X - R_E) > (\pi_{HPH} + \pi_{MPM})(X - R'_E).$$

Note that this incentive constraint automatically holds in the conservative case because the interest rate is higher for second-timers than for first-timers. Here, it does not always hold and must therefore be kept among the conditions that ensure that the experimental equilibrium exists. Also note that this inequality combined with $R'_E < X$ implies that $R_E < X$. This leads to the following conditions for the existence of an experimental equilibrium:

Lemma 3 *An experimental equilibrium exists if:*

$$\left\{ \begin{array}{l} R'_E < X, \\ \frac{\pi_{HPH} + \pi_{MPM}}{p_H} < \frac{X - R_E}{X - R'_E} < \frac{\pi_{HPH} + \pi_{MPM}}{p_M}. \end{array} \right.$$

Discussion

Our initial motivation was the large variations of entrepreneurial activity across regions and sectors. From the model I have fleshed out, the notion emerges that two distinct regimes of entrepreneurial activity (experimental and conservative) exist. The analysis provides the condition for the existence of these two regimes and one of the important consequence is that for given parameters, the two equilibria can coexist.

Proposition 4

- *There are two possible equilibria: the conservative equilibrium characterized by a high stigma of failure (i.e., a high cost of capital for failed entrepreneurs) and the experimental equilibrium, characterized by a low stigma of failure (i.e., a low cost of capital for failed entrepreneurs).*
- *For some parameter values, the conservative and experimental equilibria coexist.*
- *A sufficient condition for at least one equilibrium to exist is:*

$$p_H(X - R_E) > (\pi_{HPH} + \pi_{MPM})(X - R'_E).$$

The third point means that an equilibrium exists, unless, a first-timer with high outcomes has an incentive to start again, so that first-time projects do not get financed.

In this section, I have developed a model of entrepreneurship and shown that two regimes of entrepreneurship – conservative and experimental – can exist in similar economies. A superficial look at these two regimes might suggest that they result from differences in culture or social norms. But in our model, the stigma of failure is endogenous and determined in equilibrium by purely economic factors. In the next section, I compare the two equilibria in more detail.

1.5 Comparison

In this section, I describe qualitative differences between the two equilibria, determine what type of countries or industries are likely to be in one equilibrium rather than the other, and propose testable implications of the model.

1.5.1 Failed Entrepreneurs and the Credit Market

The fraction of good types in the pool of failed entrepreneurs is higher in the experimental equilibrium than in the conservative one: θ'_E is higher than θ'_C because in the experimental equilibrium, good entrepreneurs fail when $p = p_M$, not only $p = 0$. These differences in composition of the pool of failed entrepreneurs have implications for the cost of capital.

In the experimental equilibrium, investors anticipate at $t = 0$ that more first-timers will abandon their project. Therefore, for investors to break even, the cost of capital for first-timers

is higher in the experimental equilibrium.

Result 5 *Relative to the experimental equilibrium, the conservative equilibrium is characterized by:*

- *a lower cost of capital for first-time entrepreneurs, $R_C < R_E$,*
- *a higher cost of capital for second-time entrepreneurs, $R'_C > R'_E$.*

A testable implication of this result is as follows.

Corollary 6 *The elasticity of the cost of capital with respect to credit history is smaller in the experimental than in the conservative equilibrium, i.e.,*

$$R'_E/R_E < R'_C/R_C.$$

This equation implies that in the conservative equilibrium, the cost of capital rises sharply when the credit history of an entrepreneur includes a failure, while it should be flatter in the experimental equilibrium. An assessment

1.5.2 Firm Creation and Destruction

The two equilibria also differ in the level of firm creation and destruction. The average number of firms created per entrepreneur is $2 - \theta\pi_H$ in the experimental equilibrium (1 at $t = 0$ and $1 - \theta\pi_H$ at $t = 1$), which is more than in the conservative equilibrium, where the number is $2 - \theta(\pi_H + \pi_M)$ (and simply 1 if $R_C = \infty$). This reflects a higher degree of “serial-entrepreneurialism” in the experimental case. The number of failures at $t = 1$ is also higher in the experimental than in the conservative equilibrium: $(1 - \theta\pi_H)$ vs. $(1 - \theta(\pi_H + \pi_M))$.

Result 7 *Relative to the conservative equilibrium, the experimental equilibrium is characterized by:*

- *a higher rate of creation and destruction of firms,*
- *a higher probability for a firm to fail at $t = 1$,*
- *a lower probability for a firm to fail at $t = 2$ conditional on survival at $t = 1$.*

The first prediction seems in line with cross-country anecdotal evidence – the Schumpeterian dynamism of the US economy, characterized by a high level of creation/destruction is often highlighted. It would however deserve more empirical scrutiny.

The prediction also sheds light on the large variance of survival rates across industries (e.g. Audretsch (1991, 1995)). Following Winter (1984), Audretsch describes his findings in term of the coexistence of two technological regimes. In the “entrepreneurial regime”, small firms have an innovative advantage and therefore undertake risky innovative projects which leads to a high mortality rate. In the “routine regime”, innovation is undertaken by large firms and new firms have a higher survival rate. Our model provides an explanation for why such a polarization in distinct regimes could arise even if the underlying heterogeneity in the sectors’ characteristics is continuous rather than binary.

Assuming that “innovative sectors” are more likely to be in the experimental equilibrium (we will show in section 6 that the experimental equilibrium tends to be more efficient and more likely in these sectors), the two other predictions are consistent with the empirical results of Audretsch (1995), who reports that:

“In industries where innovative activity, and especially the innovative activity of small firms, plays an important role, the likelihood of new entrants’ surviving over a decade is lower than in industries where innovative activity is less important. At the same time, those entrants that are able to survive exhibit higher growth rates. In addition, the conditional likelihood of surviving an additional two years for entrants that have already survived the first few years is actually greater, and not lower, in highly innovative industries”.

Consider now the cross-section of firms after $t = 1$. These firms can take three values: $V^H = p_H X$, $V^M = p_M X$, or $V^L = 0$. The distribution of firms in the experimental equilibrium exhibits fatter tails, i.e., a larger fraction of firms of value V^H and 0. This reflects higher risk-taking by entrepreneurs: mediocre projects are abandoned and replaced by random draws.

Result 8 *Relative to the conservative equilibrium, the experimental equilibrium is characterized by:*

- a higher variance in the value of firms created, with more high-value firms and more low-value firms.
- a higher expected value of a firm at $t = 2$ conditional on survival at $t = 1$.
- a higher expected value of a representative firm at $t = 2$ if $R_E < R'_E$.

If we think to Europe as being in the conservative equilibrium, contrary to the US, the technological leadership of the US can be seen as the result of an intense experimentation process where entrepreneurs abandon mediocre projects until they create “something big”. Cisco, Intel, Microsoft, Dell, 3Com, Palm are among the numerous examples of entrepreneurial ventures grown into giants. They have few European counterparts.

These results are also consistent with empirical evidence on the distribution of the firms by size. Even though much fewer firms are created in Europe, the proportion of very small firms in the stock of existing firms is much higher in Europe than in the US. For example, the OECD Small and Medium Enterprise outlook reports that in the late 90’s, 31.7% (resp. 29.7%) of French employees worked in an enterprise of less than 20 employees (resp. 500), vs. 19.5% (resp. 47.5%) for their American counterparts. One interpretation is in terms of the conservative equilibrium. Many (mediocre) projects survive that will never grow into large firms.

1.5.3 Likelihood of the Two Equilibria

I now discuss which sectors are more likely to be in one type of equilibrium or the other.

Keeping other parameters constant, an increase in θ or X or a decrease in π_M make the experimental equilibrium more likely (in the sense that it exists for a larger set of the other parameters) and the conservative equilibrium less likely. Moreover, starting from a set of parameters for which the two equilibria exist, it is possible, by increasing X or θ or by decreasing π_M , to make the conservative equilibrium disappear and, by varying one of these parameters in the other direction, to make the experimental equilibrium disappear. The intuition is that when the proportion of good entrepreneurs is high enough, the stigma associated to failure diminishes and thus experimentation becomes more attractive. Similarly, if the returns to success increase, the option to start again becomes more attractive, relative to the continuation of a mediocre prospects project.

Result 9 *Keeping other parameters constant, there exist p_M^* , p_M^{**} and θ^* with $0 < p_M^* < p_M^{**} < p_H$ such that :*

- *For $p_M < p_M^*$ the conservative equilibrium does not exist and for $p_M > p_M^{**}$, the experimental equilibrium does not exist.*
- *If $\frac{p_M}{p_H} < \frac{\pi_H}{1-\pi_M}$, for $\theta > \theta^*$, the conservative equilibrium does not exist.*
- *An increase in p_H and a simultaneous decrease in p_M , leaving $\pi_M p_M + \pi_H p_H$ constant makes the conservative (experimental) equilibrium less (more) likely.*

The first point means that when mediocre prospects become bad enough, the incentive to continue these projects vanishes. On the contrary if the difference between mediocre and good prospects is small, the incentive to start again weakens.

The second point illustrates that when the expected outcome of the intermediary project is less than the expected outcome of a new project (i.e., $p_M X < (p_H \pi_H + p_M \pi_M) X$), the entrepreneur always starts again if the proportion of good entrepreneurs, θ , is close enough to 1. This arises because the interest rate difference $R' - R$ can be made smaller than any positive number for θ high enough.

The meaning of the third point is that for a given expected value of first-time project, the experimental equilibrium is more likely when the prospects are skewed on the right: when the gap between mediocre and high prospects projects increases. This property is characteristic of innovative sectors, such as high tech, where expected outcomes have a very large scope and the option value to start again in case of mediocre prospects is therefore higher.

1.6 Welfare Analysis

I now turn to the question of the relative efficiency of the equilibria. A first result is that the expected utility of an entrepreneur who has failed (whatever his prospects on the first project) is higher in the experimental than in the conservative equilibrium. But this increased cost of failure does not mean that the experimental equilibrium is more efficient. To answer this question, we need to characterize the potential sources of inefficiency.

The source of inefficiency is the misalignment between the private value of the option to abandon and restart projects and its social value. The decision of entrepreneurs with mediocre

prospects to continue or not affects the composition of the pool of failed entrepreneurs. This can lead to an inefficient pricing of the cost of capital. Consider an entrepreneur with $p = p_M$. Instead of comparing V^M to $(\pi_H V^H + \pi_M V^M - I)$, the entrepreneur decides whether to continue by comparing $V^M - R$ to $\pi_H(V^H - R') + \pi_M(V^M - R')$. That means that the difference between the individual and social option value of starting again is $R + (I - (\pi_M + \pi_H)R')$. Three pecuniary externalities can be distinguished.

The first one is a debt overhang effect (Myers (1977)) and is related to the cost of capital for first-timers. If R is large, the option to continue is unattractive. If first-timers fail often, the interest rate is high, which makes continuation less attractive.¹³

Second, entrepreneurs do not internalize the impact of their abandon/continue decisions on the quality of the pool of failed entrepreneurs, and therefore on the cost of capital R' faced by other entrepreneurs. Conservatism worsens the quality of the pool of failed entrepreneurs, making abandonment less attractive to entrepreneurs.

Third, entrepreneurs with $p = 0$ can be tempted to start again, even if their project's expected value is negative. This can lead to two types of adverse effects. First, in the experimental equilibrium, excessive financing of negative value projects can occur, an externality that good entrepreneurs with $p = p_M$ do not internalize when they choose to restart. Second, the extreme case of conservatism ($R'_C = +\infty$) alleviates this cost by preventing any restart. However, entrepreneurs with $p = p_M$ cannot restart either, even if it is optimal.

Perhaps contrary to immediate intuition, the experimental equilibrium need not Pareto-dominate the conservative one. The experimental equilibrium allows for more successful projects but at the cost of a high level of destruction. Which of the two equilibria dominates the other depends on the parameters, in a way that reflects this trade-off. We compute the aggregate value generated by entrepreneurship.¹⁴ In the conservative equilibrium it is:

$$\begin{cases} W_C &= \theta[\pi_H V^H + \pi_M V^M + \pi_L(\pi_H V^H + \pi_M V^M - I)] - (2 - \theta)I & \text{if } R_C \leq X \\ W_C^\infty &= \theta(\pi_H V^H + \pi_M V^M) - I & \text{if } R_C = +\infty \end{cases}$$

¹³Usually debt overhang prevents you from financing new projects. Here, it induces you to start new projects.

¹⁴Investors make zero profit. Therefore, we do not have to consider them when we perform welfare analysis.

In the experimental equilibrium it is:

$$W_E = \theta[\pi_H V^H + (\pi_M + \pi_L)(\pi_H V^H + \pi_M V^M - I)] - (2 - \theta)I$$

Proposition 10 *The difference in the value of entrepreneurial activity between the experimental and conservative equilibrium is:*

$$\begin{cases} W_E - W_C = \pi_M \theta [(\pi_H V^H + \pi_M V^M - I) - V^M] & \text{if } R'_C \leq X \\ W_E - W_C^\infty = W_E - W_C + \theta \pi_L (\pi_H V^H + \pi_M V^M - I) - (1 - \theta)I & \text{if } R'_C = +\infty \end{cases}$$

It follows that in efficiency terms, the equilibria can be ranked one way or the other, depending on parameters. When V^H is high, the experimental equilibrium dominates the other one. This is not the case anymore when $(\pi_H V^H + \pi_M V^M - I)$ – which is the expected total value of a new draw – becomes smaller than V^M – the social value of continuation. As long as the two equilibria coexist, with $R'_C \leq X$, their relative efficiency depends only on the structure of payoffs in the industry and not in the proportion of good entrepreneurs, θ . This reflects the fact that in this case, efficiency depends only on what the first-best continuation decision is for entrepreneurs with $p = p_M$. We discuss efficiency in the light of the first-best:

Lemma 11 *Assume that both equilibria exist.*

- *If it is socially optimal for entrepreneurs with $p = p_M$ to continue, then the conservative equilibrium dominates the experimental one.*
- *If it is socially optimal for entrepreneurs with $p = p_M$ and with $p = p_L$ to start again, then the experimental equilibrium dominates the conservative one.*
- *If it is socially optimal for entrepreneurs with $p = p_M$ to start again and for entrepreneurs with $p = p_L$ not to start again, then*
 - *if $R'_C < X$ the experimental equilibrium dominates*
 - *if $R'_C = \infty$ equilibria can be ranked one way or the other.*

Corollary 12 *Within the parameter region in which the two equilibria coexist, the relative efficiency of the experimental equilibrium,*

- *increases with X if $R'_C \leq X$ and $p_H > (1 + \frac{\pi_L}{\pi_H})p_M$.*
- *decreases with I .*
- *increases with p_H .*

If most of the value of entrepreneurship lies in large uncertain outcomes, i.e., if V^H is large, experimentation is optimal. For innovative sectors such as the high-tech industry, the experimental equilibrium is likely to dominate the other. But in more traditional forms of business, for which ability is more important than luck, the conservative equilibrium dominates. If we think to Europe as being on the conservative equilibrium, the model predicts that this is likely to represent a loss in efficiency for sectors with high V^H such as high-tech. Other sources of inefficiencies could easily be incorporated in our model, such as job creations, technological spillover or learning effects.¹⁵

1.7 Bankruptcy Law

Bankruptcy law affects the possibility for a bankrupt entrepreneur to start again. In certain countries (e.g. the UK), an entrepreneur that went bankrupt cannot legally incorporate a new firm during a certain period. The period of time during which creditors retain claims on a bankrupt's assets varies across countries. This too can impede new business creation by failed entrepreneurs. In that respect, the legal provisions in the US are more favorable than in most European countries. The UK is considering a substantial reduction of the penalties that bankrupt entrepreneurs face. The purpose of this reform is to help building a culture of US style entrepreneurship and promoting risk-taking. The trend is the reverse in the US, where personal bankruptcy rules are becoming less debtor-friendly.

These features can be incorporated in our model. Assume that a failed entrepreneur still owes βR to his previous creditors, where $\beta \in [0, 1]$. In the “fresh-start” environment that I have considered so far, $\beta = 0$. A “tougher” bankruptcy rule corresponds to a higher β . For simplicity, I assume that prior debt is senior to new claims. The future pledgeable cash flows of the second project are therefore $X - \beta R$ times the probability of success. It can be shown that

¹⁵The idea that failure can enhance entrepreneurial skills is often mentioned by practitioners. It tends to make experimentation more efficient.

for any value of $\beta \in (0, 1]$, there exists values of the parameters for which the two equilibria coexist.

Result 13 *Tougher bankruptcy rules (i.e., an increase in β) make the conservative equilibrium more likely and the experimental equilibrium less likely.*

An increase in β has two effects. First, investors who lend at $t = 0$ are more likely to get a positive repayment. This lowers the interest rate R and therefore continuation becomes a relatively more attractive option for entrepreneurs with mediocre prospects, $p = p_M$. Second, starting a new project becomes less attractive as previous debt imposes a tax on future projects. Both forces make the entrepreneur more likely to continue the first project.

Our model provides a framework for thinking about the welfare effects of bankruptcy rules. In a situation where experimentation behavior is socially optimal, decreasing the toughness of bankruptcy rules (increasing β) can be beneficial. Conversely, if being conservative is socially optimal, decreasing β can be beneficial.

Result 14 *Assume that both equilibria coexist for $\beta = 0$ and that the conservative equilibrium is optimal. By setting β high enough, it is possible to make the experimental equilibrium disappear, while the conservative remains. This has no efficiency cost.*

The European Community prescribes more entrepreneur-friendly bankruptcy laws to foster entrepreneurship in Europe. Our model shows why this measure is likely to be efficient in innovative sectors but might be damaging in more traditional sectors. It also shows that it might be a bad idea to move simultaneously towards softer bankruptcy rules and a higher protection of distressed firms from liquidation. To move towards an experimental equilibrium, it is important to favor the liquidation of “mediocre projects” rather than their survival.

Note that in sectors where the experimental equilibrium is the most efficient, it may be optimal to set a negative β , meaning that entrepreneurs who fail, restart and eventually succeed would receive a premium. Another possibility is just a subsidy for restarters. Interestingly, such a scheme has been implemented in Singapore recently (the “phoenix award”) and is part of the European Commission’s policy recommendations (“the best re-starter award”).

1.8 Project Choice: Growth vs. Risk

The stigma of failure affects the continuation decision of entrepreneurs. It is also likely to affect the type of project that they undertake in the first place. Intuitively, when failure is highly stigmatized, entrepreneurs are likely to favor projects that are less likely to fail.

This can be formalized as follows. We start from parameters where the two equilibria coexist (we will refer to them as the reference parameters). I note U_E (U_C) the expected utility of a good type entrepreneur who fails at $t = 1$ in the experimental (conservative) equilibrium. We know that $U_E > U_C$ (because the cost of capital is smaller in the experimental equilibrium). Consider a small change in (π_H, π_L, p_H) with p_H increasing, π_H decreasing, and $\pi_H + \pi_L$ remaining constant. This change can be described as a move towards a more aggressive growth strategy. For simplicity, I assume that there is no change for second-timers. The indifference curve of an entrepreneur over this type of change in equilibrium i is described by: $[p_H(X - R_i) - U_i]d\pi_H + \pi_H(X - R_i)dp_H = 0$ where $i \in \{E, C\}$.

Therefore the elasticity of substitution reflecting project preferences is:

$$\epsilon_i = \frac{dp_H/p_H}{d\pi_H/\pi_H} = -\left[1 - \frac{U_i}{p_H(X - R_i)}\right]$$

Since $U_E > U_C$ and $R_C < R_E$, in absolute value, this elasticity is higher in the conservative equilibrium (ϵ_C) than in the experimental one (ϵ_E).

Result 15 *In the experimental equilibrium, entrepreneurs tend to prefer more aggressive projects than in the conservative equilibrium.*

$$\epsilon_C < \epsilon_E$$

Therefore, in the two equilibria, the same agents look as having different preferences over risk. This is in fact the consequence of the fact that similar projects differ in the two equilibria, due to different continuation values in case of failure.

Suppose now that entrepreneurs face a menu of two possible projects, at $t = 0$, indexed by $i \in \{0, 1\}$, and that the lender cannot control which one is chosen.¹⁶ The two projects are

¹⁶Either the type of project cannot be asserted at $t = 0$ or the entrepreneur can affect the project after the

characterized by $p_{H,0} < p_{H,1}$, $\pi_{H,1} < \pi_{H,0}$, and $\pi_{H,0} + \pi_{L,0} = \pi_{H,1} + \pi_{L,1}$. Projects are similar to the reference project with regard to other parameters. Project 0 is therefore safer and project 1 is more aggressive.

Result 16 *There exist $\delta > 0$, and a neighborhood of the reference parameters such that if the two projects belong to it and*

$$\epsilon_C + \delta < \frac{1 - p_{H,1}/p_{H,0}}{1 - \pi_{H,1}/\pi_{H,0}} < \epsilon_E - \delta,$$

then project choice leads to two equilibria:

- *a conservative equilibrium where project 0 is chosen,*
- *and an experimental equilibrium where project 1 is chosen.*

In the conservative equilibrium, entrepreneurs choose the safest project, at the expense of growth. The project choice dimension creates an externality that reinforces the multiplicity of equilibria. Because the entrepreneur chooses less risky projects in the conservative equilibrium good entrepreneurs are less likely to fail at $t = 1$, which increases the cost of capital for second-timers. Similarly, in the experimental equilibrium, that entrepreneurs choose projects that are more likely to fail at $t = 1$ reduces further the cost of capital for second-timers.

An interesting consequence is that project choice can per se create multiplicity of equilibria and can therefore induce inefficiencies, by making the wrong type of equilibrium appear, or the good equilibrium disappear. For example, even if it is socially optimal for entrepreneurs to take more risks, individual choice might lead to risk-conservatism and therefore to a conservative equilibrium. When empire building is detrimental to aggregate welfare, risk conservatism is a good thing. But it is perverse for the society when large opportunities lie in the highest outcomes. This is a Schumpeterian view of entrepreneurship. Positive externalities associated to the high outcome of projects, such as technological complementarities or job creation would reinforce the point. In particular, the risk conservatism induced by the stigma of failure can be costly in high-tech sectors, by reducing the speed at which the technology frontier moves.

funding has been contracted.

In a recent interview, Eric Benhamou, a French engineer who became an entrepreneur in the Silicon Valley and is the current CEO of 3Com said: “Twenty years ago, as a student at Stanford, I realized how naive I had been to believe I could start a business in France.[...]in France, you keep all your life the stigma of a failure. Here [in Silicon Valley] it is the mark of your entrepreneurial spirit.” Benhamou also added: “In France, it is common practice to give up on growth in order to limit risk. Here, when you start a venture, your goal is to become number one of your sector.”

This risk-conservatism can be illustrated in the biotech industry. Europe had a technological advantage in this sector in the early 80’s. Now, the US domination of the industry is overwhelming. A recent survey of Ernst&Young (Annual European Life and Sciences Report 2001) reports that European firms are slightly more numerous than US firms (1570 vs. 1273) but that they have remained very small. The comparison of number of employees is 61104 in Europe vs. 162000 in the US. The disparity in the level of investment is striking as well. For instance, American companies spend more than twice as much as the European in R&D. Currently, the top-ten US biotech companies outcapitalise the top ten European companies by almost three to one. US biotech company Amgen is about comparable to all Europe’s publicly quoted biotechs. All this seems to indicate that small companies choose relatively safe business plans in Europe, at the expense of growth options.

1.9 Endogenizing the Number of Entrepreneurs

Compared to Europe, the US has more startups per entrepreneur but also more entrepreneurs per capita. I extend the model to endogenize the number of new entrepreneurs. First, I establish a link between efficiency and the level of start-up activity. Second, I propose a test to determine whether an economy lies in the efficient equilibrium or not. This test is based on the observation of migration flows of entrepreneurs.

Assume that a continuum of agents choose initially between becoming employees for a wage w_0 (received at $t = 2$) or becoming entrepreneurs. This decision is irreversible. We restrict our analysis to parameter values such that the two equilibria coexist. We assume that the wage w_0 is drawn at $t = 0$ from an exogenous draw of cumulative distribution F which is the same for

all individuals: w_0 is uncorrelated with entrepreneurial ability ¹⁷

Since agents choose entrepreneurship if the wage they are offered is less than the expected returns of entrepreneurship, i.e. $w_0 < W$, the flow into entrepreneurship is proportional to $F(W)$. This implies that the most efficient equilibrium should exhibit more entry into entrepreneurship. This also implies that in this extension of the model (i.e. with endogenous entry), the ranking of equilibria (in terms of efficiency) is preserved.

Proposition 17 *When the wage w_0 is uncorrelated with entrepreneurial ability, more agents become entrepreneurs in the most efficient equilibrium.*

This effect amplifies the inefficiency result discussed previously. As discussed above, Europe seems to be in a conservative equilibrium while in a sector like high-tech, the experimental equilibrium is more efficient. This also implies that fewer people choose to become entrepreneurs in these sectors in Europe, and indeed, several empirical studies document this fact (c.f. Entrepreneurship Global Monitor 2000).

An indirect test of the theory can be based on entrepreneurial migration. Consider two countries, 1 and 2. For a given sector the expected return of entrepreneurial activity is W_i in country i . There is a continuum of mass 1 of potential entrepreneurs in each country. Migrating to the other country involves a mobility cost $c > 0$ drawn from the same distribution g . Entrepreneurs have an outside option wage $w_0 > 0$ in their country of origin, drawn as before from distribution with c.d.f. F .

Proposition 18 *When the mobility cost and the wage are uncorrelated with entrepreneurial ability:*

- *The mass of individuals migrating from country 1 to become entrepreneurs in country 2 is*
 - *zero if $W_1 > W_2$.*
 - *$\int_0^{W_2 - W_1} F(W_2 - c)g(c)dc$, if $W_1 < W_2$. This mass increases with the efficiency gap between the two economies ($W_2 - W_1$).*

¹⁷Otherwise w_0 would be a signal on ability and therefore adverse selection would occur at $t = 0$.

- *The mass of individuals from country 1 becoming entrepreneurs in their country of origin is,*
 - $F(W_1)$ if $W_1 > W_2$
 - *and* $(1 - G(W_2 - W_1))F(W_1)$ if $W_2 > W_1$.

This proposition captures the stylized fact that many entrepreneurs in innovative sectors in the US come from other countries. Flows of high-tech entrepreneurs from the US to Europe are virtually inexistent. The “entrepreneurial brain-drain”, defined as the mass of emigrants from country 1 who would have been entrepreneurs in country 1 if there was no mobility is $G(W_2 - W_1)F(W_1)$.

1.10 Extensions

1.10.1 Financial Institutions

In this section, I study how different legal and financial environments might favor one of the two entrepreneurial regimes.

Liquidation Value

We have assumed the liquidation value of projects to be zero. The resale market for projects can be an important determinant of the type of equilibrium: suppose that at $t = 1$ entrepreneurs can resell their projects at a price γEV , which is the value of an abandoned project expected by the market, discounted by a factor $\gamma \in [0, 1]$, which represents the liquidity of the resale market. The introduction of a resale value reinforces the strategic complementarity which is at the source of the multiplicity of equilibria. If few good entrepreneurs resale their current project to start a new one, resale value is low. This, in turn, makes liquidation less attractive. A more liquid resale market (i.e., a higher γ) improves the outside option of entrepreneurs at $t = 1$. It makes the experimental equilibrium more likely and the conservative equilibrium less likely. An increase in γ also makes the experimental equilibrium more efficient relatively to the conservative one (since less value is lost when a project is abandoned). In conclusion,

the possibility of an experimental equilibrium might be conditional on the existence of efficient private equity and IPO markets.

Debt, Equity and Venture Capital

Our model can also be used to study differences between different modalities of financing. There are different dimensions to the question. The first one is cash-flow allocation. Since there is only one possible positive cash flow in our benchmark model, there is no difference between debt and equity as far as return rights are concerned.¹⁸

Second, in many countries, a major difference between debt and equity finance is the fresh-start : defaulting on debt is subject to tougher regulation than the liquidation of an equity-financed projects. For this reason, equity is more likely to be associated to the experimental regime than debt.

Another important dimension of venture capital as a style of financing is the extent of technological monitoring exercised by the financier: venture capitalists typically spend time in the firm they are financing and dispose of high control rights. This type of lending (characterized by high monitoring costs) is likely to reduce the extent of asymmetric information and therefore promote the selection of the most efficient equilibrium : if the financier is aware of the signal $p = p_M$, he might finance a new project from the same entrepreneur, knowing that he is good.

In another paper, I study how variations in the stigma of failure are related to different lending modes (e.g. bank debt vs. venture capital). I show that when the stigma of failure is high, technological monitoring from the investor is not needed because the fear of having to raise new capital plays as a disciplining device. In other words, bank debt works well. On the contrary, if the stigma of failure is low, the entrepreneur cannot commit not to hold-up the investor ex-post and therefore, it is optimal to have the investor performing active technological

¹⁸I study in appendix the cash-flow allocation effect of different securities when different levels of cash-flows are introduced in the model. I show that the experimental equilibrium is more likely with debt than with equity. A modality of financing that makes the experimental equilibrium more likely than debt is one where the investor would get more in the intermediate case and less in the high value case. Venture capital contracts, based on convertible debt, have the particularity of being intensively state-contingent. Their design goes exactly in the direction I point out: the entrepreneur is largely compensated in case of large success (in particular, he typically gets control back), while in case of mediocre achievement, the venture capitalist gets control and the possibility to dilute the entrepreneur. In conclusion, more than the existence of an equity market, it is the possibility to write state contingent contracts that favors the apparition of an experimental regime. Venture capitalists are investors who rely on this type of state contingent contracts.

monitoring and the optimal contract stages the investment in several rounds.

1.11 Conclusion

The creation of new ventures is a key determinant of innovation, employment and growth. It is therefore crucial to understand what drives the large sectorial and regional variations in the levels and nature of entrepreneurial activity. This paper develops a model of entrepreneurship in which different equilibria of entrepreneurial activity arise. In the conservative (experimental) equilibrium, the cost of capital for failed entrepreneurs is high (low), therefore good entrepreneurs will be reluctant (less reluctant) to fail, which in turn justifies the high (low) cost of capital. Rather than invoking cultural differences, this model offers a theory where distinct social norms can emerge as a result of the complementarity between entrepreneurs' actions, and makes several testable empirical predictions.

The two equilibria are characterized by different levels of the creation/destruction of firms and different costs of capital. I discuss the relative efficiency of the two equilibria and show how it relates to the aggregate level of entrepreneurial activity. Due to an endogenously higher cost of failure, entrepreneurs choose more secure projects in the conservative equilibrium rather than aggressive growth strategies. The two equilibria lead to different distributions of firms' value. In the framework of the model, I study the role of bankruptcy rules: relaxing (tightening) bankruptcy rules is a policy tool to select the experimental (conservative) equilibrium. The model predicts the sectors in which such reforms are suitable.

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1.12 Appendix

1.12.1 Estimates of α and δ

α and δ are the coefficients on the self-employment dummy in the regressions:

$$\ln(w_{t+1}) = X'_{t+1}\beta + \alpha SE_t + \epsilon,$$

$$\ln(w_t) = X'_t\beta + \delta SE_{t+1} + \epsilon.$$

	α	δ
91-92	-0.136 (-3.54)	0.08 (-2.6)
92-93	-0.151 (-3.84)	-0.014 (-0.5)
93-94	-0.104 (-3.66)	-0.017 (-0.8)
94-95	-0.085 (-3.21)	-0.012 (0.5)
95-96	-0.094 (-2.61)	-0.04 (-1.4)
96-97	-0.167 (-5.26)	0.018 (0.63)
97-98	-0.196 (-5.58)	-0.06 (-2.1)
98-99	-0.122 (-3.74)	-0.11 (-4.1)
99-00	-0.035 (-1.02)	-0.03 (-1.19)

1.12.2 Equilibria

An equilibrium is characterized by:

1. the strategy of "first-time" entrepreneurs -failure or continuation- conditional on $V = V^M$: $d \in \{\text{failure, continuation}\}$.

2. the menu of debt contracts offered in period 0 to the inflow of entrepreneurs and in period 1, to failed entrepreneurs.

The following result is going to considerably simplify the range of possible equilibria: only pooling equilibria exist in our set-up.

Proposition 19 1. *There is no competitive screening equilibrium.*

2. *"Failed entrepreneurs" are offered a single debt contract where they get nothing in case of bankruptcy in period 2.*

This means that in any equilibrium, the market will not be able to differentiate between entrepreneurs who were failed because the project was totally worthless ($p = 0$) and those who chose to renounce to a project of intermediate value ($p = p_M$) in order to get a new chance to create a high value firm (V^H). The proof is provided in appendix. The assumption that entrepreneurs don't have collateral to invest is crucial here¹⁹.

proof of prop. 5:

First, notice that we can restrict the analysis to $\pi_M = 0$, replacing π_H by $\frac{\pi_H V_H + \pi_M V_M}{V_H}$, because both types have the same preferences on risk-neutral reallocations between states M and H .

Consider a menu of contracts taking the form $\{(\alpha_1, D_1), (\alpha_2, D_2)\}$ where $\alpha_i \geq 0$ is what the entrepreneur gets when he defaults and $D_i > 0$ is the face value of debt.

Suppose the contracts screen entrepreneurs, good types choosing (α_1, D_1) .

The competition imposes a zero profit condition on each types. Noting $p = \pi_H p_H$:

$$\begin{cases} pD_1 - (1-p)\alpha_1 = I \\ \theta'pD_2 - (1-\theta'p)\alpha_2 = rC \end{cases}$$

$$\theta'p(X - D_2) + (1 - \theta'p)\alpha_2 = \theta'pX - I < \theta'pX - I + (1 - \theta'p)p(\alpha_1 + D_1) = [\theta'pX - (pD_1 - (1-p)\alpha_1)] +$$

$$(1 - \theta'p)p(\alpha_1 + D_1) = \theta'p(X - D_1) + (1 - \theta'p)\alpha_1.$$

¹⁹The result remains true if the probability for "bad types" to get a positive outcome is small enough or if the distribution of their outcomes conditional on them being positive is close to the one of "good types".

This violates incentive compatibility for the second group. So there is no separating equilibrium.

In the pooling equilibrium, $\alpha_1 = \alpha_2 = 0$ (it is otherwise possible to introduce a contract that will attract only good types and make positive profits).

Proof of the coexistence of the two equilibria:

Select a value of X and θ such that $\pi_H \theta V_H > I$ and $V_M < \pi_H V_H + \pi_M V_M - I$. From the last inequality, we can be sure that for θ close enough to 1, the conservative equilibrium will not exist. Now, let's pick a value of π_H small enough, such that the conservative equilibrium exists. (increasing π_M does not affect the previous inequalities). Suppose the experimental equilibrium does not exist for this set of parameters. Let's increase θ . There is a θ^* upon which the conservative equilibrium would disappear: at this threshold, the IC just binds (entrepreneurs with $p = p_M$ are indifferent between failing or not). The experimental equilibrium exists at this level of θ for the following reason: since $R_E > R_C$ and $R'_E < R'_C$, the IC holds, while $\pi_H \theta V^H > I$ insures that $R_E < X$.

Sufficient condition for the existence of one equilibrium:

assume that the conservative equilibrium does not exist. Then, it must be that $R'_C < X$ and $p_M(X - R_C) < (\pi_{HPH} + \pi_{MPM})(X - R'_C)$. Given that $R'_E < R_E$ and $R'_C > R_C$, it is true a fortiori that $R'_E < X$ and $p_M(X - R_E) < (\pi_{HPH} + \pi_{MPM})(X - R'_E)$. Therefore, it must be the case that one of the two remaining inequalities of lemma 2 doesn't hold.

Different Levels of Cash-Flows:

In our benchmark model, there are only two possible outcomes. It is naturally possible to consider the case where more than two outcomes can arise. For example, assume that the final outcome can take three values, $X \in \{0, X_M, X_H\}$ and that at $t = 1$, the entrepreneur privately observes X . All the previous results go through. The difference is that it is now possible to give predictions in term of the relative growth of firms and not only survival. A relatively higher X_H makes the experimental equilibrium both more likely and more efficient relative to the conservative. Different payoffs also allow for more complex contracts than debt. Even with state-contingent contracts, multiple equilibria arise.

In the case of three cash-flows levels $(X_H, X_M, 0)$ proposed as a possible extension, the allocation of cash-flows across states of nature becomes an important issue. In what follows, we focus on the cash-flows differences of debt vs. equity (not control rights or monitoring

differences, as discussed above). If τ is the equity share of the investor in the project, the payoff of the investor are zero if the project gets abandoned, τV^M , τV^H , in the high value and intermediate value cases respectively. In a given equilibrium, the transfer to the investor is smaller in the intermediate value case when the project is financed by equity than when it is financed by debt. This is due to the fact that whatever the modality of financing, the investor gets the same in expected value and equity imposes that the transfer is higher in the best state than in the intermediate state. Mechanically, since debt financing pays the same in both states, it must be that debt finance pays more than equity finance in the intermediate case (for a given equilibrium and conditional on project's continuation). Consequently,

Result 20 *If entrepreneurial projects are financed by regular equity, the conservative equilibrium is more likely than it is under debt financing. Conversely, debt finance makes the experimental equilibrium more likely relative to equity finance.*

Chapter 2

Entrepreneurial Finance: Banks vs. Venture-Capital

“Value-added VCs are few and far between, especially in Europe. Most European VCs have learned their trade in management buy-outs. They aren’t nurturing and every board meeting is about justifying your existence. They are used to sitting across from you and seeing if you’re meeting your milestones. Real VCs are about helping you identify your milestones, and then opening up relationships, exploring business models, and being nurturing - that way they get you closer to meeting your milestones. Be very careful with people who are trying to reinvent themselves from private equity to venture capital.”

Sonia Lo, founder and CEO of eZoka.com (Financial Times, June 8, 2000).

2.1 Introduction

Venture capital has emerged as the most common form of financing for high-technology start-ups in the US and is frequently referred to as an important factor in the technological leadership of the US economy. This form of financing differs from standard bank finance in three major dimensions.¹ First, venture capitalists use their high level of expertise to perform technological

¹An extensive description of venture capital contracts can be found in Kaplan and Stromberg (2001)

monitoring and to actively manage the companies they finance. Second, the capital infusions in the firms financed by venture capital are staged in several rounds. Third, venture capitalists usually have extensive control rights (e.g., board rights, voting rights). This form of financing is in contrast with standard bank debt: banks traditionally perform accounting monitoring but no technological monitoring and, outside default, their control is limited to assets used as collateral.

In Europe, the venture capital industry remains small and focusses primarily on financing buyouts rather than on early and expansion-stage financing. Moreover, European venture capitalists are less “hands-on” (they rarely play an active role in the management of the companies they finance) and have less control rights than their American counterparts. Such differences in financing also exist within the US. Saxenian (1994) provides evidence that venture capitalists in Massachusetts are less involved in management and behave more like bankers than in Silicon Valley. In this paper, I investigate the source of these variations in financing forms. I formalize the idea that these variations are related to differences in the exit option of entrepreneurs, which affect their bargaining power.

Entrepreneurs and investors can hold up each other once the venture is under way: investors can deny further funding, and entrepreneurs can withdraw from the venture. The optimal form of financing balances the terms of bargaining. The entrepreneurs’ exit option determines which party needs protection.

If the exit option is bad, the entrepreneur needs to be protected from ex-post appropriation of rents by the investor. This goal is achieved by standard bank debt, as it involves little technological monitoring, limited control rights, and committed finance. Infusing a large amount of cash at the beginning solves two problems. First, the entrepreneur behaves efficiently, maximizing the value of the project, and second, the probability that refinancing is needed is small, relaxing the hold-up problem.

If the exit option is good, the investor needs to be protected. Venture capital financing meets this goal through technological monitoring, control rights, and staged financing. The investor acquires technological expertise, allowing him to perform technological monitoring, which increases the liquidation value of the firm if the entrepreneur withdraws. The optimal initial infusion of cash in this context is smaller, reflecting the trade-off between incentives and the ex-post hold-up. The entrepreneur cannot commit to high repayments. The level

of repayments can be decreased by lowering the first cash-infusion. The cost of this form of financing are twofold. First the lower initial infusion decreases the incentives of the entrepreneur to act efficiently. The second cost is the investor's technological expertise. Both costs lower the ex ante value of a given project.

Variations in the outside option of entrepreneurs have two sources. First, they are related to the legal environment. We show how changes in bankruptcy rules affect financial institutions and contracts. Second, and perhaps more interestingly, the outside option depends on the stigma associated with failure in entrepreneurial ventures. This "stigma of failure" is endogenized by formalizing the relationship between a project's risk and the "stigma of failure". The success of a given project depends on luck and ability. Ex ante entrepreneurs do not have information on their ability. The more "normal" it is for a good entrepreneur to fail, the lower the stigma of failure and therefore the stronger the bargaining position of the entrepreneur.

When entrepreneurs can choose between risky high growth projects and safer low-growth projects, two types of equilibria are possible and can coexist under certain conditions. The riskiness of the strategies of other entrepreneurs determines in equilibrium the extent of the stigma of failure and, therefore, affects the trade-off between growth and risk that a given entrepreneur faces. This interaction can lead to multiple equilibria and explain cross-country (e.g. Europe vs. US) or cross-regional differences (e.g. Route 128 vs. Silicon valley) that have been so far described as the result of exogenous differences in corporate culture.

In the *low risk equilibrium*, entrepreneurs choose safe strategies. If their ability is high, they are relatively unlikely to fail. Therefore, the pool of failed entrepreneurs is of relatively low quality, making the stigma of failure high. This reduces the need for expertise on the investor's side because the fear of being forced to default on the debt payment enforces the entrepreneur's discipline. As a consequence, the optimal form of financing looks more like bank debt. In turn, the high stigma of failure makes safe strategies ex ante the most attractive choice.

On the contrary, in the *high-risk equilibrium*, entrepreneurs choose aggressive growth strategies. This means that even entrepreneurs with high ability are likely to fail. Therefore, the pool of failed entrepreneurs is of high quality, leading to a low stigma of failure. This tilts the hold-up problem in a direction favorable to the entrepreneur. Therefore the optimal form of financing looks like venture capital, with high investor expertise and investment staging. The inefficiencies that arise due to the hold-up problem increase the cost of capital. In turn, due to

the low stigma of failure, the risky strategy is the most attractive.

Which equilibrium is the most efficient depends on the trade-off between growth and hold-up inefficiencies: if the value of high-risk projects is large enough, it offsets the costs generated by the technological monitoring, and therefore, the high-risk equilibrium is the most efficient one.

This paper is related to two strands of literature. The first is the career concern literature initiated by Holmstrom (1982, 1999) where managers are concerned by how their reputation will be affected their actions. Second, this paper is related to the large literature on the principal-agent problem in financial contracting. Grossman and Hart (1986) and Hart and Moore (1990) build a theory of incomplete contracting under renegotiation and study how the nature of the hold-up problem affects contracting. Aghion and Bolton (1992) show how the dissociation between control rights and cash-flow rights can decrease inefficiencies due to the *ex post* misalignment of objectives of entrepreneurs and investors. Rajan (1992) considers the trade-off between informed and non-informed finance in a set-up where inefficiencies arise due to the threat of termination of informed creditors. Specifically related to our topic, Gompers (1995) shows empirically that venture capitalists concentrate investment in early-stage and high technology companies where informational asymmetries are highest, and that financing rounds become more frequent when the intangibility of assets is higher. Several papers model the relationship between a venture capitalist and an investor, such as Berglof (1994) or Repullo and Suarez (2000). Hellmann (1998) has a model where control rights protect the investor from hold-up from the entrepreneur. These models do not link investment staging with hold-up and the misalignment between the two parties is due to private benefits (as opposed to endogenous career concerns in our model). The main contribution of my model is to offer a capital market equilibrium perspective to the problem of the conflict between creditors and entrepreneurs: The hold-up and moral-hazard problems to which an entrepreneur is subject depend both on financial institutions and on the choices of other entrepreneurs that prevail in equilibrium. Gromb and Scharfstein (2001) have a model of entrepreneurship where managerial incentives are determined by the career prospects in the event of a project's failure which in turn depends on the type of organization where the project failed (intrapreneurial vs. entrepreneurial). Managers who fail an internal venture can be redeployed by their firms into other jobs which has costs in terms of incentives whereas failed entrepreneurs must seek employment at other firms. Incentive

problems depend the organizational choice of firms and, like in my model, on the equilibrium of the labor market. While their focus is on whether projects are done inside or outside large firms, my model focusses on financing institutions and project choice for start-ups.

The paper proceeds as follows. Section 2 describes the benchmark model and solves for the equilibrium. Section 3 endogenizes the stigma of failure. Section 4 discusses the cross-sectorial implications of the model. Section 5 studies the conditions for multiple equilibria to arise and discusses their relative efficiency. Section 6 presents two case studies comparing the level and nature of venture-capital finance in Europe vs. the US and Silicon Valley vs. Route 128 respectively. Section 7 concludes. All mathematical proofs are in the appendix.

2.2 A Model of Start-up Financing

In this section I present a simple model of start-up finance. The model endogenizes the staging of investment as the solution to an optimal contracting problem. I characterize investors by their level of expertise. Bank finance corresponds to a non-expert investor and a unique infusion of funds. Venture capital corresponds to an expert investor and a positive probability for more than one round of cash infusion to occur.

2.2.1 Model

The model has four periods, $t = 0, 1, 2, 3$. All agents are risk-neutral. There is no discounting. The main trade-off that we capture is the one between the costs of technological monitoring and the time-inconsistent incentives of the entrepreneur to minimize costs and repay debt.

At $t = 0$, there is a continuum of mass one of wealthless entrepreneurs, each with a project generating a cash-flow V at $t = 3$. Each entrepreneur matches with a competitive investor with whom he enters a contract. The contract specifies a cash injection at $t = 0$, I_0 , a final repayment D to the investor, and a level of expertise of the investor $H > 0$. Expertise H has a unit cost γ . The role of the investor's expertise in our model is to affect the terms of bargaining.² A higher H increases the firm value to the investor if the entrepreneur leaves, $V(H)$ where $V(H)$ is increasing concave, $V'(0) = +\infty$ and $\lim_{H \rightarrow \infty} V(H) < V$. Concretely, H is the effective

²We could assume that H also affects the surplus (V), therefore providing another motive for investor's expertise. We want to isolate the impact of H on the hold-up problem.

control of the investor on the project: it represents both the ability of the investor to process technological information relevant for pursuing the project (technological expertise) and the possibility to have access to this information (control rights).

At $t = 1$, the entrepreneur and the investor observe whether the entrepreneur is competent to undertake the project. If he is not (this happens with probability p), the project is liquidated, at a value normalized to zero. If he is competent, the entrepreneur chooses privately a level of effort e , at private cost $e^2/4$.

At $t = 2$, the cost C of the project is revealed. C , which is observable to both the investor and the entrepreneur, but not contractible. C is a random variable, distributed uniformly on $[0, 2C(e)]$, where $C(e)$ is a decreasing, convex function of effort e . We also assume that $-1/C(e)$ is convex and that continuation is efficient for all levels of e . The investment C is spent on the project's execution (if $I_0 < C$, the investor makes the complementary injection $I_1 = C - I_0$), after which a payoff V is produced.

At $t = 3$, the entrepreneur's career goes on. The expectations of the labor market only depend on whether he was successful or not on his first venture. He receives a wage equal to his expected productivity: w_f if he failed and w_s if he succeeded, with $w_s > w_f$. (The next section endogenizes w_f and w_s). We note $\Delta = w_s - w_f$, the stigma of failure.

2.2.2 First-Best

The first-best levels of effort e and expertise H are determined by the maximization of the surplus:

$$\max_{e,H} (1-p)[V - C(e) - e^2/2] - \gamma H$$

Therefore, the first-best levels are:

$$\begin{cases} H^* & = & 0 \\ e^* & = & -C'(e^*) \end{cases}$$

The optimal level of expertise is zero, reflecting the fact that H is costly and does not increase the surplus in the absence of market inefficiencies. The wages w_s and w_f have no impact on the first-best values of effort and expertise. This won't be the case any more in the presence of contracting inefficiencies.

2.2.3 Hold-up

We now depart from the first-best world by introducing a contract incompleteness: we assume that each party can hold-up the other at $t = 2$. The investor can force renegotiation when more cash needs to be infused at $t = 2$, and the entrepreneur can always force renegotiation by threatening to quit the project. We assume symmetric Nash-bargaining.

If the investor does not inject the cash required for the project at $t = 2$, the project stops and the entrepreneur gets w_f , namely the wage of a failed entrepreneur³. The value functions of the entrepreneur (E), and of the investor (I), when renegotiation occurs are:

$$\begin{cases} E &= w_f + \frac{1}{2}(V + w_s - V(H) - w_f) \\ I &= V(H) + \frac{1}{2}(V + w_s - V(H) - w_f) \end{cases}$$

Remark that $E + I = V + w_s$, which is the surplus from continuation and that the terms of bargaining do not depend on how much cash has to be reinjected. In what follows, we call $\Delta = w_s - w_f$, the “stigma of failure”. We can rewrite the outcome of the bargaining as follows:

$$\begin{cases} E &= w_s + \frac{1}{2}(V - V(H) - \Delta) \\ I &= V(H) + \frac{1}{2}(V - V(H) + \Delta) \end{cases}$$

This shows that, *ceteris paribus*, an increase of the stigma of failure (Δ), improves the bargaining position of the investor. When Δ is large, the main problem tends to be investor’s ability to appropriate rents *ex post* if he has the power to do so. Conversely, for a small Δ , the main problem tends to be the entrepreneur’s threat to leave the firm.

There is an asymmetry between these two commitment problems. The threat of rent appropriation by the investor can be remedied by injecting more cash (or equivalently offering a deeper line of credit) at the beginning, which reduces the states of the world where the entrepreneur has to ask for further funding. Absent default, the investor does not have control and can not threaten the entrepreneur. Such a solution, however, does not exist for the entrepreneur’s commitment problem.

³To be precise, we assume that the market only observes if the project has been successfully completed or not, i.e. if V has been produced. The market has no information on the reasons why V “did not happen”.

2.2.4 The Optimal Contract

We look for the optimal contract. In addition to the hold-up assumption, we assume that entrepreneurs cannot credibly pledge the future incomes that they will get at $t = 3$ from the labor-market. We also assume perfect accounting monitoring: the entrepreneur cannot divert cash injected by the investor outside the firm until the completion of the project. This implies that when the entrepreneur is incompetent, the investor gets all his investment I_0 back because the entrepreneur does not have any bargaining power⁴: he cannot steal money and if he leaves, the investor gets everything back. Last, we assume that continuation is always efficient at $t = 2$. Therefore it is not possible for the investor to commit to terminate the project.

Each time an additional injection of cash is needed, i.e. $I_0 > C$, the sharing of the payoff is determined by the Nash-bargaining solution. The reason is that for any other sharing rule, one of the two parties would find it attractive to renegotiate. It follows that the only case where the sharing rule can be different from the bargaining solution is the case where the first injection of cash can cover the costs ($I_0 > C$) and the entrepreneur prefers to repay his debt rather than renegotiate ($w_s + V + I_0 - C - D > E$). In this case, the investor would like to renegotiate but cannot force renegotiation, since the survival of the firm does not rely on him injecting more cash.

When E is low enough, it is possible to implement the first-best by a simple debt contract: the investor does not invest in expertise, ($H = 0$), an injection of $I_0 = 2C(e^*)$ is made at the beginning. As long as the repayment level D^* required for the investor to break even is such that

$$w_s + V - D^* > E, \tag{2.1}$$

the entrepreneur prefers to repay his debt for any value of $C < 2C(e^*)$. For this reason, the fear of having to ask for more money plays the role of a discipline device which induces the first-best level of effort. Assuming, that the entrepreneur always repay his debt, the break-even condition writes simply: $D^* = 2C(e^*)$. In turn, equation 1 rewrites :

⁴We could alternatively assume that the entrepreneur can threaten to burn the cash inside the firm and can therefore extract $\Delta/2$. This would however lead to a mechanical relation between the risk of the project and inefficiency.

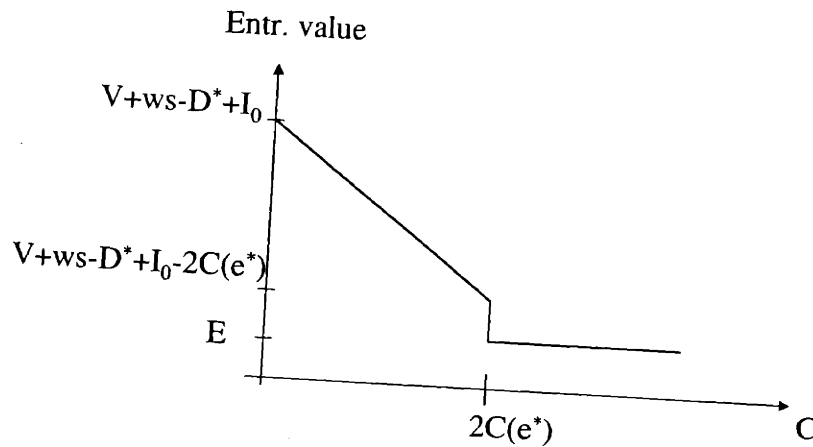
$$w_s - w_f > 4C(e^*) - V \quad (2.2)$$

Remark that for any $\epsilon \geq 0$, all contracts of the form $I_0 = C(e^*) + \epsilon$, $D = D^* + \epsilon$ have the same properties. In term of payoffs and of incentives, only the difference $I_0 - D$ matters. In what follows, when several contracts are optimal, we pick the one than minimizes I_0 and D , a convention that makes comparisons possible⁵.

In brief, when the stigma of failure is high enough, the first-best is implemented. The investor does not invest in technological expertise and the fear of failure is sufficient for the entrepreneur to commit to repay his debt and perform optimal effort. This type of lending has the essential characteristics of bank finance.

Proposition 21 *There exists a threshold value $\Delta^* = 4C(e^*) - V$ such that for $w_s - w_f > \Delta^*$:*

- *Investor does not have technological expertise: $H = 0$.*
- *The optimal contract consists of an initial injection of cash $I_0 = 2C(e^*)$.*
- *There is no renegotiation.*
- *First best effort, e^* , is implemented.*
- *There is no need for a second-stage injection. of cash.*



⁵Such a contract would be the optimal contract for an arbitrary small opportunity cost of injecting money at $t = 0$ rather than $t = 2$.

Consider now what happens when the stigma of failure becomes small, i.e. $w_s - w_f$ just below Δ^* . Implementing the first-best becomes impossible because the condition that the entrepreneur does not find it attractive to renegotiate for $C < 2C(e^*)$ is now incompatible with the break-even condition. There are two tools that can be used ex ante to solve the commitment problem of the entrepreneur. First, the investor can decrease I_0 , which has only a second-order impact on the surplus (through a first-order decrease in effort) but relaxes the budget constraint to the first-order. He can also acquire technological expertise ex ante. Since $V'(0) = +\infty$, both tools are used at the optimum contract. We let the formal proof for the appendix and try to go further with an intuitive derivation of the optimal contract. Decreasing I_0 decreases incentives to perform effort and leads to a level of effort $e < e^*$, since the excess of cash that the entrepreneur can try to keep is smaller. The positive relationship between effort and I_0 (which constitutes the incentive compatibility constraint) is:⁶

$$I_0 = 2\sqrt{-\frac{C(e)^2}{C'(e)}}e.$$

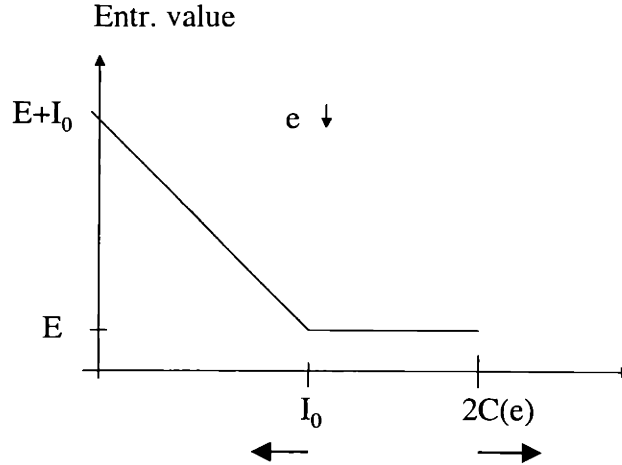
Therefore, a larger I_0 also means a larger average cost, $C(e) > C(e^*)$. Since $I_0 < 2C(e^*)$, this implies that with a positive probability $(1 - I_0/2C(e))$, the entrepreneur does not have sufficient cash from the first injection to pursue the project and has to negotiate for a second cash-injection. When this occurs, the sharing rule is determined by the terms of bargaining. Now, when the realization of C is smaller than I_0 , as I show in appendix, at the optimal contract, the entrepreneur repays his debt⁷.

Proposition 22 *For $w_s - w_f < \Delta^*$, optimal contracting results in:*

- *A positive level of technological expertise H ,*
- *A first injection $I_0 < C(e^*)$. Effort is second-best, $e^{**} < e^*$.*
- *There is a positive probability that a second injection I_1 occurs.*
- *The cost of capital for a given project is higher than when $w_s - w_f < \Delta^*$, reflecting undereffort and the cost of expertise.*

⁶Remark that e^* is solution of this equation for $I_0 = 2C(e^*)$.

⁷The repayment D is equal to what would occur in case of renegotiation (but the investor does not have to make a complementary cash injection).



As the stigma of failure, $w_s - w_f$, decreases, effort decreases and expertise H increases. The probability that a second cash injection is needed is now $1 - \frac{I_0}{C(e^{**})}$ which increases. The level of the first cash injection decreases and the average level of the second one, $\frac{C(e^{**}) - C^*}{2}$ increases. The total expected level of cash needed to finance the venture, $\gamma H + C(e^{**})$, increases, due to the inefficient underprovision of effort. The loss in efficiency due to the hold-up friction is $L = \gamma H + (1 - p)(C(e^{**}) - C(e^*))$.

Proposition 23 *In the second-best region ($\Delta < \Delta^*$), as the stigma of failure $\Delta = w_s - w_f$ decreases:*

- *The level of technological expertise of investor increases.*
- *Effort decreases : The lower the stigma of failure, the more stringent the incentive constraint is.*
- *The probability that a second-stage investment occurs increases as the level of effort decreases. This probability is: $1 - (-e^{**}/C'(e^{**}))^{1/2}$.*
- *The initial cash injection decreases, the average second cash-injection increases, the total amount of cash needed increases.*
- *The loss in efficiency with regard to the first best is decreasing with Δ and increasing with the cost of technological expertise H .*

This benchmark model captures the main intuition of the paper:

As long as the stigma of failure ($w_s - w_f$) is “high enough” simple debt contracts are the optimal mode of financing. The investor does not need to acquire technological expertise: the fear to be forced to raise new funding operates as a discipline device and forces entrepreneurs to choose the first-best effort. In turn, the investor has no power to exercise a threat on the entrepreneur as long as he repays his debt. This kind of financing has the characteristics of bank debt.

Conversely, when the stigma of failure is low, the entrepreneur cannot commit not to trigger renegotiation. This leads to a loss in efficiency that is partly solved by having the investor acquire technological expertise. This expertise, by alleviating the hold-up threat of the entrepreneur, rebalances the terms of bargaining. This improvement in the efficiency of the terms of bargaining represents the “value-enhancement” of venture-capital as a style of financing in our model. It however has costs, simply those of high-skilled technological expertise. The model shows that an endogenous staging of capital injection in two rounds occurs.

Proposition 24 *A testable prediction of the model is the following:*

Ceteris paribus, the higher the stigma of failure, the higher the ratio of second-stage infusion over first-stage infusion.

2.3 Value Enhancing Investors

In our model, the value enhancement of investor’s expertise lies exclusively in the resolution of a hold-up problem. As a consequence, whenever bank debt is possible, it is also first-best efficient. This feature is not essential to the model. For example, when the technological knowledge of the investor adds value to the project (e.g., if the payoff is an increasing function of H , $V(H)$) it might be first-best to have a positive level of H and a large stigma of failure would lead to a level of technological monitoring lower than H . In this case, the relationship between efficiency and stigma might be non-monotonic. Venture capitalists are known to add value to the ventures they finance, e.g. by helping to hire appropriate managements, or using their network to help the entrepreneur to obtaining contracts.

2.4 The Stigma of Failure

The framework we have developed allows us to clarify the link between the stigma of failure and the nature of financial institutions and contracts. The determinants of the stigma can be both exogenous (institutions) or endogenous (informational).

2.4.1 Exogenous Stigma

Assume that bankruptcy rules or liquidation rules are the determinants of the stigma: $w_s = w$, $w_f = w - \Delta$. We assume that Δ is pure waste for society (think to Δ as the time it takes for the entrepreneur to be discharged and able to go on with his career). We can use our model to describe how Δ affects financial contracts and what level of Δ is efficient. There is a trade-off between the disciplining effect of Δ and its cost for society. A higher Δ alleviates the commitment problem of the entrepreneur but diminishes the expected surplus by $p\Delta$.

Proposition 25 • *There exists a threshold $p^* < 1$ such that for $p < p^*$, the optimal bankruptcy cost Δ is positive and decreases with p .*

- *Investor's expertise and the probability of second-stage financing decrease weakly with Δ (strictly decrease for $p < p^*$).*

The first point shows that bankruptcy rules are an effective way to give bargaining-power to the investor and that the riskier the sector, the more distortionary it is. The second point shows that softer bankruptcy rules ask for an investor with higher technological monitoring. Even though bankruptcy rules vary across countries, they are not the only component of the stigma of failure. As it is shown in the last section, a crucial component of the stigma of failure is the endogenous competent resulting from the market's inference about the ability of a failed entrepreneur.

2.4.2 Endogenous Stigma

We now extend our model so as to endogenize the stigma of failure, $w_s - w_f$ in a simple career-concern set-up.⁸

⁸This formalization is related to Landier (2001).

Assume that there are two types of entrepreneurs: Good types (G) –in proportion θ – and bad types (B). Initially, the types are unknown to everyone, including the entrepreneurs. The type of an entrepreneur matters for two distinct reasons: it affects the probability of being competent on the entrepreneurial project and the entrepreneur’s productivity on the labor-market. High (low) types have a probability p_G ($p_B = 1$) to be incompetent to finish their project and therefore, the ex ante probability for an entrepreneur to fail on a project is $p = \theta p_G + (1 - \theta)$. The wage w will reflect inference conditional on the history of the entrepreneur (competent or not). Bad types have a productivity normalized to zero on the labor market, while high types have productivity y .

Inference on productivity:

Since there is a proportion θ of good types in the population, the probability that a “fired” entrepreneur is of high type is:

$$\pi_f = \frac{\theta p_G}{\theta p_G + (1 - \theta)}.$$

Since bad entrepreneurs never succeed, the probability that a “successful” entrepreneur is of the good type is one: $\pi_s = 1$.

The wage on the labor-market is competitive and therefore equal to the expected of the entrepreneur conditional on the available information. The wage is therefore $w_s = \pi_s y$ if the entrepreneur has been replaced and $w_f = (1 - \pi_f)y$ if he has successfully completed his project.

The stigma of failure is:

Proposition 26 *The “stigma of failure” is a decreasing function of p_G and therefore of p :*

$$w_s - w_f = \frac{1 - \theta}{\theta p_G + (1 - \theta)} = \frac{1 - \theta}{p}.$$

We use this career concern structure in two contexts: first we want to study how sectorial characteristics impact the “style of financing”. Second, we show how complementarities between the strategies chosen by entrepreneurs might lead to multiple equilibria and therefore to differences in lending styles in a given sector of similar economies.

2.5 Start-up Finance and Sector Characteristics

In this section, we do comparative statics with regard to p_G the probability that a good entrepreneur fails. When p_G goes through $[0, 1]$, the ex ante risk of failure $p = \theta p_G + (1 - \theta)$ goes through $[1 - \theta, 1]$. p can be seen as an index of sectors, a higher p meaning a riskier sector. The payoff in case of success in sector p is $V(p)$ and the cost function is $C(p, e)$. As before, there are good and bad entrepreneurs. Bad entrepreneurs always fail and good entrepreneurs fail with probability $p_G(p) = 1 - \frac{1-p}{\theta}$, which is increasing with sector-risk p . We assume that entrepreneurs are randomly affected across sectors, justifying the fact that θ is constant across sectors.

Assumption 27 *Riskier sectors have higher payoffs in case of success:*

If $p < p'$, $V_p < V_{p'}$ and $V_p(H) < V_{p'}(H)$ for all $H > 0$.

Failing in a low-risk sector is more informative than failing in a high-risk sector: to fail in a low-risk sector, “you really have to be bad”. As a consequence, the “stigma of failure” decreases with the sector index p :

Lemma 28

- *A failed entrepreneur is more likely to be of high type in a riskier sector.*
- *The stigma of failure, $\Delta(p) = w_s^p - w_f^p = (\frac{1-\theta}{p})y$, decreases with the index p .*

Now, we want to compare the ways of financing (contracts and institutions) in these sectors. To do so, we need a normalization assumption. Specifically, we make the following homogeneity assumption:

Assumption 29 • *$(1 - p)C(p, e)$ and $(1 - p)V(p)$ are independent on p and the private cost for project p is $\frac{e^2}{2(1-p)}$.*

- *$\Delta^*(1 - \theta) = 4C(1 - \theta, e^*) - V(1 - \theta)$ is positive.*

Under these assumptions, the level of first-best effort does not depend on p and $\Delta^*(p) = \frac{\Delta^*(0)}{1-p}$ increases with p .

Therefore, $\Delta(p) - \Delta^*(p)$ decreases with p , implying that the incentive constraint becomes more stringent. As a consequence, assuming that sectors are financed with the optimal institution, the following is true when we move towards more risky sectors (higher p):

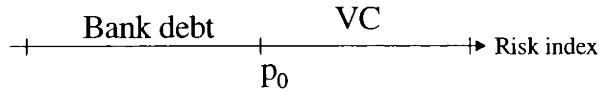
Proposition 30 *When p increases:*

- *The level of technological expertise H_p^* is higher and the level of effort diminishes (weakly).*
- *The cost of capital increases, due to the higher level of expertise required from the investor.*
- *The level of the first cash injection decreases and the probability of a second cash injection to occur increases. The expected level of this second cash injection increases as well, while the first cash injection decreases.*

Moreover, if we assume that $y > \Delta^*(1 - \theta)$, the less risky project ($p = 0$) can be financed by “bank debt” (i.e. with $H = 0$) while the most risky is in the second-best region, where renegotiation occurs with positive probability, we have:

Proposition 31 *There exists a cut-off sector p_0 such that:*

- *If $p < p_0$, sector p is financed by an investor without expertise ($H_p^* = 0$) and a simple debt contract. In other words, traditional bank lending prevail in these sectors.*
- *If $p > p_0$, sector p is financed by an investor with expertise $H_p^* > 0$, increasing in p . This type of financing has the characteristics of venture capital (e.g. staging in two rounds).*



2.6 Growth Strategies and Multiple Equilibria.

So far our model explains why different sorts of institutions and financial contracts might emerge to finance entrepreneurship in different sectors. It does not however explain why venture capital would succeed in certain economies but fail to become an important source of start-up

funding in otherwise similar economies.⁹ The explanation we propose is based on multiple equilibria: Assume that entrepreneurs within a given sector can choose different development strategies. They can choose aggressive business plans leading to “big hits” but likely to fail or they can choose more secure growth strategies, leading to smaller but more certain payoffs. Two equilibria can exist.

- In a “high-risk” equilibrium, entrepreneurs choose “high-risk” strategies for their project (meaning the probability for the entrepreneur to be incompetent is high). Therefore the stigma of failure is low which ensures that low-risk strategies do not look attractive.
- Conversely, in a “low-risk” equilibrium, the fact that all entrepreneurs choose low-risk strategies makes the stigma of failure high. Therefore, “high-risk” strategies are unattractive.

We now formalize this idea. The set-up is as in section one, except for the fact that the entrepreneur now chooses irreversibly at time zero among two possible strategies (or business plans) for the project: a risky one (p_2, V_2) and a low-risk one (p_1, V_1) . This choice is observable by the investor but cannot be credibly signaled to the labor market once the entrepreneur has failed.

There are two potential pure strategy equilibria in our model: one where entrepreneurs all choose the low-risk strategy and one where they all choose the high-risk strategy.

We note $\Delta_1^* = 4C_1(e_1^*) - V_1$, $\Delta_2^* = 4C_2(e_2^*) - V_2$. The stigma of failure Δ is determined in each potential equilibrium by $\Delta_i = \frac{1-\theta}{p_i}$, therefore $\Delta_1 > \Delta_2$: the stigma of failure is higher in a low-risk than in a high-risk equilibrium..

For both types of projects, we note $B_i = (1-p_i)(V_i - C_i(e_i^*) - e_i^{*2}/2)$, the expected first-best value generated by project i .

We note $L_i(\Delta) = (1-p_i)(C_i(e_i(\Delta)) - C_i(e_i^*) + (e_i(\Delta)^2 - e_i^{*2})/2) + \gamma H_i(\Delta)$ the efficiency loss in equilibrium i . L_i is a decreasing function of Δ .

The condition for project i to be preferred to project j in equilibrium (i) is that:

$$-p_i\Delta_i + (B_i - L_i(\Delta_i)) > -p_j\Delta_i + (B_j - L_j(\Delta_i))$$

⁹More exactly, the only explanation it gives is that when the cost of technological expertise, γ , is too high, the commitment problem cannot be resolved.

Proposition 32

- *The low-risk equilibrium exists if*

$$\Delta_1 > \frac{B_2 - B_1}{p_2 - p_1} + \frac{L_1(\Delta_1) - L_2(\Delta_1)}{p_2 - p_1}.$$

- *The high-risk equilibrium (“high-risk”) exists if*

$$\Delta_2 < \frac{B_2 - B_1}{p_2 - p_1} + \frac{L_1(\Delta_2) - L_2(\Delta_2)}{p_2 - p_1}.$$

- *Therefore, the condition for the two equilibria to coexist is that:*

$$\Delta_2 + \frac{L_2(\Delta_2) - L_1(\Delta_2)}{p_2 - p_1} < \frac{B_2 - B_1}{p_2 - p_1} < \Delta_1 + \frac{L_2(\Delta_1) - L_1(\Delta_1)}{p_2 - p_1}$$

To perform welfare analysis, since the investor makes zero profit, we have to compare the ex ante value of a project in each equilibrium, i.e.

$$W_i = B_i - L_i(\Delta_i)$$

The last expression rewrites:

$$\Delta_2 + \frac{L_1(\Delta_1) - L_1(\Delta_2)}{p_2 - p_1} < \frac{W_2 - W_1}{p_2 - p_1} < \Delta_1 + \frac{L_2(\Delta_1) - L_2(\Delta_2)}{p_2 - p_1}$$

Using this criterion, we can discuss the coexistence and the relative efficiency of the equilibria:

Proposition 33 • *The high-risk and low-risk equilibria can coexist.*

- *Depending on parameters, each equilibrium can be more efficient than the other.*
- *The high-risk equilibrium is the most efficient if the difference in the value of the projects exceeds the higher costs of financing, i.e.,*

$$B_2 - B_1 > L_2(\Delta_2) - L_1(\Delta_1),$$

To summarize, we compare the two regimes of entrepreneurship in the case where the difference in stigmas in the two equilibria is large enough such that $\Delta_1 < \Delta_1^*$ and $\Delta_2 > \Delta_2^*$ (a condition under which the coexistence result still holds).

Proposition 34 *Compared to the low-risk equilibrium, the high-risk equilibrium is characterized by:*

- *investors with more technological expertise.*
- *a higher probability of second-stage financing, with this probability being zero in the low-risk equilibrium.*
- *a higher probability for the entrepreneur to fail.*
- *a lower stigma of failure ($w_s - w_f$).*
- *a higher cost of capital.*

Proposition 35

- *An increase in V_2 increases the efficiency and the likelihood of the high-risk equilibrium.*
- *An increase in the cost of technological expertise reduces the efficiency and the likelihood of the high-risk equilibrium.*

The first point illustrates that when there are large returns to risky strategies, the high-risk equilibrium tends to be both more likely and more efficient. This is likely to be the case in high-tech sectors. The picture that emerges from this proposition is broadly the one of Europe vs. the US:

- In Europe, young firms tend to have strategies that are not very aggressive. This leads to few “firings” of entrepreneurs and a high-stigma of failure (you have to be a bad manager to fail a conservative strategy), which in turn makes aggressive strategies too risky to be attractive. Financing does not require financial expertise of the investor: the stigma of failure plays the role of a discipline device, making simple debt contracts possible.

- On the contrary, in the US entrepreneurs choose risky, more aggressive strategies, that make them more likely to be unsuccessful. For this reason, the stigma of failure is low (having failed does not reveal much about your ability). This in turn creates a hold-up problem, leading to:
 - Acquisition of expertise from the investor to rebalance the terms of bargaining.
 - Staging of the investment in two rounds.
 - A higher cost of project’s financing, reflecting the cost of investor’s skills and the moral hazard problem (undereffort).

A quotation of Eric Benhamou, a french entrepreneur who emigrated to Silicon Valley and is currently the CEO of 3Com summarizes this link between strategy choice and the stigma of failure:

“As a student at Stanford, I realized how naive I had been to believe I could start a business in France.[...]in France, you keep all your life the stigma of a failure. Here [in Silicon Valley] it is the mark of your entrepreneurial spirit. In France, it is common practice to give up on growth in order to limit risk. Here, when you start a venture, your goal is to become number one of your sector”.

2.7 New Ventures: Europe vs. the US.

2.7.1 Financing

Venture Capital has played a prominent role in the technological leadership of the US¹⁰. More than 70% of firms in the personal computer industries have been venture-capital backed. Giant companies such as Cisco, Cray, Genentech, Lotus, Apple and Microsoft got started with venture capital.

In 1999, the US venture capital industry raises more than three times more capital than the rest of the world taken together. The development of Venture Capital funds in Europe

¹⁰Venture capital rivals in-house R&D as a major source of funding for innovation: as reported by M.Mandel, based on a report of the NVCA, “in the first quarter of 2000, Venture Capital equaled one-third of all money spent on R&D compared to 3% in the 80s”.

has grown recently. However, it is difficult to draw a line between private equity and venture capital. If we aggregate the two, we find that about \$99.4 billion of private equity and VC was invested in North America (\$97.1 raised) in 1999, which amounts to 1.01% of GDP, whereas only \$26.8 billion was invested in Europe (\$27.1 bil. raised), i.e. 0.3% of the European GDP. While European countries have an increasing amount of venture capital under management, most of it is dedicated to buyouts of mature companies rather than seed or start-up financing. About 13% of financing went to seed and start-up in Europe against more than 30% in the US. Restricting oneself to the high tech industry makes this opposition even more striking: 26% in Europe against 80% in the US.

Characteristics of venture-capital contracts in the US include staging of investment and a high level of control rights. The replacement of the founder of the company by a manager who is more able to accomplish the project occurs with high probability. Moreover, venture capitalists spend a large amount of time learning about the technological aspects of the project of the firm both pre and post first-state financing. In our model, this intensity of technological monitoring –requiring a high level of expertise on the investor’s side– and the staging of cash infusions are endogenous features of venture-capital as a lending technology.

European venture capitalists are traditionally less “hands on” and less strategically involved than their American counterparts. In the context of our model, this means that they perform less technological monitoring. Sapienza, Manigart and Vermeir (1996) provide empirical evidence that French venture capitalists spend much less effort than their American counterparts in monitoring the firms they finance. They describe French venture capitalists as closer to bank managers than value-added investors.

Historically, early-stage venture-capital funds in Europe have produced relatively low rates of return (as compared to buyout funds, for example). Investment appears to be less high-tech in Europe. For example, in Europe, less than 20% of all venture capital investment was in high tech in 1998 compared with more than 60% for the US. Compared to the US, European venture capital devotes a much larger percentage of venture financing goes to manufacturing rather than High-tech.

2.7.2 The Stigma of Failure: Some Empirical Evidence

To quantify the “stigma of failure”, I use wage information in labor market data. Two studies based on US data, Evans and Leighton (1989) and Hamilton (2000), establish that American entrepreneurs returning to employment earn slightly higher wages than other workers with similar characteristics.¹¹

To my knowledge, no such study exists for France. I run my own regressions, using *Enquête-Emploi*, an annual survey of 1/300 of the French population. I find that French entrepreneurs returning to paid employment earn significantly lower wages than other workers. To control for transitions between self-employment and employment, I construct a sequence of two-year panel data. Given year t and $t + 1$, I know the employment status of each individual for both years: employed, self-employed, unemployed or out of the labor force. I also know the wage w_t of employees, but not the income of the self-employed. Given this restriction, I run the following regression¹² in order to “estimate” the stigma of failure is:

$$\ln(w_{t+1}) = X'_{t+1}\beta + \alpha SE_t + \epsilon,$$

where X_{t+1} is the vector of observable characteristics of employed individuals in year $t + 1$, and SE_t , a dummy variable equal to 1 if the individual is self-employed in year t . The coefficient α estimates the percentage wage premium for individuals who made the transition from self-employment in year t to employment in year $t + 1$. I run this regression from 1990 to 2000. I find that in contrast to what prevails in the US, self-employed who become employees earn significantly less than other employees. The wage discount is -13% on average over the period.

This wage discount can reflect that leaving self-employment is a bad signal to the labor-market. Alternatively, however, it could reflect a selection effect, i.e., self-employed are of a relatively low type with regard to the rest of the population, in a way that the market but not

¹¹Evans and Leighton (1989), relies on the National Longitudinal Survey of Young Men (1966-1981) and finds that “workers who fail at self-employment return to wage work at roughly the same wages they would have received had they not tried self-employment”. Each additional year of self-employment experience increases the mean wages of males aged 29-39 by 4.5%, as compared with an increase of 3.1% for an extra year of wage experience. Hamilton (2000) uses the Survey of Income and Program Participation (1984) and finds that “entrepreneurs returning to paid employment actually earn a higher wage than employees with the same observed characteristics”.

¹²on the set of individuals employed in year t .

the econometrician observes. To control for this effect, I run the following regression on all paid employees of period t :

$$\ln(w_t) = X_t'\beta + \delta SE_{t+1} + \epsilon,$$

where SE_{t+1} is a dummy variable equal to 1 if the individual has become self-employed at time $t + 1$. The coefficient δ estimates whether workers who make the transition from paid employment to self-employment have relatively low wages vis-a-vis the rest of the population¹³. It turns out that it is not the case: δ is only -0.017 on average over the period and insignificant for most years. This confirms that the discount α is not due to selection and thus can be interpreted as a proxy for the stigma of failure. This estimation allows us to conclude that the wage discount α captures mostly the “stigma of failure”.

In summary, the picture that emerges from these empirical results confirms that the French and US labor markets react differently to the termination of entrepreneurial activity. In contrast with the US labor market, the French labor market penalizes heavily those who quit self-employment for employment.

2.7.3 Route 128 vs. Silicon Valley

Saxenian (1994) describes how Silicon Valley and Route 128 –two regions that had similar innovative advantages in the early 1980’s– evolved differently. Route 128 lost its competitive edge, generating three times less jobs in the high tech industry between 1975 and 1990 than Silicon Valley. Saxenian shows how this divergence is related to different social norms concerning job mobility and failure. While Route 128 has a conservative culture, valuing safer projects and careers, Silicon Valley has created an environment that encourages risk and accepts failure. “There is little embarrassment or shame associated with business failure. In fact, the list of individuals who failed, even repeatedly, only to succeed later was well-known in the region.” The different performance of the two regions is reflected in the levels of venture capital investment. For example, in 1981, 38% of the US venture capital went to California, but only 12% to Massachusetts based companies. Interestingly, the nature of venture-capital itself has been different in the two regions. Saxenian gives the following quote from a top executive of DEC who became a consultant in Silicon Valley: “There is no real venture capital in Massachusetts.

¹³before making the transition and controlling by observable characteristics.

The venture capital community is a bunch of very conservative bankers. They are radically different from the venture capitalists in Silicon Valley.” This picture matches the multiple equilibria characteristic of the model.

2.8 Conclusion

This paper presents a model of entrepreneurial finance, where the outside option of entrepreneurs in case of failure determines the staging of investment in different rounds and the choice of a monitoring technology. I show how, in turn, the outside option depends on the industry parameters, on the legal environment and on the coordination of agents. I describe how these different styles of financing relate to bank debt vs. venture capital. If agents can choose between aggressive or safe growth strategies, I show that two equilibria can arise with different efficiency consequences. In a low-risk equilibrium, entrepreneurs choose safe projects, failure is highly stigmatized and, therefore, the optimal style of financing is bank debt. In a high-risk equilibrium, entrepreneurs choose riskier projects. In this equilibrium, failure is not stigmatized and the optimal form of financing requires intense technological monitoring and investment staging, features which are characteristic of venture capital. The theory explains why similar economies might be in different entrepreneurial regimes, characterized by different growth strategies and different financial institutions.

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2.9 Appendix

Proof of prop. 1:

Take H as given.

Effort is chosen such as to maximize :

$$\max_e \int_0^{2C(e)} \max(V + I_0 - D + w_s - C, E) \frac{dC}{2C(e)} - e^2/2.$$

Remark that only $I_0 - D$ is relevant for incentives. When several contracts are optimal, we select the one that minimizes I_0 . This contract would be dominant for an arbitrarily small opportunity cost of injecting money at the beginning.

Let C^* be such that $V + I_0 - D + w_s - C^* = E$.

- First assume that the optimization problem leads to a level of effort e^{**} such that $C^* > C(e^{**})$. That means that the entrepreneur will never find it attractive to trigger renegotiation, and therefore, his maximization problem rewrites:

$$\max_e (V + I_0 - D + w_s) - C(e) - e^2/2$$

which is the first-best program. Therefore, $e^{**} = e^*$. The contract that minimizes the level of D is an initial injection $I_0 = 2C(e^*)$ and a level of debt D^* determined by the break-even condition of the investor:

$$(1 - p)D^* = 2(1 - p)C(e^*) + \gamma H$$

It follows that, as long as $D^* = 2C(e^*) + \frac{\gamma H}{1-p}$ verifies :

$$V - D^* + w_s > E = w_f + \frac{1}{2}(V + w_s - V(H) - w_f).$$

i.e.

$$(w_s - w_f) > 4C(e^*) + 2\frac{\gamma H}{1-p} - (V + V(H)) = \Delta^*,$$

then an initial injection $I_0 = 2C(e^*)$ leads to the implementation of the first best effort e^* . Remark that in this region, higher bargaining power of the investor does not lead to ineffi-

cient outcomes, since as long as he repays his debt, the investor cannot hold-up the entrepreneur. In this region, the optimal level of H is zero, which is also the first-best level. Therefore, the threshold is:

$$\Delta^* = 4C(e^*) - V.$$

- Consider $(w_s - w_f)$ just below Δ^* ? The level of effort e^{**} is now such that $C^* < C(e^{**})$, so that the optimization problem rewrites:

$$\max_e \left(\frac{C^*}{2C(e)} \right) (E + C^*) + \left(1 - \frac{C^*}{2C(e)} \right) E - e^2/2$$

$$\max_e \left(\frac{C^{*2}}{C(e)} \right) - e^2 = U(e)$$

U is concave and $U'(e) = - \left(\frac{C^*}{C(e)} \right)^2 C'(e) - 2e$

The first order condition writes:

$$f(e^{**}) = -2 \frac{C(e^{**})^2}{C'(e^{**})} e^{**} = C^{*2}$$

The function f increases with e^{**} (from the assumption that $1/C(e)$ is concave). Therefore, e^{**} decreases with C^* .

Remark that for $C^* = C(e^*)$, the solution is $e^{**} = e^*$ since $e^* = -C'(e^*)$. Since we look for the contract that minimizes I_0 , at the margin, the entrepreneur is just able to cover his costs, namely $I_0 = C^*$.

The second-best choice of effort and technological expertise is determined by the maximization of the ex-ante surplus,

$$\max_{e,H} -C(e) - e^2/2 - \gamma H$$

under the following constraints:

1. Threshold condition 1:

$$V - D + w_s = E.$$

2. Threshold condition 2:

$$I_0 = C^*$$

3. Break-even condition:

$$\frac{C^*}{2C(e)}(D - I) + I \geq C^* + \left(1 - \frac{C^*}{2C(e)}\right)\left(\frac{2C(e) - C^*}{2}\right) + \frac{\gamma H}{1-p}.$$

Remark that $D - I = 0^{14}$, so this rewrites:

$$V + w_s - E \geq C^* + \left(1 - \frac{C^*}{2C(e)}\right)\left(\frac{2C(e) - C^*}{2}\right) + \frac{\gamma H}{1-p}.$$

i.e.,

$$C^* + \left(1 - \frac{C^*}{2C(e)}\right)\left(\frac{2C(e) - C^*}{2}\right) + \frac{\gamma H}{1-p} \leq \frac{\Delta + V + V(H)}{2}.$$

i.e.,

$$C^* + \left(1 - \frac{C^*}{C(e)}\right)\left(\frac{C(e) - C^*}{2}\right) + \frac{\gamma H}{1-p} + 2C(e^*) \leq \frac{\Delta - \Delta^* + V(H)}{2}.$$

4. Incentive constraint:

$$-2\frac{C(e)^2}{C'(e)}e = C^{*2}$$

Since by assumption, even for $e = 0$, continuation is efficient, and since $[\frac{\partial}{\partial e}(e^2/2)](e = 0) = 0$, there is an interior solution. It is solution of the reduced-form problem:

$$\max_{e,H} -C(e) - e^2/2 - \gamma H$$

such that:

$$\begin{cases} C^* + \left(1 - \frac{C^*}{C(e)}\right)\left(\frac{C(e) - C^*}{2}\right) + \frac{\gamma H}{1-p} + 2C(e^*) \leq \frac{\Delta - \Delta^* + V(H)}{2}. \\ -2\frac{C(e)^2}{C'(e)}e = C^{*2} \end{cases} \quad (2.3)$$

¹⁴This is another way to write threshold condition one.

Chapter 3

The Perverse Effects of Partial Labor Market Reform¹

There is now substantial evidence that high employment protection leads to a sclerotic labor market, with low separation rates but long unemployment duration. While this sclerosis may not lead to high unemployment—because of the opposite effects of low flows and high duration on the unemployment rate—it is likely to lead to both lower productivity, lower output, and lower welfare.

Broad reductions in employment protection run however into strong political opposition. The reason is simple: Those who are currently protected see themselves as having more to lose than to gain from such a reduction. For this reason, governments have either done little, or have tried to reform at the margin, allowing for reduced protection, but only for (some) new contracts. In France for example, firms now can, under some conditions, hire workers for a fixed term, at the end of which separation occurs with low separation costs. If workers are kept beyond this fixed term however, later separation becomes subject to normal firing costs.

Are such partial reforms better than none? The motivation for this paper was our suspicion that the answer might actually be negative, that the effects of such a partial reform might be perverse, leading to higher unemployment, lower output, and lower welfare for workers. Our intuition was as follows:

¹This chapter is coauthored with Olivier Blanchard.

- Think of firms as hiring workers in entry-level jobs, finding out how good the matches are, and then deciding whether or not to keep the workers in higher productivity, regular, jobs.
- Now think of reform as lowering firing costs for entry-level jobs while keeping them the same for regular jobs. This will have two effects: It will make firms more willing to hire new workers, and see how they perform. But, second, it will make firms more reluctant to keep them in regular jobs: Even if a match turns out to be quite productive, a firm may still prefer to fire the worker while the firing cost is low, and take a chance with a new worker.
- One may therefore worry that the result of such a reform may be more low productivity entry-level jobs, fewer regular jobs, and so lower overall productivity and output. Higher turnover in entry-level jobs may lead to higher, not lower, unemployment. And, even if unemployment comes down, workers may actually be worse off, going through many spells of unemployment and low productivity entry-level jobs, before obtaining a regular job.²

Our purpose in this paper is to explore this argument, both theoretically and empirically. Our interest is broader than just the effects of fixed-term contracts in France. We see our paper as shedding some light on two larger issues. First, the effect of labor market institutions on the nature of the labor market—a popular but often fuzzy theme. Second, the pitfalls of partial labor market reforms.

Our paper is organized as follows: We develop a formal model in Section 1. We solve it analytically in Section 2. We further explore its properties by use of simulations in Section 3. The model makes clear that partial reform can indeed be perverse, increasing unemployment as well as decreasing welfare. We then turn to the empirical evidence, looking at the effects of the introduction of fixed-term contracts in France since the early 1980s. Section 4 shows the basic evolutions. Section 5 focuses on labor market evolutions for 20-24 year olds, the group most affected by the increase in fixed-term contracts. The section looks at the evolution of

²The French have a word for such a succession of unemployment spells and low-productivity jobs: They call this “precarité”. There does not seem to be an equivalent English expression—although there is an adjective, “precarious”. “Insecurity” may come close.

transitions between entry-level jobs, regular jobs, and unemployment, and also looks at wages by contract type. The reforms appear to have substantially increased turnover, without a substantial reduction in unemployment duration. If anything, their effect on the welfare of young workers appears to have been negative. Section 6 concludes.³

3.1 A simple model

In formalizing the labor market, we think of it as a market in which match-idiosyncratic productivity shocks lead to separations and new hires. In that context, we think of employment protection as layoff costs, affecting both the layoff decision and the nature of bargaining between workers and firms.

In this section, we describe the model, derive the Bellman equations, and characterize the equilibrium conditions.

3.1.1 Assumptions

The economy has a labor force of mass 1. There is a constant flow of entrants equal to s , and each individual retires with instantaneous probability (Poisson parameter) s , so the flow of retirements is equal to the flow of entrants.

Firms are risk neutral value maximizers. They can create a position at cost k , and then operate it forever.⁴ They can always fill the position instantaneously, by hiring a worker from the pool of unemployed. In other words, the matching technology has “workers waiting at the gate”.⁵ The number of positions in the economy is determined by free entry, and thus by the condition that there is zero net profit. The interest rate is equal to r .

New matches all start with productivity equal to y_0 . Productivity then changes with instantaneous probability λ . The new level of productivity y is drawn from a distribution with

³Throughout, our focus is on the economic effects of the introduction of fixed-term contracts, not on their political economy implications. These political economy issues, which are highly relevant to the design of employment protection reforms, have been studied by Gilles Saint-Paul in a series of contributions, in particular [?] and [?].

⁴Allowing for Poisson stochastic depreciation for positions would introduce an additional parameter, but not change anything of substance.

⁵The effects of matching frictions on the equilibrium are well understood. Leaving them out makes it easier to focus on the distortions implied by employment protection.

cumulative distribution function $F(y)$ and expected value Ey . y is then constant until the worker retires.

Nothing in the algebra depends on it, but it is natural to think of y_0 as smaller than Ey . This captures the idea that workers start in low productivity, “entry-level” jobs, and, if they are not laid off, move on to higher productivity, “regular” jobs. The assumption that, after the first draw, productivity is constant until the worker retires, is also inessential but captures in the simplest way the notion that regular jobs are likely to last much longer than entry-level jobs.

When productivity changes from y_0 to y , the firm can decide either to lay off the worker—and hire a new worker in an entry-level job with productivity y_0 —or keep him in a regular job, with productivity y (until the worker retires, at which point the firm hires a new worker with productivity y_0 .)

At the center of our model and crucial to the firm’s decisions are state-imposed firing costs. We take them to be pure waste (think administrative and legal costs) rather than transfers.⁶ The firing cost associated with an entry-level job (i.e. up to and including the time at which the productivity level changes from y_0 to y) is c_0 . The firing cost associated with a regular job (i.e. starting just after the change in productivity from y_0 to y) is c . Separations due to retirement are not subject to firing costs.

We can look at the same labor market from the point of view of the workers. *Workers* are risk neutral, with discount rate equal to r , and they retire with instantaneous probability s . By normalization, the flow utility of being unemployed is equal to 0. New workers enter the labor market unemployed. They look for an entry-level job, which they find with probability x , where $x = h/u$, with h being the flow of hires, and u being the unemployment rate. Their entry-level job comes to an end with instantaneous probability λ , at which time they are either laid off, or retained in a regular job. If they are laid off, they become unemployed, and look for another entry-level job. The model therefore generates a work life-cycle, in which young workers typically go through a succession of unemployment spells and entry-level jobs until

⁶What we need is that at least some component of firing costs be waste. The implications of thinking about firing costs as waste or as transfers, and the scope for bonding to cancel the effects of the transfer component, are well understood. See for example [?]. We think that there is enough evidence of waste and limited bonding to warrant our assumptions.

they obtain a regular job, which they keep until they retire.

The flow into unemployment is composed of new entrants and of those workers who are laid off at the end of their entry-level job. The flow out of unemployment is equal to the number of workers hired in new entry-level jobs. All regular jobs are filled from within, and all regular jobs end with retirement.

The only element of the model left to specify is *wage determination*. We assume that wages, both in entry-level and in regular jobs, are set by symmetric Nash bargaining, with continuous renegotiation. All entry-level jobs have the same level of productivity y_0 and thus pay the same wage w_0 . Regular jobs have different levels of productivity; the wage in a regular job with productivity y is denoted $w(y)$.

Given the way we have set up the model, distortions in this economy come only from the presence of the two firing costs, c and c_0 . Our focus in this paper will be on the effects of a decrease in c_0 given c , i.e. of a decrease in the firing costs associated with entry-level jobs, keeping unchanged the firing costs associated with regular jobs.⁷

3.1.2 Bellman equations

Consider first the Bellman equations characterizing the firm. Let V_0 be the expected present value of profits from a position currently filled as an entry-level job (the value of an entry-level job for short), a job with current productivity equal to y_0 . Let $V(y)$ be the value of a regular job with productivity equal to y . Let y^* be the threshold level of productivity above which the firm keeps a worker, and below which it lays him off.

V_0 is given by:

$$rV_0 = (y_0 - w_0) - c_0\lambda F(y^*) + \lambda \int_{y^*}^{\infty} (V(y) - V_0)dF(y)$$

The first term on the right gives flow profit. The second gives the firing cost associated with terminating the entry-level job, times the probability that the worker is laid off—itsself equal to

⁷Note that our assumption that regular jobs are not subject to productivity shocks implies that the only role of c , the firing cost associated with regular jobs, is to affect wage bargaining in regular jobs, not layoffs from regular jobs. Allowing for productivity shocks to regular jobs would complicate the algebra, generate a richer structure of flows, but not change anything of substance.

the probability of a productivity change, times the probability that y is less than the threshold value y^* . The third reflects the expected change in the value of the job if the worker is kept in a regular job.⁸ The sum of these three terms must be equal to the annuity value of an entry level job, rV_0

$V(y)$ is given in turn by:

$$rV(y) = (y - w(y)) + s(V_0 - V(y))$$

The first term on the right gives flow profit if productivity is equal to y . The second term reflects the change in value if the worker retires and the firm must hire a new worker at productivity level y_0 . The sum of the two must be equal to the annuity value of a regular job, $rV(y)$.

Turn to the Bellman equations for a worker. Let V_0^e denote the expected present value of utility for a worker currently in an entry-level job (the value of being in an entry-level job for short), V^u the present value of utility for a worker currently unemployed (the value of being unemployed for short), and $V^e(w(y))$ is the value of being employed in a regular job with productivity y . Note that V^u is also the expected lifetime utility of an entrant in the labor market; for this reason, it is a natural measure of welfare in this model.

V_0^e is given by:

$$rV_0^e = w_0 + \lambda F(y^*)(V^u - V_0^e) - sV_0^e + \lambda \int_{y^*}^{\infty} (V^e(w(y)) - V_0^e) dF(y)$$

The first term on the right is the wage for an entry-level job. The second is the probability that the job ends, times the change in value from going from employment to unemployment. The third reflects the loss in value from retirement. The fourth reflects the expected change in value if the worker is retained in a regular job. The sum of these terms is equal to the annuity value of the value of being in an entry-level job.

$V^e(w(y))$ is given by:

$$rV^e(w(y)) = w(y) - sV^e(w(y))$$

⁸Note the absence of a term reflecting the probability that the worker retires. If the worker retires while in an entry-level job, the firm can replace him instantaneously at no cost by a worker with the same productivity, so this term is equal to $s(V_0 - V_0) = 0$.

The worker receives the wage associated with productivity level y , until he retires, in which case he loses the value of being employed in a regular job. The sum of these terms is equal to the annuity value of being employed in a regular job.

Finally, V^u is given by:

$$rV^u = x(V_0^e - V^u) - sV^u$$

The first term is equal to the probability of being hired in an entry-level job, the second the probability of retiring while unemployed, times the loss in value from retirement. The sum of these terms must be equal to the annuity value of being unemployed.

3.1.3 Equilibrium conditions

The model imposes four equilibrium conditions. The first is the free entry condition, that the value of a new position be equal to the cost of creating it:

$$V_0 = k \tag{3.1}$$

The second is that, at the threshold level of productivity, the firm be indifferent between keeping the worker, or laying him off, paying the firing cost, and hiring a new worker:

$$V(y^*) = V_0 - c_0 \tag{3.2}$$

The third is the Nash bargaining condition for entry-level jobs. A worker who loses an entry-level job loses $V_0^e - V^u$. A firm which lays off a worker in an entry-level job loses $V_0 - V_0 + c_0 = c_0$. This implies:

$$V_0^e - V^u = c_0 \tag{3.3}$$

The fourth is the Nash bargaining condition for regular jobs. A worker who loses a regular job loses $V^e(w(y)) - V^u$. A firm which lays off a worker in a regular job loses $V(y) - V_0 + c$. The Nash condition therefore takes the form:

$$V^e(w(y)) - V^u = V(y) - V_0 + c \tag{3.4}$$

We now turn to a characterization of the equilibrium.

3.2 The equilibrium

The equilibrium is easiest to characterize by focusing on two variables, V^u , the value of being unemployed, and y^* , the threshold level of productivity below which workers are laid-off.

One can then think of the equilibrium in terms of two relations. The first, which we shall call the “layoff relation”, gives threshold productivity y^* as a function of labor market conditions, summarized by V^u , and of the two firing costs c and c_0 . The second, which we shall call the “hiring relation” gives V^u , the value of being unemployed as a function of y^* and the two firing costs c and c_0 . Together the two relations determine V^u and y^* . Once this is done, all other variables can easily be derived, and so can the effects of changes in firing costs.

3.2.1 The layoff relation

The condition determining the choice of the threshold productivity value y^* by the firm is given by 3.2. Using equation 3.4, it can be rewritten as:

$$(V(y^*) - V_0 + c_0) + (V^e(w(y^*)) - V^u) = c - c_0 \quad (3.5)$$

Note that the left side gives the total surplus (i.e the surplus to the firm and the surplus to the worker from staying together rather than separating) from a match with productivity y^* . Were the choice of the threshold productivity level privately efficient, the threshold productivity level would be chosen so that the total surplus was equal to zero. As 3.5 shows, unless $c - c_0$ is equal to zero, this is not the case here. If c exceeds c_0 , so $c - c_0$ is positive, some workers will be laid-off despite the fact that keeping them would yield a positive total surplus. The source of the distortion is clear: If c is higher than c_0 , the worker, if kept in a regular job, will be in a stronger bargaining position and thus be able to extract a higher wage. Anticipating this, the firm will only keep jobs where the surplus is sufficiently large to offset this increase in the worker’s bargaining power.

Using the Bellman equations to derive $V(y^*) + V(w(y^*))$, together with the free entry condition $V_0 = k$, gives the first relation between y^* and V^u :

$$\frac{y^* + sk}{r + s} - V^u - k = -c_0 + (c - c_0) \quad (3.6)$$

We shall refer to this relation as the “layoff relation” between y^* and V^u . The left side gives the total gross surplus (i.e. ignoring firing costs) of a match of productivity y^* . The first term is the expected value of output. The next two terms subtract the outside options of workers and firms.

The two terms on the right side show the two roles of c_0 in determining y^* . If the layoff decision was *privately efficient*, only the first term would be present: The firm would choose y^* so that the net surplus on a job with productivity y^* was equal to zero. The second term reflects the private distortion due to bargaining. It implies that, if c is higher than c_0 , then y^* will be (privately) inefficiently high.

We can now look at the effects of V_u , c and c_0 on y^* . The derivatives are as follows:

$$\frac{dy^*}{dV^u} = (r + s)$$

The higher the value of being unemployed V^u , the higher must be the productivity of the marginal match.

$$\frac{dy^*}{dc_0} = -2(r + s)$$

The lower the firing cost for entry-level jobs, c_0 , the higher the threshold (and also the larger the deviation of the threshold y^* from its privately efficient level, thus the larger the overdestruction).

3.2.2 The hiring relation

The derivation of the second relation between V^u and y^* starts with the Nash bargaining condition for entry-level jobs, equation 3.3. Adding and subtracting V_0 , this equation can be rewritten as:

$$(V_0^e + V_0) - (V_0 + V^u) = c_0$$

Note that the left side is equal to the surplus from a new match. The first term in parentheses is the expected value of output from the match. The second term in parentheses is equal to the sum of the outside option of the worker and the firm. Note that, again, this condition is not (privately) efficient. Firms should hire workers until the surplus from a match was equal to zero. This is not the case here: The surplus is only driven down to c_0 , not to zero. Just as before,

this distortion reflects the increased bargaining power of workers coming from renegotiation in the presence of firing costs.

Using the Bellman equations to replace $V_0^e + V_0$, together with the free entry condition $V_0 = k$ gives:

$$y_0 + sk + \lambda \int_{y^*}^{\infty} \frac{y + sk}{r + s} dF(y) - (r + s + \lambda(1 - F(y^*))) (V^u + k) = \lambda F(y^*) c_0 + (r + s + \lambda) \bar{a}_0$$

This gives the second relation between V^u , y^* , and c_0 (c does not appear here). In effect, it gives the value of being unemployed such that the wages set in bargaining, and by implication, the present value of profits associated with a new position just cover the cost of creating that position and hiring the worker. We shall call it the “hiring relation”.

Up to a discount factor $(r + s + \lambda)$, the left side gives the total gross surplus from creating a new job and hiring a worker (gross of the firing cost which may have to be paid if the productivity shock turns out to be lower than the threshold).

Turning to the right side, note that there are two terms in c_0 . If the hiring decision was *privately efficient*, then only the first term on the right side would be present. Hiring would take place until the total gross surplus was equal to the expected firing cost (the probability that firing takes place times the firing cost). The second term reflects the distortion coming from the effect of c_0 on the bargaining position of workers.⁹

We can now look at the effects of y^* and c_0 on V^u . The effect of y^* on V^u is given by:

$$(r + s + \lambda(1 - F(y^*))) \frac{dV^u}{dy^*} = \lambda f(y^*) (V^u + k - c_0 - \frac{y^* + sk}{r + s})$$

The sign of the derivative appears ambiguous: An increase in y^* leads both to a higher expected output in continuing jobs, but also to a higher probability that jobs are terminated. But, in fact, we can say more, and this will be important later on:

⁹The “no bonding” assumption is important here. Indeed, in our model, both private distortions—in the layoff and in the hiring relations—could be eliminated by bonding. A large enough payment by the worker to the firm before he was hired would eliminate the private distortion in the hiring relation. A large enough payment by the worker to the firm before he was promoted to a regular job would eliminate the private distortion in the layoff decision. For reasons discussed at length in the literature, we believe that, while there is some scope for bonding, it is too limited to eliminate these bargaining distortions.

At the equilibrium (i.e. at the intersection with the first relation, 3.6), the derivative is given by:

$$(r + s + \lambda(1 - F(y^*))) \frac{dV^u}{dy^*} = -\lambda f(y^*)(c - c_0) \leq 0$$

If both $(c - c_0)$ and the density function $f(y^*)$ are different from zero, then an increase in y^* leads to a decrease in V^u . If either $c = c_0$ or $f(y^*) = 0$, then V^u is independent of y^* . The intuition is as follows: As we saw earlier, if $c = c_0$, the layoff decision is privately efficient, so a small change in y^* has no effect on the surplus and thus no effect on the feasible V_u . If $c > c_0$ however, the marginal regular job generates a positive surplus, so an increase in y^* , if it leads to an increase in the layoff rate (i.e. if $f(y^*) > 0$) leads to a smaller total surplus, requiring a decrease in the feasible V_u .

Now consider the effect of c_0 on V_u (given y^*). From ??:

$$(r + s + \lambda(1 - F(y^*))) \frac{dV^u}{dc_0} = -(r + s + \lambda) - \lambda F(y^*) < 0$$

An increase in c_0 decreases the feasible value of being unemployed, V^u . There are two separate effects at work here. The first, captured by $-\lambda F(y^*)$, is a direct cost effect: An increase in c_0 increases firing costs actually paid by firms, and therefore increases waste, leading to a decrease in the feasible value of V^u . The second, captured by $(r + s + \lambda)$, reflects the effects of firing costs through bargaining. Both effects require new matches to generate a larger surplus. In equilibrium, this is achieved through a lower value of V^u .¹⁰

3.2.3 The equilibrium

The two relations we have just derived are drawn in Figure 1. The first relation, 3.6, the “layoff relation”, is upward sloping: The higher V^u , the higher the threshold y^* . The second relation, the “hiring relation”, is either flat or downward sloping (it is drawn as downward sloping here), at least around the equilibrium: V^u is either invariant to, or a decreasing function of, y^* . Together the two relations determine the threshold productivity level and the value of being

¹⁰This is a familiar result from bargaining or efficiency wage models, (for example [?], or more recently [?]), that, in equilibrium, unemployment plays the role of a market “discipline device”. In these models, the zero profit condition ties down the wage. Any factor which increases the wage given reservation utility requires, in equilibrium, a decrease in reservation utility.

unemployed. The equilibrium is given by point A .

The effects of a partial reform of employment protection, i.e. the effects of a decrease in c_0 on y^* and on V^u , keeping c constant, are then easy to derive. The layoff relation shifts to the right: For given V^u , the lower value of c_0 makes it more attractive to layoff entry-level workers, and thus increases y^* . The hiring relation condition shifts up: For given y^* , lower c_0 leads to a higher value of V^u , both because of the reduction in costs, and because of the decrease in the bargaining power of entry-level workers.

The new equilibrium is given by point B . It is clear that, while y^* unambiguously increases, the effect on V^u is ambiguous. This is because there are two distortions at work, and they work in opposite directions.

- On the one hand, the decrease in c_0 leads to an increase in $(c - c_0)$ and thus to an increase in the distortion affecting the layoff relation (a distortion which depends on the bargaining power in regular jobs *relative to* entry-level jobs). This tends to decrease V^u .
- On the other hand, the decrease in c_0 leads to a decrease in the distortion affecting the hiring relation (a distortion which depends on the bargaining power of workers in entry-level jobs). This tends to increase V^u .

To see the two effects more clearly, suppose first that $(c - c_0)$ is equal to zero to start. In this case the first distortion is absent and, as we saw, small changes in y^* have no effect on V^u in the hiring relation. Thus, the only effect of a decrease in c_0 on V^u is through its direct effect in the hiring relation relation: By both decreasing waste and decreasing the bargaining power of entry-level workers, the decrease in c_0 leads to an unambiguous increase in V^u .

This case is represented in Figure 2. We know from above that, if $(c - c_0) = 0$, the hiring relation is flat at the equilibrium. The decrease in c_0 shifts the hiring relation condition up: Lower costs and lower bargaining power by entry-level workers lead to a higher equilibrium value of V^u . The decrease in c_0 shifts the layoff relation to the right: For given V^u , a decrease in c_0 makes layoffs more attractive, leading to an increase in y^* . The equilibrium moves from A to B , with higher V^u , and a higher threshold, y^* .

When $(c - c_0)$ is positive instead, the effect of the decrease in c_0 on the first distortion becomes relevant. The decrease in $(c - c_0)$ leads to an increase in the first distortion, and

thus, other things equal, to a decrease in V^u . The strength of this effect is proportional to $(c - c_0)f(y^*)$ and is thus increasing in the density evaluated at the equilibrium—in the number of entry-level jobs which are (inefficiently) terminated as a result of the increase in y^* . If either $(c - c_0)$ or $f(y^*)$ are sufficiently large, this adverse effect can dominate. Figure 3 is drawn on the assumption that $f(y)$ is very large around $y = y^*$, so the hiring relation is (nearly) vertical. In this case, a decrease in c_0 does not shift the hiring relation. But, as before, it shifts the layoff relation to the right: For given V^u , a decrease in c_0 makes layoffs more attractive, leading to an increase in y^* . The equilibrium moves from A to B, with lower value $V^{u'}$, and an unchanged threshold, y^* .

To summarize, we have a first answer to our initial question. If $(c - c_0)$ or/and $f(y^*)$ are sufficiently large, a partial reform may indeed lead to an increase in excess turnover, and, by implication, to a decrease in the value of being unemployed.¹¹

3.2.4 Other implications

Given the equilibrium values of y^* and V^u , it is straightforward to derive the other variables of the model. For example:

- The layoff rate is given by $\lambda F(y^*)$, so a decrease in c_0 , which, as we have seen, unambiguously increases y^* , unambiguously increases the layoff rate.
- Using the condition that $(V_0^e - V^u) = c_0$, the hiring rate from unemployment x is given by $x = (r + s)V^u/c_0$. Thus, if reform is welfare improving—if V^u increases when c_0 decreases—we know that x increases, equivalently, unemployment duration decreases. But the effect is ambiguous in general.
- The unemployment rate is given by $u(x + s - (\lambda F(y^*)x)/(\lambda + s)) = s$. Even if unemployment duration decreases (x increases), higher turnover ($F(y^*)$ increases) implies an ambiguous effect on the unemployment rate.
- From the Nash bargaining conditions, the values of being employed in an entry-level job, of being employed in a regular job with productivity equal to the threshold, and of being

¹¹Note that, for values of the parameters that give rise to this effect, the value of c_0 that maximizes V^u will be less than c but positive. Thus, this can be seen as an argument for *partial* “partial reform” (i.e. some decrease in c_0 from c , but not all the way to zero)...

unemployed, are related by $V_0^e - V^u = c_0$ and $V^e(w(y^*)) - V_0^e = c - 2c_0$. Thus, a decrease in c_0 makes entry-level jobs more like unemployment (decreasing c_0), and entry-level jobs less like regular jobs (increasing $c - 2c_0$). In this sense, a reduction in c_0 leads to increased dualism in the labor market.

To fully characterize the effects of the decrease in c_0 on the different dimensions of our economy, it is more convenient to turn to simulations. This is what we do in the next section.

3.3 Simulations

Our goal in this section is to show the effects of partial reform both on the work life-cycle of an individual worker, as well as on macro aggregates, from unemployment to GDP.

We think of the unit time period as one month, and choose the parameters as follows:

- We normalize the level of output on an entry-level job, y_0 to be equal to 1.
- We take k to be equal to 24, implying a ratio of capital to annual output on an entry-level job of 2.
- We take the monthly real interest rate, r , to be equal to 1%. Together with the two previous assumptions, this implies a share of labor in output on entry-level jobs, of $(1 - .01 * 24) = 76\%$.
- We take the monthly probability of exogenous separation (“retirement”) s , to be equal to 1.5%.
- We take the monthly probability of a productivity change on an entry-level job, λ to be equal to 10%. This implies an expected duration of an entry-level job of about a year.
- We take the distribution of productivity on regular jobs to be uniform, distributed on $[m - 1/2f, m + 1/2f]$, thus with mean m , and density f . The use of a uniform distribution makes particularly transparent the influence of the density f on the effects of partial reform.

- To capture the notion that regular jobs are more productive, we set the mean m equal to 1.4. (Because jobs below the threshold are terminated, the mean of the observed distribution will be higher.)
- Because our theoretical analysis in the previous section showed that the density function plays a crucial role in determining the outcome, we look at the effects of reform for different values of f . The graphs below show the results of reform for values of f varying from 1 to 6.
- We choose the firing cost on regular jobs, c , equal to 24—which represents about a year and a half of average output. We shall discuss the legal and empirical evidence for France in the next section; we believe this to be a reasonable estimate.

Our simulations then focus on the effects of a decrease in c_0 . If c_0 is either too large or too small, the equilibrium may be at a corner, i.e. at a point where y^* lies outside the support of the productivity distribution for regular jobs. In those cases, changes in c_0 have no effect on the layoff rate; their effect takes place only through bargaining. While these corner equilibria are interesting, we limit the presentation of results to the range where there is an interior solution, so changes in y^* affect the layoff rate. The results below are presented for the range where c_0 decreases from 6 to 2 months of output. The results are presented in Figures 4a, 4b, and 5.

Figure 4 shows the effects of partial reform on different aspects of a worker's individual experience, namely the value of being unemployed (V^u), the probability that the worker is laid-off at the end of an entry-level job ($F(y^*)$), the monthly hiring rate from unemployment (x), and the expected time to a regular job starting from unemployment (T_u). For each 3D box, the firing cost c_0 is plotted on the y axis, decreasing as one goes away from the origin. The density function f is plotted on the x axis, with the density decreasing as one goes away from the origin. The variable of interest is plotted on the vertical axis.

Start with V^u . For low density—low f —a decrease in c_0 increases V^u . But, for high density f , it decreases V^u . The basic intuition was given in the previous section. When f is low, the adverse effects of reform on excess turnover are small, and workers are better off. When f is high, the adverse effects of excess turnover dominate.

This intuition is confirmed by looking at x and $F(y^*)$. While the effect of reform on x is theoretically ambiguous, in our simulation reform always increases x , and thus decreases unemployment duration. It also increases the probability that an entry-level job will lead to a layoff (this effect is theoretically unambiguous). This second effect is stronger when density is high. For $f = 6$, the probability increases from 0.3 to 0.8; for $f = 1$, the probability increases from 0.45 to 0.75.

The last box shows that reform increases the average time it takes a new entrant to get a regular job. The effect is stronger when the density is high. For $f = 6$, the expected time increases from two years to nearly six years.

Figure 5 shows what happens to the macroeconomic aggregates. The first box repeats the graph for V^u in Figure 4. We can think here of V^u not as the value of being unemployed, but as average lifetime utility for a worker in the economy, thus as a measure of welfare.

The second box shows the effects of reform on the unemployment rate, and shows these effects to be ambiguous. For low density, the combined effects of lower duration and only slightly higher turnover lead to a decrease in unemployment. For high density, the effect is ambiguous. Unemployment first goes up as c_0 decreases, then goes down a bit. (This is a warning, if there was a need, that what happens to utility and to unemployment need not have the same sign. For high density, utility goes down strongly while unemployment goes up and then down.)

The third box plots the proportion of workers who are either unemployed or employed in entry-level jobs. The idea is to get at the idea of “precarite”, the idea that the decrease in unemployment, if any, may come with a large increase in low productivity jobs. This proportion increases with reform, for all values of f . Again, it is stronger when f is high. In this sense, reform indeed increases “precarité”.

The last graph gives the value of GDP. For low density, the decrease in the unemployment rate, together with the limited increase in low productivity entry-level jobs, leads to an increase in output. For high density, the larger increase in the proportion of entry-level jobs, and the roughly constant unemployment rate, combine to lead to a decline in output—by nearly 5% under our parameter assumptions. Another warning is therefore in order here: What happens to output, to unemployment, and to utility, can all be quite different.

3.4 The development of CDDs in France: Basic facts and evolutions

In France, regular contracts, called “Contrats a duree indeterminée”, or “CDI” for short, are subject to employment protection rules. Firms can layoff workers for one of two reasons: For “personal reasons”, in which case they have to show that the worker cannot do the job he or she was hired for, or for “economic reasons”, in which case, the firm must prove that it needs to reduce its employment.¹²

Barring serious negligence on the part of the worker, the law requires a firm to give both a notice period and a severance payment to the worker. The notice period is relatively short, 1 or 2 months depending on seniority. In the absence of a specific contract between unions and firms, the amount of severance pay set by law is also modest, typically 1/10 of a month per year of work, plus 1/15 of a month for years above 10 years. But sectoral agreements typically set higher amounts, and firms perceive the costs to be even higher, because of the administrative and legal steps required to go through the process. The monetary equivalent of these costs (which are indeed waste from the point of view of firms and workers) is hard to assess, but severance packages offered by firms in exchange for a quick resolution are typically much more generous than the legal or the contractual minimum.¹³

Since the late 1970s, successive governments have tried to reduce these costs by introducing fixed-term contracts, called “Contrats à durée déterminée”, or CDDs. These contracts still require a severance payment, but eliminate the need for a costly administrative and legal process.¹⁴

3.4.1 The history and the current rules

A brief history of CDDs goes as follows: CDDs were introduced in 1979. With the election of a socialist government in 1981 and the passage of a law in 1982, their scope was reduced: A list of 12 conditions was drawn, and only under those conditions could firms use fixed-term contracts. In 1986, the 12 conditions were replaced by a general rule: CDDs should not be used

¹²A useful source on French labor legislation is the [?].

¹³For a comparison of France with other OECD countries, see [?].

¹⁴[?] gives a detailed description of the rules governing CDDs.

to fill a permanent position in the firm. The current architecture dates for the most part to an agreement signed in March 1990.

Under this agreement, CDDs can be offered by firms for only one of four reasons: (1) The replacement of an employee on leave (2) Temporary increases in activity (3) Seasonal activities (4) Special contracts, aimed at facilitating employment for targeted groups, from the young to the long term unemployed. The list of special contracts has grown in the 1990s, as each government has tried to improve labor market outcomes for one group or another; some of these contracts require the firm to provide training, and many come with subsidies to firms.

CDDs are subject to a very short trial period, typically one month. They have a fixed duration, from 6 to 24 months depending on the specific contract type. Mean duration is roughly one year. They typically cannot be renewed, and, in any case, cannot be renewed beyond 24 months. If the worker is kept, he or she must then be hired on a regular contract. If the worker is not kept, he or she receives a severance payment equal to 6% of the total salary received during the life of the contract (a law currently under consideration would raise this amount to 10%).

Two other dimensions of these contracts are relevant here:

First, the law states that the wage paid to a worker under a CDD should be the same as the wage which would be paid to a worker doing the same job under a CDI. This is obviously difficult to verify and enforce, and, as we shall see, it appears not to be satisfied in practice.

Second, at the end of a CDD, workers qualify for unemployment benefits. Unemployment benefits start at either 40% of the previous gross salary, plus a fixed sum, or 57.4% of previous gross salary, whichever is more advantageous. The benefits then decrease over time; the decrease is faster the younger the worker, and the shorter the work experience. For example, a worker who has been working for 4 out of the previous 8 months, gets benefits for 4 months; a worker who has been working for 6 out of the previous 12 months gets 4 months with full benefits, then 3 months at 85%, then nothing, and so on for workers with longer employment histories. In short, workers can alternate between CDDs and unemployment spells, and receive benefits while unemployed.

For our purposes, the history and the specific set of rules regulating CDDs has two main implications:

- One should think of what has happened since the 1980s primarily as an increase in fixed-term contracts at the extensive margin (an increase in the number of eligible workers and jobs), rather than as an increase in the intensive margin (a decrease in c_0).¹⁵
- The rather stringent rules governing CDDs (conditions, duration, non renewal) imply that, while the proportion of workers under CDDs has increased over time, it has not reached—and, unless rules are changed, will not reach—the levels observed in some other European countries, in particular Spain.¹⁶

3.4.2 Data sources

Our data, here and in the next section, come from “Enquetes Emploi”, a survey of about 1/300th of the French population, conducted annually by INSEE, the French National Statistical Institute.

Questions about CDI versus CDD status are only available from 1983 on, so we only look at the evidence from 1983 to 2000. The design of the survey and the wording of some of the questions were changed in 1990, leading to discontinuities in some of the series in 1990; these discontinuities appear clearly in some of the figures below.

We use the “Enquetes Emploi” to look at the evolution of both stocks and flows. Measures of flows can be constructed in two ways:

- The 3-year panel data structure of the survey allows to follow two thirds of individuals across consecutive surveys, and so to measure their annual transitions. Panel-based transition probabilities (“panel transitions” for short) can be constructed from every year since 1984 on, with one exception: Changes in survey design in 1990 make it impossible to compute transitions for 1990.
- In addition, from 1990 on, the survey includes a question asking for status 12 months earlier. Thus, except for 1999 when the answer to the question has not yet been tabulated,

¹⁵A model which formalizes the introduction of CDDs at the extensive margin, and which shares some of the features of our model (but was developed independently), is given in [?].

¹⁶For a description of the nature and the scope of fixed-term contracts in Spain, and in Italy, see for example [?], and [?].

we can also construct retrospective transition probabilities (“retrospective transitions” for short) for each year since 1990.¹⁷

For our purposes, namely assessing the evolutions (rather than the levels) of transition probabilities over time, it is not clear which approach dominates. As documented by many researchers, transitions based on retrospective information are subject to systematic memory biases.¹⁸ But these memory biases are likely to be fairly stable over time. Panel based transition probabilities suffer instead from some attrition bias. This bias, while smaller, is more likely to change over time: An increase in the proportion of workers with short duration jobs may well lead to an increase in attrition. We therefore remain agnostic and present both the numbers for panel based transitions from 1984 to 2000, and for retrospective information based transitions for 1991 to 2000.

3.4.3 Basic evolutions

As a start, Figure 6 plots the evolution of CDD employment as a proportion of total (salaried) employment, since 1983. It shows how this proportion has increased from 1.4% of salaried employment in 1983 to 10.8% in 2000. At the same time, the graph makes clear that the specific conditions under which firms can offer CDDs have limited their scope; by contrast, in Spain today, more than 30% of salaried employment is in the form of fixed-term contracts.

While the proportion of CDDs in total employment remains limited, the introduction and development of CDDs have completely changed the nature of the labor market for the young. Figure 7 shows the evolution of the proportions of individuals, age 20-24, who are either employed under a CDI, employed under a CDD, or unemployed, or students, from 1983 to 2000. The figure yields a number of conclusions:

- The proportion of students in this age group has increased dramatically, from 21% in 1983 to 49% in 2000. This increase is due in large part to a deliberate policy aimed at increasing

¹⁷The question actually asks for status during each of the previous 12 months, thus allowing for the construction of monthly probabilities—which are closer conceptually to the instantaneous probabilities in the theoretical model. Because of well known issues such as rounding up by respondents, these monthly probabilities are very noisy, and we have not explored these data further.

¹⁸For more on the differences between the two sets of transition probabilities in the context of Enquetes Emploi, see [?], and [?].

the proportion of children taking and passing the baccalaureat (the examination at the end of high school); this proportion has increased over the same period from 28% to 59%. But it is also a reflection of the poor labor market prospects faced by the young; indeed, as unemployment has decreased since the mid-1990s, so has the proportion of students. This indicates that, for this age group, unemployment numbers should be interpreted with caution.

- The proportion of unemployed in a given 5-year cohort has remained roughly constant, from 15% in 1983 to 16% in 1999, and down to 12% in 2000 (although, because of the steady decrease in participation, the unemployment rate has increased from 20% in 1983 to 32% in 1999, and 24% in 2000).
- Most relevant for our purposes, the proportion of CDIs has sharply dropped while the proportion of CDDs has sharply increased. In 1983, 60% of a cohort (equivalently 95% of those employed) were employed under CDIs; in 2000, the proportion was down to 21% (54% of those employed). And during the same period, the proportion of those employed under CDDs went from 3.0% (5% of employment) to 17% (46% of employment).

The same qualitative evolution is visible in other age groups, but its quantitative effect decreases across cohorts. The proportion of CDDs has increased from 1.6% in 1983 to 10% in 2000 for the 25-29 cohort, from 1.1% in 1983 to 6% in 2000 for the 30-34 cohort, and so on. For this reason, it makes good sense to focus on market evolutions for the 20-24 cohort, and this is what we do in the next section.¹⁹

3.5 Transitions, wages, and utility

We now look at labor market evolutions for 20-24 year olds, for the period 1983-2000, with the goal of learning something about the effects of CDDs on the labor market. Our approach is descriptive, and its limitations are obvious:

¹⁹We have focused here at differences by age group; one can take other cuts, such as education. One might have expected the proportion of CDDs to decrease with the level of education. This is not the case. In 2000, the proportion of CDDs was roughly the same across education levels, probably reflecting the restrictions under which CDDs can be used by firms.

First, there has been many other institutional changes in the labor market during that period, from the introduction of a minimum income floor (the RMI), to the reduction in social contributions on low wage workers, to a number of other programs aimed at specific groups in the labor market.²⁰ We believe however that, for the group we focus on below, the 20-24 age group, the increase in the proportion of CDDs is indeed the dominant development.

Second, much of the evolution of unemployment during the period, either for the 20-24 year olds or for the population at large, has been due not so much to institutional changes but to macroeconomic factors. Until recently, this would have raised a very serious identification issue: From the early 1980s to the late 1990s, macroeconomic factors had led to a trend increase in unemployment, making it very difficult to disentangle the effects of that trend from those of the trend increase in CDDs. Fortunately (both for France, and for us), unemployment has started decreasing, so there is now hope of disentangling the two. To see why and how, we start this section by looking at aggregate evolutions.

3.5.1 Aggregate evolutions

The top panel of Figure 8 plots the evolution of the aggregate unemployment rate in France since 1983.²¹ The general picture is of a trend increase from 1983 to the mid-1990s, and of a limited decrease since then.

What is relevant to a worker in the labor market is not however the unemployment rate per se, but the probabilities of becoming unemployed if he is currently employed, or of becoming employed if he is currently unemployed. The evolutions of these two transition probabilities are given in the two bottom panels of Figure 8. For each panel, the series with squares gives panel transitions, the series with triangles gives retrospective transitions.²² We draw two main conclusions from these two panels:

²⁰For a description of some of the programs aimed at the youth, look for example at [?].

²¹For our purposes, the relevant series (in the sense of a series consistent with the other series we look at below) is that from Enquetes Emploi. That series gives a more pessimistic assessment of the evolution of the labor market in France than the series for the official rate. In 2000, the series implies an unemployment rate of 11.7%, compared to an official rate of 9.7%.

²²We discussed earlier why 1990 is missing for panel transitions, and why 1999 is missing for retrospective transitions. Note that 1995 is also missing for panel transitions in Figure 8: The reason is that transitions computed from Enquetes Emploi are very different from those in other years. Most of this is due to a program introduced in that year which subsidized the reemployment of the older long-term unemployed, leading to a very different pattern of flows in 1995. Part of it appears to be due to other problems with the data. We decided to exclude this year here and in most of the graphs below.

- The 1980s appear different from the 1990s. In the 1980s, the transition probability from employment to unemployment barely increased, and the transition probability from unemployment to employment actually increased. By contrast, in the 1990s, the first transition increased, and the second decreased: The labor market clearly became worse in both dimensions. This worsening surely had a strong effect on the labor market for the 20-24 year olds we focus on below.
- The panel transition from employment to unemployment was lower in 2000 than in any previous year in the sample. The panel transition from unemployment to employment in 2000 was one of the highest in the sample. In other words, despite the fact that the unemployment rate was still high, labor market prospects were, from the point of view of an individual in the labor market, arguably the best since 1984. Thus a comparison of endpoints—1984 with 2000—can help us separate out the role of cyclical and structural components. We shall use this below.

3.5.2 Transition probabilities for the 20-24 year olds

Figure 9 gives the evolution of transition probabilities between CDD employment, CDI employment, and unemployment, for 20-24 year olds, from 1984 to 1998. Each of the nine panels plots two series. The first, in black, give panel transitions; the second in grey gives retrospective transitions. Transitions for year t refer to the change in status from March of year $t - 1$ to March of year t .

We draw three main conclusions from this figure:

- The three left panels show the transition probabilities from unemployment.²³

The probability of getting a CDI decreases in both subperiods (the 1980s and the 1990s). The probability of getting a CDD increases in both subperiods. Both movements are clearly consistent with the theory.

While the effect is theoretically ambiguous, we saw that the duration of unemployment was likely to decrease as the scope of CDDs increased. The probability of remaining

²³The transition probabilities sum to less than one, as we do not report transitions to self employment, internships, military status, student status, and other non participation.

unemployed indeed decreases in the 1980s. But there is no evidence of a further decrease in the 1990s. (Note that the retrospective measure is much higher than the panel measure, but shows the same evolution). In other words, during the 1990s, the higher likelihood of getting a CDD rather than a CDI did not come with an overall increase in the probability of getting a job.

- The three center panels show the transition probabilities from CDD employment.

The probability of moving from a CDD to a CDI decreases in each of the two subperiods. The probability of remaining on a CDD (the same or another one) increases throughout the period, nearly doubling in each of the two subperiods (Recall that the level shifts between 1989 to 1991, which are often large in the figure, reflect largely differences in measurement.) Note, again, that while panel and retrospective transitions have rather different levels, their evolution is largely similar over time.

The probability of becoming unemployed decreases steadily in the 1980s. As we look at year-to-year transitions, this presumably reflects the higher probability of finding another job when the current CDD comes to an end. But, again, there appears to be a difference across the two decades. In the 1990s, the transition probability does not exhibit much of a trend.

- The three right panels of Figure 9 show transition probabilities from CDI employment. They are less central to our discussion (indeed in our formal model, these three transition probabilities were all equal to zero, by assumption). One evolution is however worth mentioning. One might have expected that allowing firms to use CDDs would have reduced the flows from CDI employment. The top panel show that this has not been the case: The probability of keeping a CDI has decreased, not increased. This suggests that other factors than changes in firing costs have played a role in determining general trends in separations.

To summarize: The transition probabilities give a picture of a labor market for 20-24 year olds where the probability of getting a CDD has steadily increased, the probability of getting a CDI has decreased, and the probability of staying or becoming unemployed shows no clear trend. In this last dimension, there appears to be a difference across the two decades. The

probabilities of becoming unemployed when on a CDD, or remaining unemployed, both decrease in the 1980s, but show no further trend in the 1990s.

3.5.3 Expected time to a CDI

One way of summarizing the information from the transition matrices is to compute the expected time to a CDI starting from different labor market positions.

To compute these expected times, we use, for each year, the estimated transition matrix obtained using either panel data or retrospective information, based on eight different states (CDI, CDD, unemployed, self employed, student, intern, army, other non participation), for 20-24 year olds. Note that this computation assumes static expectations in two dimensions. First it assumes that future transition probabilities for 20-24 year olds will be the same as this year's. Second, it ignores the fact that, as those currently 20 to 24 become older, the relevant transition probabilities will become those relevant for the 25 to 29 year olds, and so on. This second bias leads to an overestimation of the level of expected times to a CDI. But what we care about here are changes over time, and this simple approach is likely to capture them.

The evolution of expected times for the 20-24 age group, starting either from a CDD or from unemployment, is plotted in Figure 10.

Starting from a CDD, the expected time to a CDI appears roughly constant in the 1980s. Starting from unemployment, the expected time decreases slightly. This is the result of two offsetting changes: On the one hand, a decreased probability of getting a CDI starting either from unemployment or from a CDD, leading to an increase in the expected time. On the other, an increased probability of getting a CDD when unemployed, together with a higher probability of getting a CDI starting from a CDD than starting from unemployment. In the 1980s, the two effects roughly cancel each other.

The picture is different in the 1990s, where the expected time increases significantly until the late 1990s, declining partially thereafter. While the expected time based on retrospective information is higher than the expected time based on panel data, both series go up during the period. The expected time from unemployment based on retrospective information increases from 4.8 years in 1990 to 8.2 years in 1996, to decline to 6.5 years in 2000; its panel data counterpart goes from 4.0 to 6.0, down to 4.7 years in 2000.

3.5.4 Wages

A complete picture requires looking also at wages. To do so, we run a standard wage regression, regressing for each year, from 1983 to 2000, the logarithm of the monthly net wage on a set of controls—education (15 categories), age (10 categories) and a dummy equal to 1 if the worker is on a CDD, 0 if on a CDI:

$$\log w_i = X_i\beta + bD + \epsilon_i$$

Figure 11 plots the time series of estimated b 's, from estimation of the wage equation for each year from 1983 to 1998. Given age and education, CDDs appear to pay about 20% less than CDIs. The evidence suggests also that the gap between the two wages has increased over time, from 12% in 1983 to 29% in 1993, and to 22.5% in 2000.

3.5.5 Values

In our model, the welfare effects of partial reform are captured by what happens to V^u , the expected present value of utility if currently unemployed. It is tempting to construct an empirical counterpart and see how it has evolved over time. This is what we do in this last subsection. More specifically, because not all entrants enter as unemployed, we construct not V^u , but the average value \bar{V} , the average expected present value of utility for a 20-24 year old, and look at its evolution over time.

The results of this exercise must obviously be interpreted with more than a grain of salt: There are many assumptions and many steps involved in the construction of \bar{V} , all likely to imply substantial measurement error. Nevertheless, we think this provides a simple way of summarizing what we have seen about the evolutions of transition probabilities and wages in a single statistic.

Let V^i be the expected present value of utility conditional on being in state i today. We consider five states in our computation (CDI, CDD, unemployed, intern, self employed).²⁴ Let V

²⁴Note that we exclude three states: student, army, and out of the labor force. If these states were included, our results would be much stronger (i.e show a larger decline in \bar{V} .) This is because, if the flow utility of being a student is assumed to be low relative to the wage, the increase in the proportion of students would dominate the series, and lead to a large downward trend in \bar{V} . This trend however would be largely unrelated to the issue at hand, namely the role of CDDs.

be the associated vector of utilities associated with the different states. Let A be the transition matrix associated with these different states. Let w be the vector of wages or wage equivalents associated with each state. Then, we construct V as:

$$V = w + \frac{1}{1+r}AV$$

Or equivalently;

$$V = \left(I - \frac{1}{1+r}A\right)^{-1} w$$

\bar{V} is then constructed as:

$$\bar{V} = \sum p_i V_i$$

where the p_i are the proportions of individuals in state i , and sum to one, and V_i are the elements of V .

We focus on the 20-24 age group. For A , we use for each year the estimated transition matrix obtained using either panel data or retrospective information. Just as for the construction of expected times earlier, this computation assumes static expectations in two dimensions, i.e. an unchanged value of the matrix for a given age group over time, and an unchanged transition matrix as individuals in the group get older. The justification is simplicity, and our belief that, as evolutions are qualitatively similar across age groups, this should capture the relevant trends.

For w , we normalize the CDI wage to 1 (i.e. we ignore general wage growth over time). We take the CDD wage to be equal to 1 minus the discount shown in Figure 11 for each year. Based on unemployment benefit rules, we use a value of 0.5 for the wage equivalent when unemployed. Because the transition probabilities to other states are small, the other elements of w play little role in the results; we assume a value of 1 for self employment income, a value equal to the CDD wage for internships. We use an annual interest rate of 12%.

The results are presented in the top panel of Figure 12. The black line gives the series for \bar{V} using panel transitions, the grey line gives the series using retrospective transitions.

The general impression is one of little change in the 1980s, followed by a steady worsening

until the late 1990s, and a partial improvement at the end. According to this measure, (and leaving aside the general increase in real wages over time), the average welfare of the 20-24 year old is slightly lower in 2000 than it was either in 1984, or (and this comparison is safer given the changes in the survey in 1990) than in 1991.²⁵

Can we conclude from this that the effects of CDDs have been perverse? The answer is obviously not. Many other factors have been relevant during that period, and attributing all the change in \bar{V} to the introduction of CDDs would obviously be wrong. But we can make some progress:

Clearly much of the decrease in \bar{V} , especially in the 1990s, must have been due to macroeconomic factors, rather than to the increase in the proportion of CDDs. But here, the evidence from year 2000 is helpful. As we saw earlier, in terms of aggregate transition probabilities, 2000 is arguably the best year of the sample. Yet, in that year \bar{V} is still lower than it was in either 1984, or 1991. In short, the lower value of \bar{V} in 2000 cannot easily be attributed to macroeconomic factors.

We can actually go one step further. Some of the changes in \bar{V} are likely to reflect structural changes in the labor market other than CDDs, changes which might affect all cohorts. In that case, attributing the decline in \bar{V} over the sample to the introduction of CDDs would clearly be wrong. This suggests looking not at the evolution of the average value \bar{V} for the 20-24 age group, but rather at the evolution of this average value relative to the average value for the whole labor force—which is much less affected by the introduction of CDDs.

With this motivation, we plot the evolution of the ratio of the average value for the 20-24 age group to the average value for the 20-59 age group in the bottom panel of Figure 12 (We use the same wages for both groups, thus not taking into account the age profile of wages in computing the two values. This would change the level, but not the evolution, of the ratio over time).

The graph has two main characteristics. First, a nearly continuous decline in the relative value from 1984 to 1997. Then an increase, but to a lower level than at the start of the sample. This suggests two conclusions. First, much of the evolution of the relative value for the 20-24 age group reflects aggregate evolutions, the long worsening and the recent improvement

²⁵ Another finding, not reported here, is how much closer V_{CDD} is to V_U than to V_{CDI} . In that sense, the French labor market has become increasingly dual.

in the labor market: The young suffer more in a depressed labor market. Second, the fact that the value remains lower in 2000 suggests that more has been at work. The extension of CDDs, which disproportionately affects that group, is a plausible candidate explanation for this underlying deterioration. Put more conservatively, there is no evidence that the introduction and development of CDDs has improved the relative welfare of those most affected by it, namely the young.

3.6 Conclusions

We have looked at the effects of the introduction of fixed-term contracts.

On the theoretical side, we argued that the effects of such partial reform may be perverse, leading to higher turnover, and possibly lower welfare: The excess turnover induced by the forced coexistence of fixed-term and regular contracts can be high enough to offset the efficiency gains of improved flexibility.

On the empirical side, we looked at the evolution of labor market experiences for young workers in France since 1983. We found strong evidence of increased turnover, and argued that, if anything, the effect of the fixed-term contracts on the welfare of young workers appears to have been negative.

If our theoretical and empirical conclusions are valid, this suggests that, at least from an economic viewpoint (i.e. leaving aside political economy implications), such partial reform may be a very poor substitute for broader reform, i.e. an across the board reduction in firing costs for all workers.

Many questions remain open for future research. To us, the most important may be how such a reform affects the nature of the jobs offered to workers. We have assumed in our model that contracts had no impact on the nature of the jobs created by firms. There are good theoretical and empirical reasons to think they have. There are two potential effects at work (which parallel the two effects at work on firms' decisions in our model). On the one hand, lower costs on fixed-term contracts give more incentives for firms to take more risks, design jobs which, associated with the right worker, lead to high productivity. On the other, lower costs on fixed-term contracts may instead induce firms to design routine, low productivity jobs, which they can fill through the use of fixed-term contracts. The wage evidence we reviewed in our

paper suggests that this second effect might indeed be at work.

FIGURE 1.
Equilibrium value of being unemployed and threshold
productivity, and the effects of a decrease in c_0

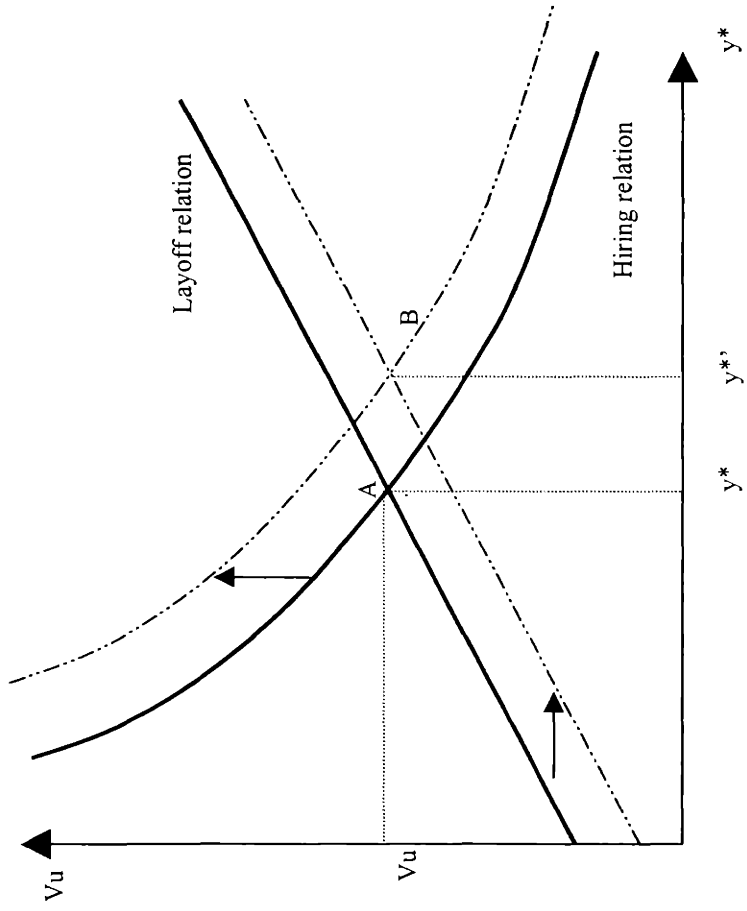


FIGURE 2.
The effects of a decrease in c_0 starting from $c_0 = 0$

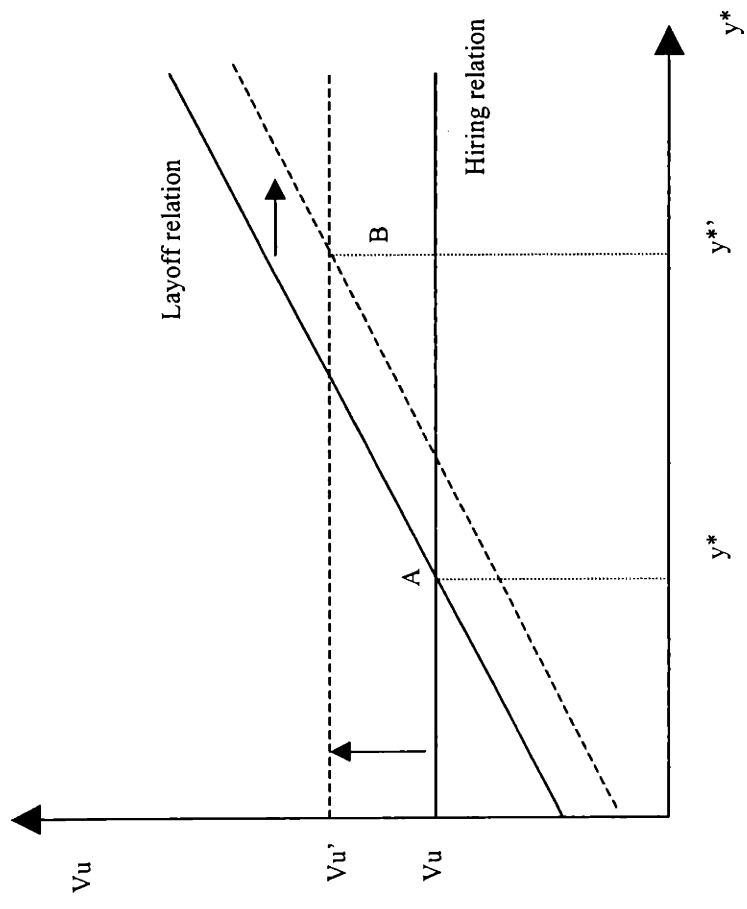


FIGURE 3.
The effects of a decrease in c_0 when $(c-c_0)$ is positive and $f(\cdot)$ is very large

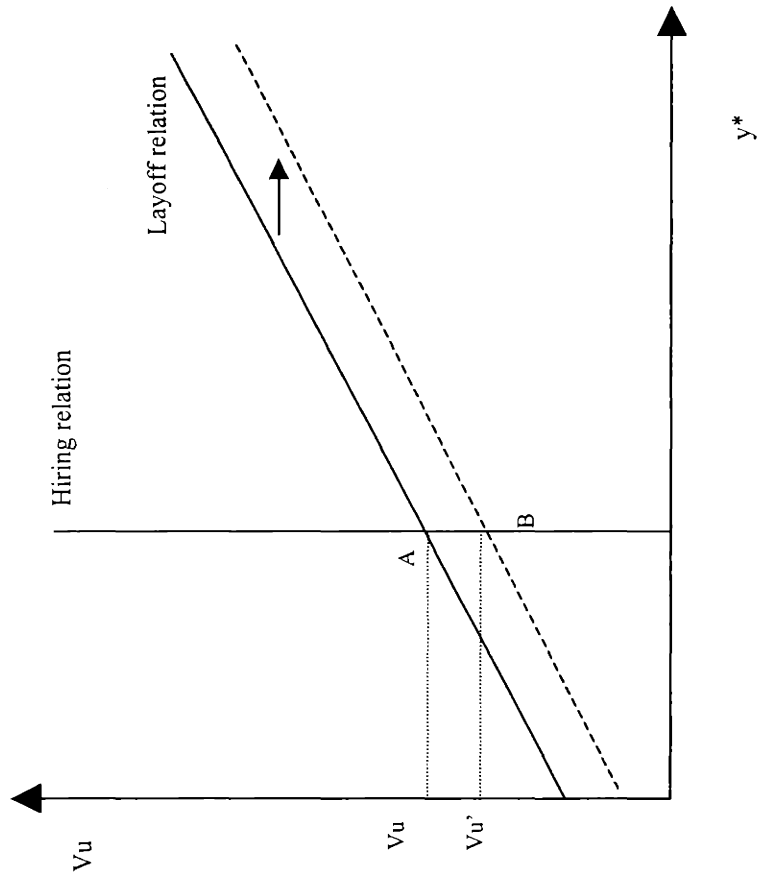


Figure 6. Proportion of CDD in employment

CDD/(CDD+CDI), 1983-2000

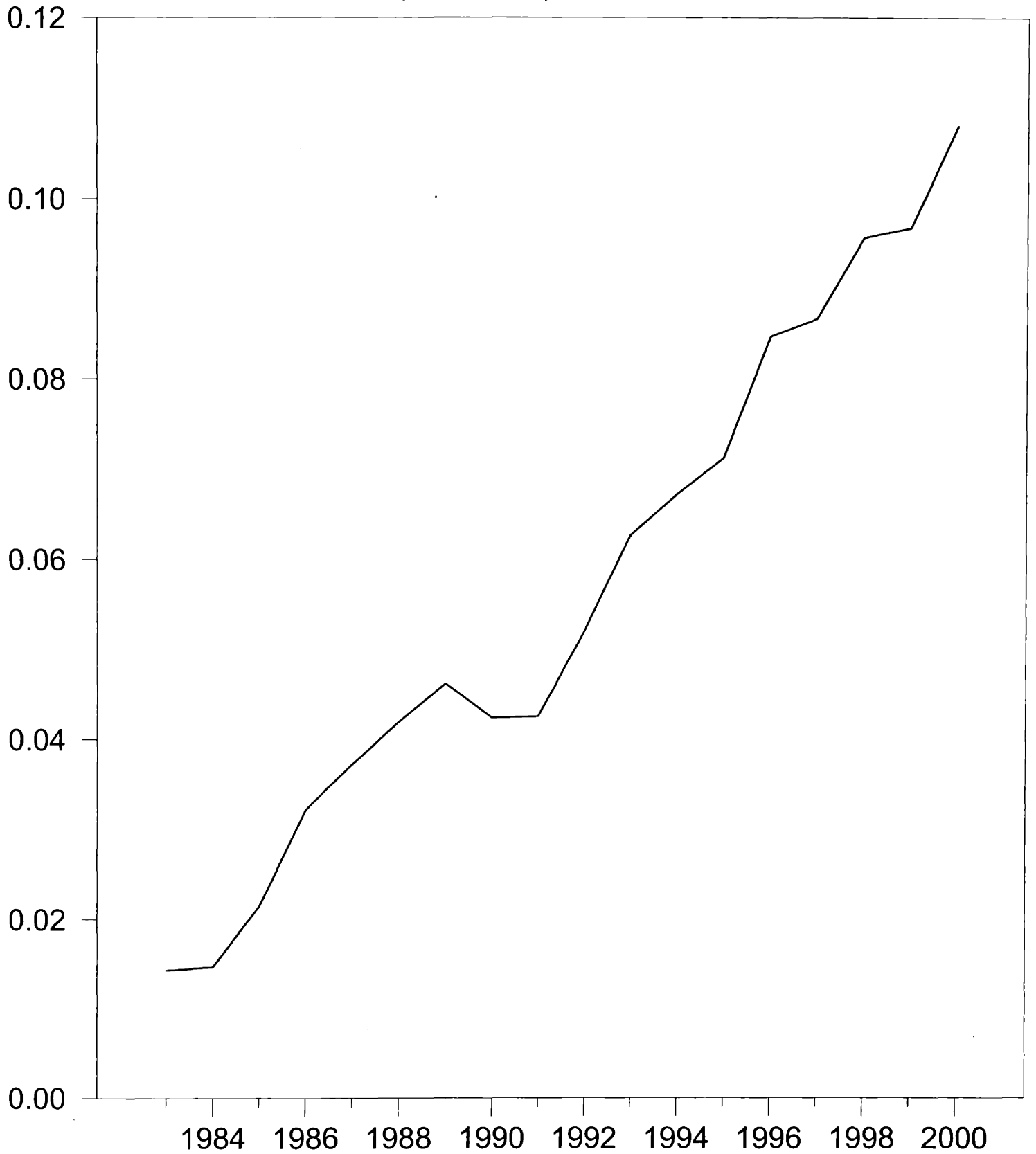


Figure 7. CDDs, CDIs, Students and Unemployed

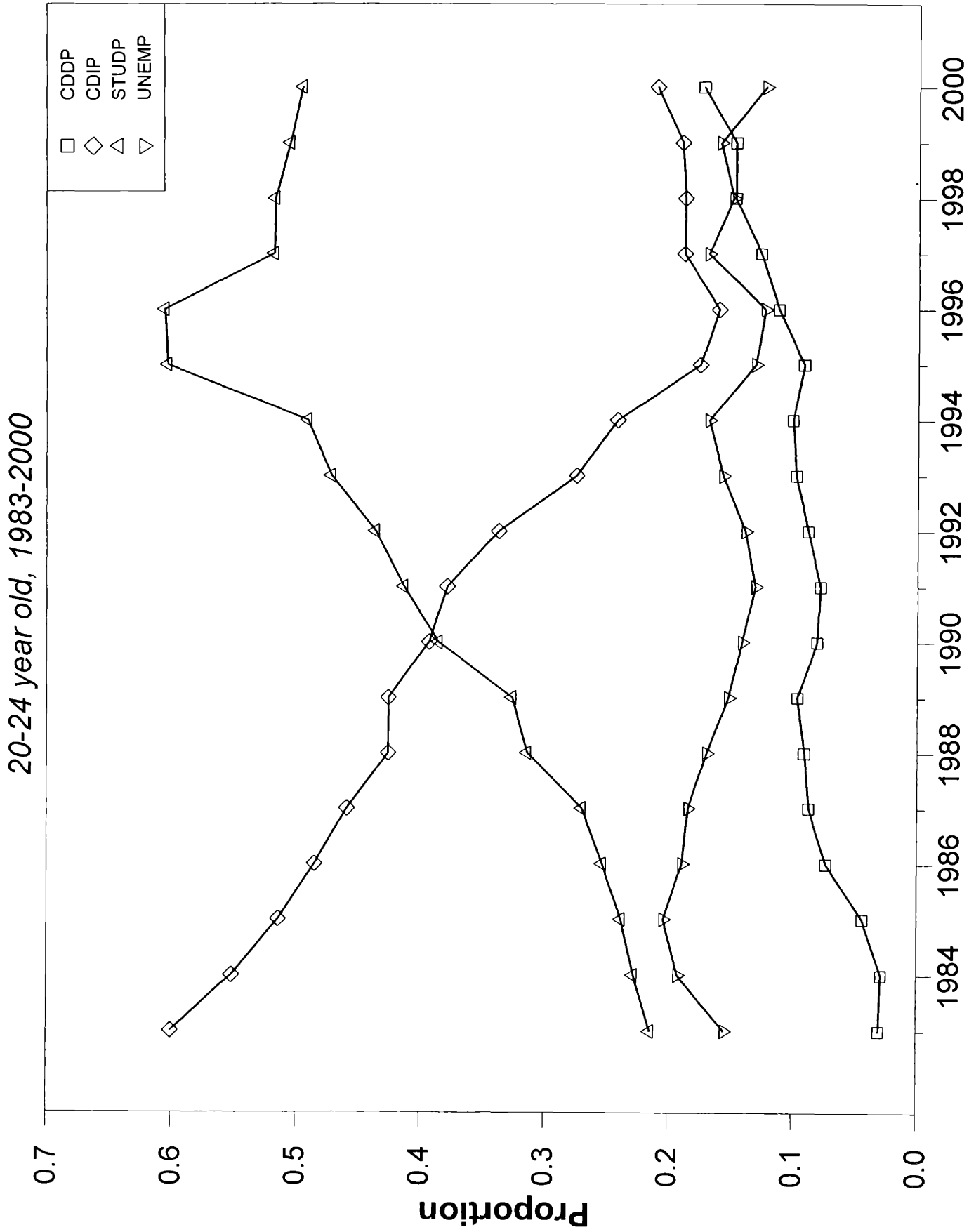


Figure 8. Aggregate labor market conditions, 1983-2000

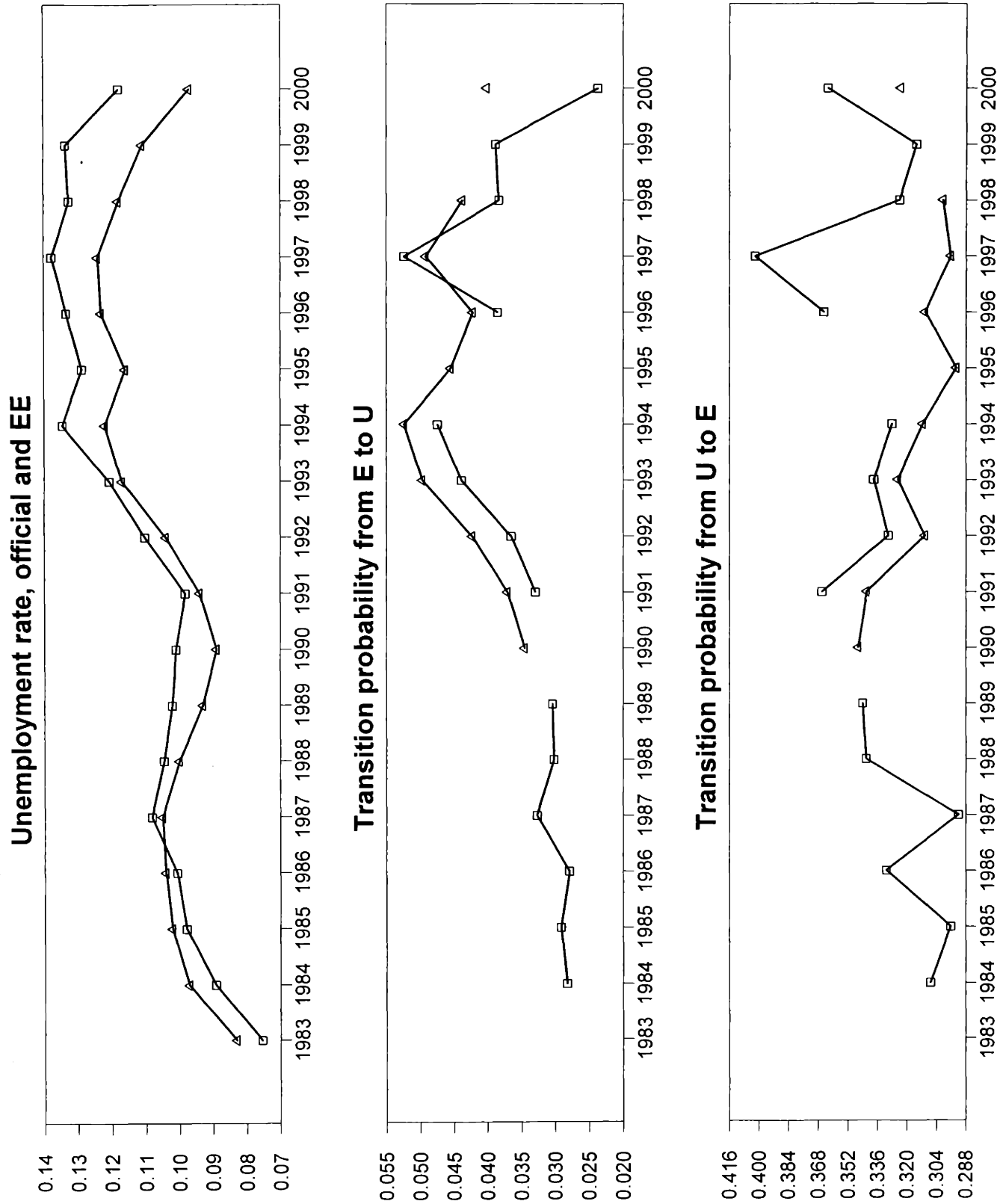


Figure 9. Transition probabilities. U, CDI, CDD

20-24 year old, 1984-2000

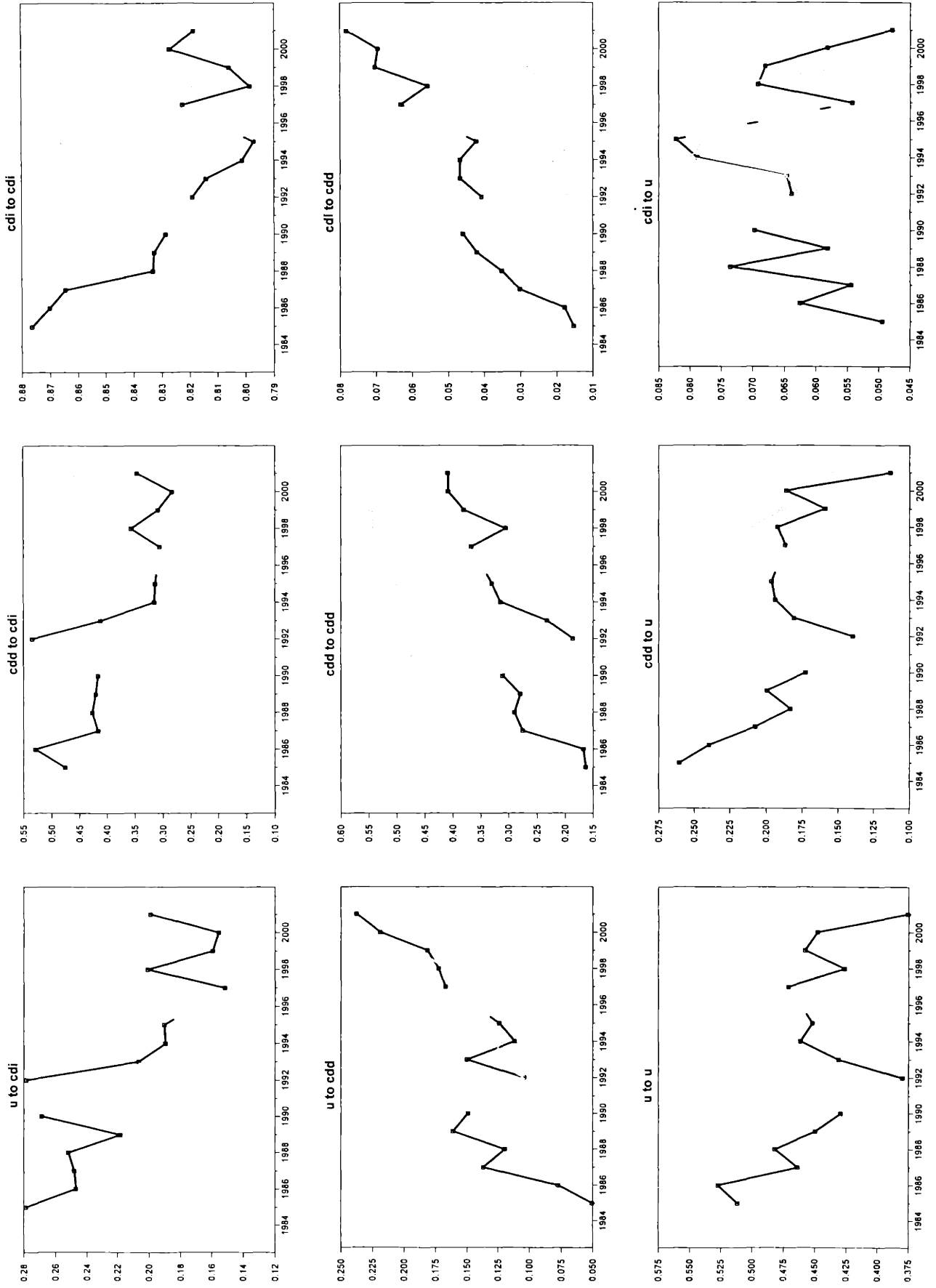


Figure 10. Expected time to a regular job

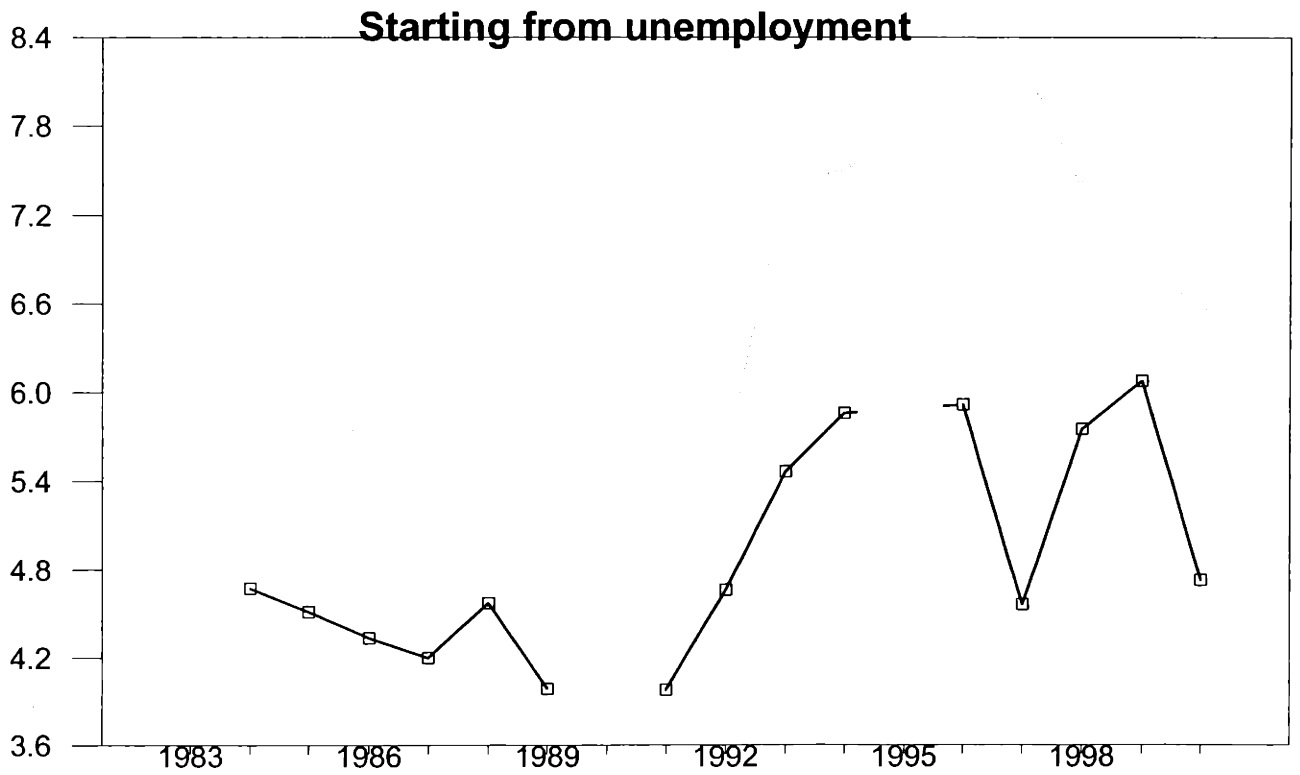
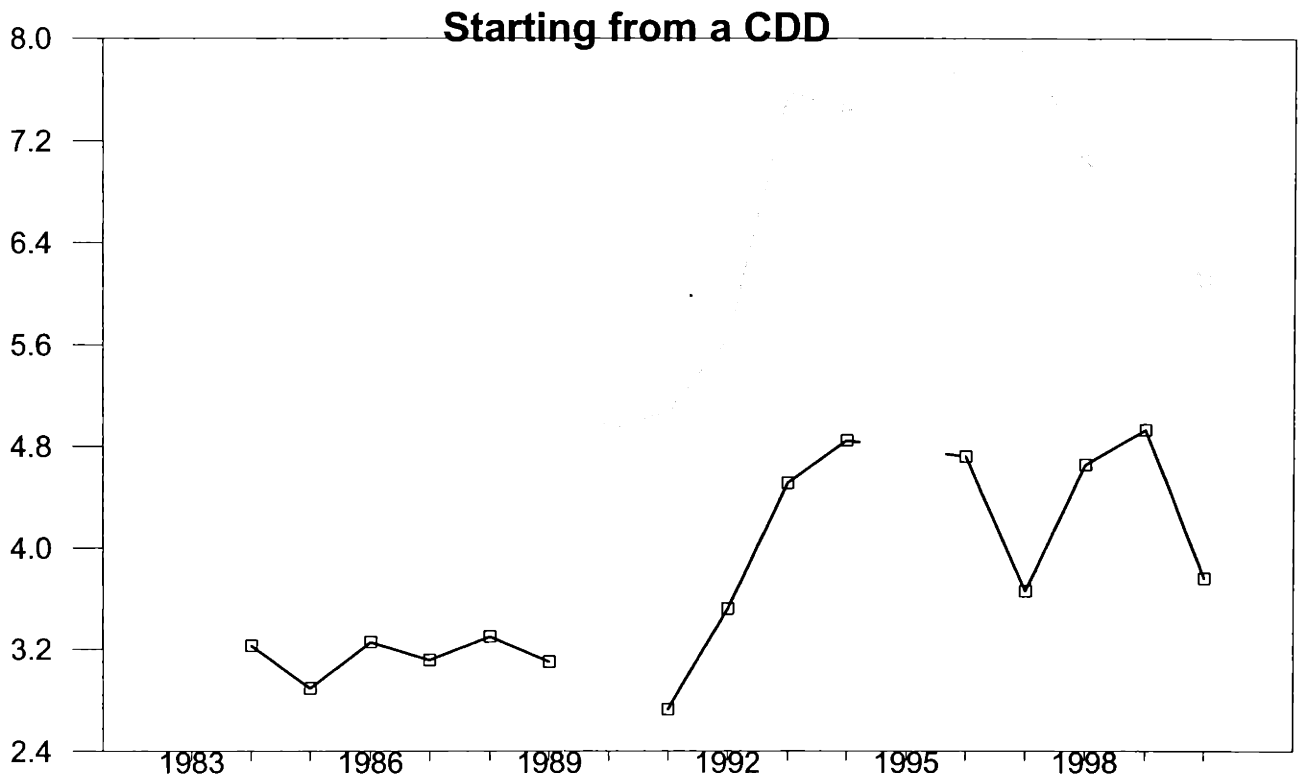


Figure 11. Wage discount for CDDs, with controls

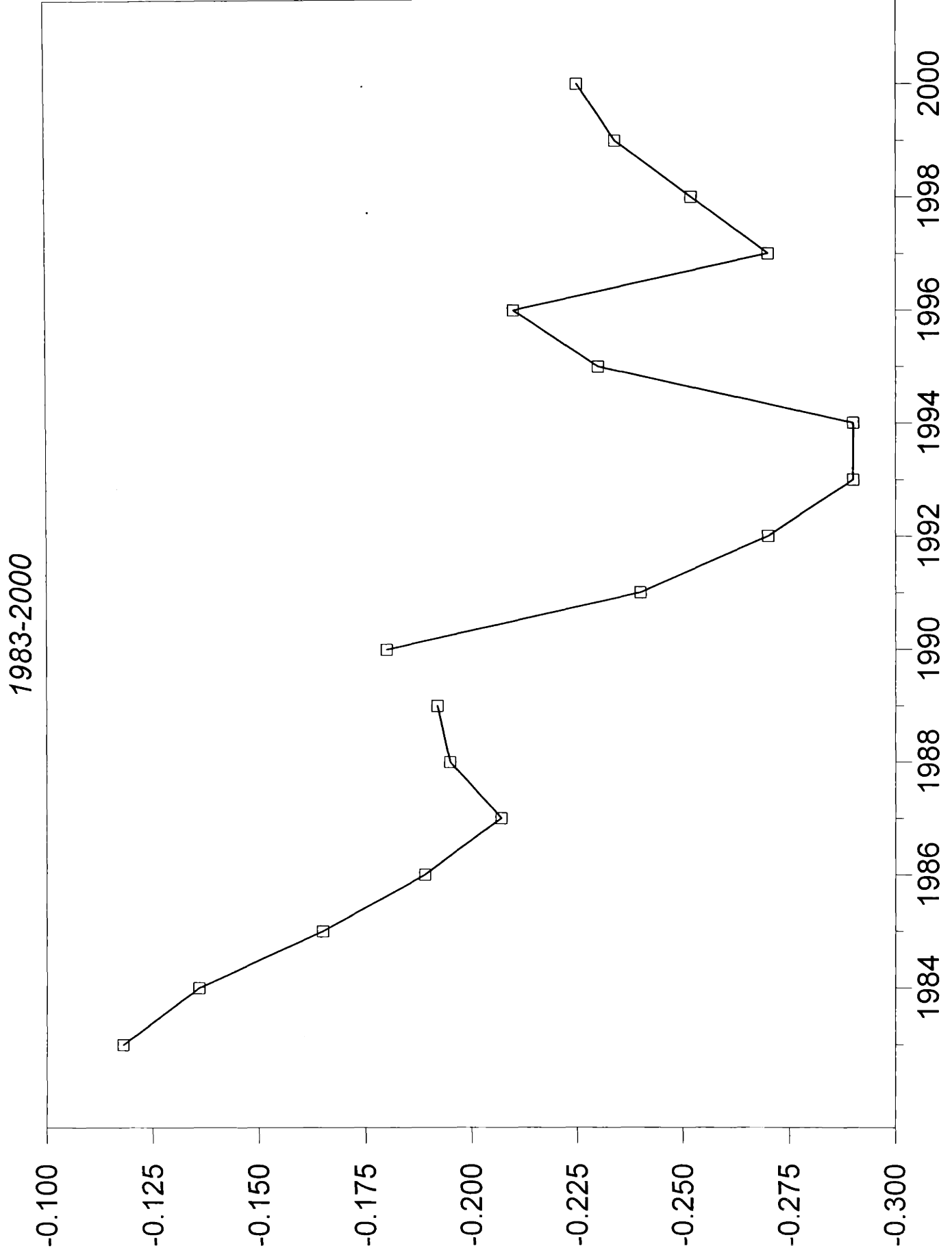


Figure 12. Values

1984-2000

