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FINANCIAL MARKET DEVELOPMENT AND THE RISE IN FIRM LEVEL UNCERTAINTY

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ABSTRACT

Financial Market Development and the Rise in Firm Level Uncertainty*

This Paper posits that firms can choose the degree of risk inherent to their technological/marketing/organizational strategies. Financial market development, by improving risk sharing between owners of listed firms, increases the willingness of these firms to take risky bets. This in turn increases firm level uncertainty in sales, employment and profits. In equilibrium, this effect diffuses to non-listed firms, a group not directly involved in risk sharing. The effect is larger when competition increases, and when labour market institutions are flexible. This Paper thus provides a finance-based, instead of technology-based, rationale for the increase of firm level uncertainty that has recently been documented in France and the US. We then use the French stock market reforms of the late 1980s to test our predictions, using listed firms as the treated group and privately held firms as a control group. Consistent with our model's testable predictions, we find that (1) for listed firms, firm sales volatility has increased markedly after the reforms; and (2) this effect is stronger where product market competition is the strongest. Such evidence holds in front of various robustness checks. In particular, we seek to control for the exposure to international competition and the adoption of new technologies, two forces that may have affected our treatment and control groups differently.

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Financial Market Development and The Rise in Firm Level Uncertainty. *

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October 14, 2004

Abstract

This paper posits that firms can choose the degree of risk inherent to their technological / marketing / organisational strategies. Financial market development, by improving risk sharing between owners of listed firms, increases the willingness of these firms to take risky bets. This in turn increases firm level uncertainty in sales, employment and profits. In equilibrium, this effect diffuses to non listed firms, a group not directly involved in risk sharing. The effect is larger when competition increases, and when labor market institutions are flexible.

This paper thus provides a finance based, instead of technology based, rationale for the increase of firm level uncertainty that has recently been documented in France and the US. We then use the French stockmarket reforms of the late 1980s to test our predictions, using listed firms as the treated group and privately held firms as a control group. Consistently with our model's testable predictions, we find that (1) for listed firms, firm sales volatility has increased markedly after the reforms (2) this effect is stronger where product market competition is the strongest. Such evidence holds in front of various robustness checks. In particular, we seek to control for the exposure to international competition and the adoption of new technologies, two forces which may have affected our treatment and control groups differently.

1 Introduction

This paper argues that financial market development is one of the driving forces behind the rise in firm level uncertainty. Theoretically, we focus on the role of risk sharing among investors. Financial globalization and stockmarket development, by broadening the pool of potential investors, promote risk sharing; this enables firms listed on the stock exchange to adopt more profitable and riskier strategies. But in equilibrium, *all* firms compete on the labor and product markets. In order to maintain their market shares in front of more aggressive listed firms, non listed firms are induced to bear more risk as well. The overall result is a pervasive increase in sales volatility and labor

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market reallocations, amplified by the extent of product market competition. We then find supportive empirical evidence for our theory by looking at French data, using the 1984-1990 stockmarket reforms as an experiment. Focusing on the French experience is useful for two main reasons: first, this event is sufficiently concentrated in time to provide us with a clear break in ownership structure. Secondly, French data give access to a large set of privately held firms, of size comparable to listed ones: we will use them as a control group to filter out contemporaneous shocks to the French economy that have nothing to do with finance. Our evidence holds in front of various robustness checks: in particular, we seek to control for the degree of information technology diffusion, which may have affected publicly and privately held firms differently.

Since the 1970s, most developed economies experienced dramatic developments of their financial markets (see figure 1 for the US, the UK and France). In financial markets, the past three decades have been years of intense financial and technical innovations, unleashed international capital flows and stockmarket reforms. As financial markets became more global, fluid and efficient, a mix of socio-demographic changes in some advanced economies channeled more and more savings to them. As a result of these mutations, the average investor changed from a passive, unexperienced, underdiversified household into an active, sophisticated and potentially foreign fund manager, well aware of notions such as risk, return and portfolio management. While the broad outlook is the same across all developed economies, the details of the picture vary from one place to the other. In the US, the dominant post war trend has indeed been one of rising institutionalization of equity ownership (Friedman [1996]): the share of outstanding equity directly held by households has declined from over 90% in 1950 to about 50% in the mid 1990s, and pension and mutual funds have progressively replaced households as the real owners of corporate America.[1] In France the stockmarket was deeply reformed by the government in the late 1980s. Within a few years, capital controls were lifted, the Paris stock brokers' monopoly was dismantled, tax incentives were provided to equity investors and stock issues were made simpler. This prompted a massive increase in the number of shareholders and in the rising involvement of domestic and foreign financial institutions.[2]

Our theory relates these developments on financial markets to the rise in firm level uncertainty which took place over the past thirty years. This rise in uncertainty is now documented by several empirical studies, mostly on US data, but also for the UK and France. Two stylized facts have been established. Regarding the product market, firms sales have become more volatile among US listed firms[3] (see Comìn [2000] and Philippon [2003]) and UK firms (see Higson et al. [2001]). Regarding

[1] This trend is partly due to demographic factors that have gained momentum in the 1970s: the baby boom cohorts started to accumulate for retirement and they planned to live longer on their pensions. In addition, some categories of workers who were not saving for their pensions before - like women - started to do so (Mitchell [1999]). This propped up the demand for equity through funds. Secondly, defined contribution retirement plans, with a bias toward equity, were given a favorable tax treatment when the 1978 ERISA law was enacted.

[2] For more details, see section 5 of this paper.

[3] Thus far, the evidence for such a trend is sparse, but unanimous: Comìn [2000] and Philippon [2003] have documented a rise in the volatility in total sales for American listed firms from COMPUSTAT. This upward trend is strong whether the variance of sales growth is computed cross sectionnally (growth dispersion across firms in a same year), or in the time dimension using quarterly accounts (variance of sales growth at the firm level, for 20 consecutive quarters). Focusing

the labor market, this literature suggests that the increase in wage inequality is in great part due to an increased dispersion of the transitory component of wages during the 80s and 90s (see for example Gottshalk and Moffit [1994], Haider [1999] for the US, Blundell and Preston [1998], and Dickens [2000] for the UK). In continental Europe this phenomenon translated into a rising job insecurity instead of wage uncertainty (Givord and Maurin [2004] for France during the 90s). Consistently with this, workers now perceive their positions as more insecure than ever (OECD [1997]).

Our theoretical analysis highlight here a new form of interaction between financial, labor and product markets. For this purpose we build a framework where those three markets clear. There are risk averse entrepreneurs who operate on the product market under monopolistic competition. These entrepreneurs may increase their market shares and profits by choosing a larger degree of risk for their technological/marketing/organizational strategies. Hence product market success goes with more risk. On the other hand, equity trading on the financial market allows the entrepreneurs to share part of their risk by selling their firm to a pool of diversified investors. We show that a larger pool of investors encourages the adoption by listed firms of riskier business strategies but whose profits are larger on average. This direct effect comes, however, with an *indirect* effect that appears in general equilibrium and affects *both* listed and non listed firms. By adopting more ambitious strategies, listed firms gain market shares from each other and from privately held firms. To recover their profits, all firms choose to increase the profitability of their project, at the expense of more risk taking. Hence, the rise in firm level uncertainty is pervasive and goes beyond those firms directly involved in risk sharing (ie. listed firms). Moreover we show that a larger degree of competition on the product market enhances this diffusion effect.

Two of the predictions of our model are put to the test: (1) compared to privately held firms, the uncertainty borne by listed firms should increase more following financial development; (2) this effect should be stronger when product market competition is tougher. We use the 1980s French stockmarket reforms as a background to test these predictions on a panel of large firms over the 1984-1999 period which we break down into listed and non listed firms. In order to sort out the pure effect of financial development from other changes that took place in the French economy within the period, we use non listed firms as a control group. We then look at two measures of uncertainty at the firm level: the volatility of firm's sales growth and the elasticity of firm's own sales to industry sales shocks. In both cases our estimates show that uncertainty increases for listed firms after stockmarket reforms, much more so than for privately held firms. These results are robust to various controls, such as firm or industry level measures of adoption of new technologies and exposure to international competition. Last, we show that most of the effect occurs in industry where traditional measures of product market competition are high.

We view this paper as a contribution to both finance and labor literatures. According to the existing literature in macro/labor, the rise in labor market insecurity could be fully accounted by technological

again on COMPUSTAT firms, Pastor and Versonesi [2002], and Wei and Zhang [2003] find that the volatility of US firms' return on equity has shown a strong upward trend over the past thirty years.

causes and by globalization of trade flows.[4] In this paper we highlight a different, complementary, channel where finance is put at the forefront: new, diversified, investors value more volatile returns, and this explains the rise in real, firm level, uncertainty. Hence, technical change and globalization of trade flows might not be the sole driving forces behind the past rise in firm level uncertainty and wage inequality (in English speaking countries) or unemployment (in continental Europe).

To be fair, some existing papers have been investigating the impact of financial development on the labor market; those papers have however mostly argued that the balance of power may have shifted in recent decades away from workers toward capitalists.[5] However, any macroeconomic interpretation of recent trends in light of this literature requires to explain why labor's share in GDP has been fully stable in most OECD countries. Our paper takes another route: better financial systems do not affect the sharing rule between capital and labor, but improve risk sharing among investors.[6]

Last, our analysis may shed light on a famous recent result from the finance literature. Campbell, Lettau, Malkiel and Xu (2000) have shown that the idiosyncratic volatility of stock returns has sharply increased over the past decades. This could partly reflect the fact that listing costs decreased over the period allowing younger but more risky firms to list on stockmarkets (the NASDAQ was created in 1971). But as shown by Pastor and Veronesi [2002] and Malkiel and Xu [2001], this line of explanation cannot fully account for rise in idiosyncratic volatility[7]. In contrast to this "pure finance" view, some very recent contributions suggest that the rise in stock returns volatility is in fact driven by real effects since firms' real profits have also become more uncertain.[8] Our explanation for the rise in stock return volatility is that it correponds to a real rise in firm level uncertainty, itself triggered in the financial

[4] The technological change hypothesis emphasizes the role of flexible technologies (e.g. Comìn [2000] or Aghion et al. [2002]) and flexible organizations (Thesmar and Thoenig [2000]). The trade hypothesis highlights the relation between globalization and insecurity through foreign outsourcing (Antras and Helpman [2003]) or political economy (Rodrik [1997]).

[5] Along these lines, a small literature had emerged after the 1980s wave of LBOs and MBOs in the US, whose main argument was that the use of debt allowed firm owners to extract more rent from the workers (Bronars and Deere [1991], Perotti and Spier [1993], Ichino [1994]). More recently, Blanchard and Philippon [2004] have argued that the rising cross border capital mobility has weakened the unions' bargaining power in the 1980s; in countries where unions did not acknowledge it, unemployment shot up as a result. Closer to our approach is Perrotti and Von Thadden [2003]'s analysis of the political economy of bank versus market based finance: in their model, the median voter will be biased toward bank dominance, because this is a guarantee that firm will seek stable, but less profitable, markets.

[6] When emphasizing this mechanism, we rely on insights from the international economics and development literatures. In development economics, this is the main reason why a sound financial industry may be a key engine of growth (Greenwood and Jovanovic [1990], Saint Paul [1993]) and why development might be a virtuous circle (Acemoglu and Zilibotti [1997]). This very same insight has also been applied in the area of international macroeconomics, where the main line of argument is that international capital mobility allows to take full advantage of international trade. The reason is that ricardian specialization is risky for members of a single country if they cannot diverisify part of their income by buying claims contingent on the output of other countries (Helpman and Razin [1978], Obstfeld [1994]). The relation between capital flows and specialization has recently been tested by Kalemli-Ozcan, Sorensen and Yosha [2000].

[7] Alternatively Morck, Yeung and Yu [2000] argue that the US financial markets have become more efficient, such that investors use more firm specific information, and less industry level information when they trade; hence, stock returns become less correlated. However, as Wei and Zhang [2003] point out, such a statement ignores the causes of the increase in the absolute level of idiosyncratic volatility.

[8] For this view, see Wei and Zhang [2003] and Pastor and Veronesi [2002]. Those papers have established two facts: (1) the volatility of firm's profitability has increased over the past three decades, and (2) the volatility of profitability is strongly correlated with stock price uncertainty in cross section empirical analyzis.

sphere.

The next section lays out the model, section 3 solves it and section 4 draws the main predictions. Section 5 presents our data and some facts. Section 6 brings some of the theoretical predictions to the test. Various robustness checks are performed in section 7 and section 8 concludes.

2 The Model

We consider a static economy endowed with L risk-averse workers. There are three markets: the financial market, the labor market and the product market on which n firms compete imperfectly. These firms are initially owned by some workers that we call entrepreneurs. Among these firms, a share μ_L is listed on the stockmarket while the remaining share μ_N is non listed (ie. privately held). To simplify exposition, we assume n, μ_L and μ_N to be exogenously fixed.

The sequence of events has three periods. At date 1, each entrepreneur, whether her firm is listed or not, chooses a strategy indexed by $0 \leq s \leq 1$. A strategy defines both the mean and the variance of the demand addressed to the firm, and we assume that a larger average demand comes at the expense of more uncertainty. At date 2, the financial market clears and risk sharing takes place: $\mu_L n$ entrepreneurs sell the shares of their firms to investors. At date 3, demand uncertainty is revealed and production takes place; the product and labor markets clear; the savers obtain the earnings from the securities they hold; everyone consumes.

2.1 Demand Side

Each agent $k \in (0, L)$ in the economy has a CARA utility

$$U_k = -e^{-aC_k} \tag{1}$$

where C_k is a consumption index which depends on the consumption levels $y_{k,i}$ of the n different goods i which are produced under monopolistic competition. The consumption index is given by the usual Dixit Stiglitz formulation:

$$C_k = \left(\sum_{j=0}^{n} (1 + \tilde{\delta}_i)^{\frac{1}{\sigma}} . y_{k,i}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{2}$$

where we assume n to be large and $\sigma \geq 2$. The difference with the standard Dixit Stiglitz framework is that consumers experience taste shocks, modelled by random coefficients $\tilde{\delta}_i$. These shocks are the *only* source of uncertainty in the model and for the sake of simplicity we will assume that they are Gaussian.[9] The $\tilde{\delta}_i$'s are assumed to be good-specific, small and uncorrelated: hence all agents k experience the same taste shocks on the good i. This extreme form of correlation structure is not

[9] More rigourously, $\widetilde{\delta_i}$ should be drawn from a *truncated* gaussian distribution since demand cannot be negative. To focus on the economics of the model, $\widetilde{\delta_i}$ is assumed to be small such that we can ignore the fact that its distribution is truncated on the left tail.

necessary; what matters here is that there is some scope for risk sharing among entrepreneurs. Finally the specific mean-variance profile of the taste shock $\tilde{\delta}_i$ is a choice variable of the firm i (cf. infra).

Given these assumptions about preferences, the total demand y_i addressed to each industry i, can be easily derived by aggregating the individual demand functions $y_{k,i}$ over the whole population $k \in (0, L)$:

$$y_i = (1 + \tilde{\delta}_i).\frac{E}{P}.(\frac{p_i}{P})^{-\sigma} \tag{3}$$

where p_i is the price charged by the monopoly producing the good i, $E \equiv \sum_0^L E_k$ is the aggregate nominal expenditure and P is a price index equal to:

$$P \equiv \left(\sum_{j=0}^{n} (1 + \tilde{\delta}_j).p_j^{1-\sigma} \right)^{1/1-\sigma} \tag{4}$$

2.2 The Strategy: Standardization vs Customization

Each good i is produced by a monopoly owned by an entrepreneur. At date 1, the entrepreneur chooses[10] her marketing strategy $0 \leq s \leq 1$; this choice impacts the distribution of demand shocks $\tilde{\delta}_i$ that the firm experiences at date 3. We posit that the demand shock is drawn from a Gaussian distribution with mean s and variance $s^2\Sigma$:

$$\tilde{\delta}_i \sim N(s, s^2\Sigma) \tag{5}$$

While such strategies could receive many alternative interpretations, we will refer to the choice of s as the "customization policy". Under this interpretation, $s = 0$ can be thought of as the design of a standardized good whose market demand is fully safe but remains small. On the contrary, $s = 1$ corresponds to the design of a fully customized, potentially highly valuable, good but whose demand is difficult to predict because of erratic trends and fashions.[11]

Finally, whatever the choice of s, each firm exploits a constant return to scale technology; it uses labor l paid at a wage w to produce:

$$y = l \tag{6}$$

[10] This trade-off and its interpretation in term of customization is also analyzed (but in a very different context) by Benabou (2003).

[11] This interpretation is remotely inspired from Piore and Sabel [1984]'s vision of modern manufacturing. Their basic line of argument was that the targeting of uncertain product niches was to be the hallmark of the third industrial revolution, because of excess competition and insufficient demand for standardized goods. The development of new, flexible, production technologies was to be key in fostering the "second industrial divide", where firms would have to evolve in more uncertain environment. In order to cope with this changes, firms would have to adopt more flexible, skilled intensive organizations. These organizations share common feature with the dominant production mode of the XIXth century, *craft production*. Piore and Sabel describe industrial districts of small, cooperating, reactive firms (like Boston's route 128) as epitomizing how production should be structured after the "second industrial divide". Twenty years later, it is unclear whether new craft production has become the dominant organizational paradigm, but casual empiricism suggests that firms now operate on more uncertain markets, that reactivity matter, and that product marketing has become much more important than ever (on this see e.g. Askenazy, Thesmar and Thoenig [2004]).

2.3 The Financial Market

The $\mu_L n$ entrepreneurs who own a listed corporation may sell equity (claims on their firms' profits) on the financial market. The pool of investors consists of an exogenous number $\phi L < L$ of agents that are given access to security trading on a domestic financial market. To make the analysis tractable, we follow Pagano [1993] and assume that these agents are also given the right to borrow or buy an infinite amount of savings from international capital markets at a given risk free rate R.[12]

The financial market allows to trade two types of securities. First, it allows the ϕL investors to issue bonds at the exogenous risk free rate R: hence there is no restriction on short sales or borrowing, like in Pagano [1993]. Second, claims on listed firms' profits can be sold by entrepreneurs, and bought by investors with access to the financial markets. These securities give to their owners a right to a fraction of profits. In the following, we use for these securities the labels "equity" or "shares" interchangeably, although the exercise of control rights usually attached to the possession of equity is not explicitly modelled here. In addition, entrepreneurs do not need external capital to produce. Hence, in this model, the sole role of financial markets is to share risk.

Given our assumptions, there are ϕL investors on the demand side of the stockmarket. On the supply side, there are $\mu_L n$ firms going public. In the rest of the analysis, we will interpret ϕ, our main comparative statics variable, as the *degree of risk sharing* between investors.

3 Basic Results

We solve the model backwards. At period 3, after observing its idiosyncratic demand shock $\tilde{\delta}$, each firm maximizes its own monopoly profit. At period 2, trade of financial assets takes place. At period 1, both listed and privately held firms choose their degree of customization s.

3.1 Firm Profits

At date 3, after the idiosyncratic demand shock $\tilde{\delta}$ is revealed, each entrepreneur chooses the amount of production in order to maximize her monopoly profit:[13]

$$\tilde{\pi} = \max_{l}(1+\tilde{\delta})^{1/\sigma}.(P^{\sigma-1}E)^{1/\sigma} l^{\frac{\sigma-1}{\sigma}} - wl \tag{7}$$

which depends on demand shock $\tilde{\delta}$. Solving this maximization problem gives the following reduced form for the firm's profits:

$$\tilde{\pi} = (1+\tilde{\delta}).\underbrace{\frac{(\sigma-1)^{\sigma-1}}{\sigma^{\sigma}}.\left(\frac{P}{w}\right)^{\sigma}.\frac{E}{P}}_{\equiv\pi_0} \tag{8}$$

[12] A perfectly equivalent alternative assumption is that (1) investors have large endowments of savings and (2) that they can invest either in stocks or in a riskless security of return R (Pagano [1993]).

[13] We implicitly assume here that, even when the firm is widely held, there are no agency costs of separation of ownership and control. Our view in this paper is that past changes in financial markets have had much more impact on the degree of risk sharing between investors than on the separation of ownership and control. Put otherwise, risk sharing has improved much more than corporate governance.

where π_0 corresponds to the profits of a fully standardized firm (ie. with no uncertainty):

Given the mean-variance trade-off [5], the mean and variance of the firm's profits are increasing in s and are given by:

$$\begin{cases} E\tilde{\pi}\left(s\right) = (1+s).\pi_0 \\ VAR\tilde{\pi}\left(s\right) = \Sigma s^2.\pi_0^2 \end{cases} \tag{9}$$

In this set-up, a risk neutral firm owner would always choose the largest s; what prevents it to happen is that owners are risk averse.

3.2 Risk Sharing On The Stockmarket

In this section we derive the equilibrium price level of shares sold by listed firms at period 2. As entrepreneurs are risk averse, they gain from being listed because the sale price of their firm is larger than the utility they would derive from holding it: financial markets enable entrepreneurs to share risk with the investors.

Portfolio Selection by Investors

On the supply side there are $\mu_L n$ listed firms, indexed by j; each one issuing a measure 1 of shares. Each share j is traded at price ρ_j. On the demand side there are ϕL investors, indexed by k: each one borrows on international markets b_k units of savings at rate R in order to buy x_{kj} shares of each firm j. Investor k's budget constraint thus writes as:

$$\sum_{j=0}^{\mu_L n} x_{kj}\rho_j \leqslant b_k \tag{10}$$

Her ex post consumption is equal to the labor and net financial incomes taken in real terms:

$$\tilde{C}_k = \frac{w}{P} + \frac{1}{P}\left[\sum_{j=0}^{\mu_L n} x_{kj}\widetilde{\pi}_j - (1+R)b_k\right]$$

Plugging back the budget constraint [10] into the consumption expression leads to:

$$\tilde{C}_k = \frac{1}{P}.\left[\sum_{0}^{\mu_L n} x_{kj}\left(\widetilde{\pi}_j - \rho_j R\right) + w\right] \tag{11}$$

The program of investor k consists of maximizing her expected CARA utility [1] with respect to her portfolio $\{x_{kj}\}_{j=0}^{\mu_L n}$, taking equity prices ρ_j, the risk free rate R and ex post deterministic wage w as given. As the $\tilde{\delta}$ demand shocks are Gaussian, so are the profits $\tilde{\pi}_j$ and therefore the consumption level $\tilde{C}_k$. As it is standard in such a CARA -Gaussian framework, solving this investor's problem amounts to maximizing the following mean-variance criterion:

$$\max_{\{x_{kj}\}_{j\in(0,\mu_L n)}} \quad \frac{w}{P} + \sum_{j=0}^{\mu_L n}\left[x_{kj}\frac{E\tilde{\pi}(s_j) - \rho_j R}{P} - \frac{a}{2}\frac{x_{kj}^2.VAR\tilde{\pi}(s_j)}{P^2}\right] \tag{12}$$

Thus, the demand for share j by investor k is given by:

$$x_{kj} = P.\left\{\frac{E\tilde{\pi}(s_j) - R\rho_j}{a.VAR\tilde{\pi}(s_j)}\right\} \tag{13}$$

where $E\tilde{\pi}(s_j)$ and $VAR(\tilde{\pi}(s_j))$ as functions of s_j are given by equations [9]. Demand for risky asset j is a decreasing function of risk aversion a, its risk $VAR(\tilde{\pi}(s_j))$ and of its price ρ_j. It is, of course, an increasing function of its expected return $E\tilde{\pi}(s_j)$.

Equilibrium on the Stockmarket

We assume that entrepreneurs taking their firms to the public do not behave like monopolies when they supply securities to the stockmarket.[14] The price of their firm is therefore taken as given and lies at the intersection of the demand and supply curves of share of firm j. X_j^d is the aggregate demand for shares j and can be easily obtained through adding individual demands given by [13] for all ϕL investors:

$$X_j^d = \phi L.P.\left\{\frac{E\tilde{\pi}(s_j) - R\rho_j}{a.VAR\tilde{\pi}(s_j)}\right\}$$

As the overall supply of shares is equal to one, we get that in equilibrium:

$$\rho_j = \frac{1}{R}\left\{E\tilde{\pi}(s_j) - \frac{a}{\phi L}\frac{VAR\tilde{\pi}(s_j)}{P}\right\} \tag{14}$$

This equilibrium condition illustrates the benefits of risk sharing for the entrepreneur: by selling her firm to the market, she will receive the amount ρ_j of savings. In doing so, she will behave as if she had reduced her risk aversion from a to $a/\phi L$.

3.3 The Choice of s

At period 1, entrepreneurs choose their marketing strategies s_j in order to maximize their own utilities. However, this utility takes a very different form whether the entrepreneur will take her firm to the public or not. For future listed firms, the choice of s_j will affect the sales price of the firm ρ_j. For firms remaining privately held, this choice of s_j will affect the entrepreneur's utility through both expectation and variance of her ex post income, as can be seen from equation [12].

Given our CARA assumption, the utility of an entrepreneur of a non listed firm writes as:

$$U_j^N = \frac{w}{P} + \underbrace{\left(\frac{E\tilde{\pi}(s_j)}{P} - \frac{a}{2}\frac{VAR\tilde{\pi}(s_j)}{P^2}\right)}_{\text{utility derived from own firm}} \tag{15}$$

As her firm j is not listed, the entrepreneur bears all the specific risk specific linked to it. She chooses a degree of customization s such as to maximize her utility U_j^N. Given the definitions of $E\tilde{\pi}$ and $VAR(\tilde{\pi})$ (see equations [9]), we have:

$$s_N = \frac{1}{a\Sigma}.\frac{1}{\pi_0/P} \tag{16}$$

[14] This assumption allows us to suppress an unwanted market imperfection, but does not affect our qualitative results (see Pagano [1993]).

When the entrepreneur sells her firm to the market, her utility writes:

$$U_j^L = \frac{w}{P} + \underbrace{\left(\frac{E\tilde{\pi}(s_j)}{P} - \frac{a}{2\phi L}\frac{VAR\tilde{\pi}(s_j)}{P^2}\right)}_{\text{utility derived from own firm, after IPO}} \tag{17}$$

In contrast to an entrepreneur that did not list, she is able to partly diversify her risk with other entrepreneurs and ϕL investors. Hence, she acts as if her risk aversion were smaller. Again, given the definitions of $E\tilde{\pi}$ and $VAR(\tilde{\pi})$, the strategy maximizing her utility is:

$$s_L = \frac{\phi L}{a\Sigma}.\frac{1}{\pi_0/P} \tag{18}$$

We thus have that entrepreneurs of listed firms choose riskier projects than private ones:

$$s_N < s_L = \phi L.s_N \tag{19}$$

At this point, two remarks are in order. First, while it is fairly intuitive, the positive relation we obtain between risk taking and risk sharing is not theoretically robust. It depends on the type of utility function that we use and more importantly on the correlation structure of the different assets. In constraining the model to produce this result, we follow insights from both development and international finance literatures, who actually uses simpler correlation structures (Greenwood and Jovanovic [1990], Saint-Paul [1993], Obstfeld [1994] and Acemoglu-Zilibotti [1997]). The reader must bear in mind that our purpose in this theoretical analysis is to study this mechanism in general equilibrium and its interaction with product market competition, not to establish that diversification may be good for risk taking. Secondly, given our CARA specification, the relation between risk taking and risk sharing we exhibit here rests on a plain size effect: listed firms generate larger, and therefore much more volatile incomes (see the trade-off embodied in [9]). Non listed firms do not want this and prefer lower, but less uncertain, incomes.[15]

4 Financial Market Development in General Equilibrium

We now study the impact of financial market development, which the model describes as a broadening of the pool of investors ϕL. From the previous analysis, we know that in partial equilibrium - for given wage w and price P - a larger ϕ will make owners of listed firms behave more like risk neutral investors. As a consequence, the risk taken by public firms s_L will increase. An increase in ϕ has, however, no direct effect on s_N since owners of privately held firms are not directly affected by changes on the stock market. However, a look at [16] and [18] shows that s_L and s_N also depend on aggregate variables (the term π_0/P in each equation) which are affected by a change in ϕ. Therefore, we expect stockmarket development to have an *indirect effect* on both listed *and* private firms through its general equilibrium effect on wages w and price P. This is what the following analysis will make clear.

[15] Using a CRRA utility function and lognormal distributions for product specific demand shocks, we are in a position to obtain the same effect without a size effect. In such a model however, we have to dramatically simplify the correlation structure.

4.1 The Indirect Effect

To compute the values of s_L and s_N in equilibrium, we need to obtain π_0/P, the real profit of a firm adopting a riskless strategy. This requires to clear both product and labor markets. At the firm level, labor demand is easily derived from program [7]. By aggregating on the whole set of firms, the labor market clearing condition writes:

$$L = \frac{(\sigma-1)^\sigma}{\sigma^\sigma}.\frac{E}{P}.(\frac{P}{w})^\sigma.\left[n\mu_L(1+s_L)+n\mu_N(1+s_N)\right] \tag{20}$$

Similarly profit maximization [7] leads to the price charged by each monopoly. Using its definition [4], we derive the consumption price index:

$$P = \frac{\sigma}{\sigma-1}.w.\left[n\mu_L(1+s_L)+n\mu_N(1+s_N)\right]^{1/(1-\sigma)} \tag{21}$$

Given these two equations, profits are easily given by:

$$\frac{\pi_0}{P} = \frac{L}{\sigma}.\left[n\mu_L(1+s_L)+n\mu_N(1+s_N)\right]^{(2-\sigma)/(\sigma-1)} \tag{22}$$

As $\sigma \geq 2$, the profit π_0/P is decreasing with respect to the average degree of customization within the economy, $(\mu_L s_L + \mu_N s_N)$. The intuition for this is that a standard pro competitive effect is at work. Firms compete for resources on the labor market: an increase in $(\mu_L s_L + \mu_N s_N)$ means that the average demand shock $\tilde{\delta}$ is larger. This props up aggregate labor demand, and as labor supply is inelastic, wages go up and profits fall.[16]

Now that we computed the equilibrium level of riskless profits π_0/P, we obtain the values of s_L and s_N from equations [18] and [16]. They are implicitly given by the following two equations:

$$s_N = \frac{\sigma}{L.a\Sigma}.\left[n\mu_L(1+s_L)+n\mu_N(1+s_N)\right]^{(\sigma-2)/(\sigma-1)} \tag{23}$$

$$s_L = \frac{\sigma}{L.a\Sigma}.\phi L.\left[n\mu_L(1+s_L)+n\mu_N(1+s_N)\right]^{(\sigma-2)/(\sigma-1)} \tag{24}$$

Using these equations, we immediately obtain that:

Result 1: *After a broadening of the shareholder base ϕ, both listed and non listed firms adopt more risky strategies.*

$$\frac{ds_N}{d\phi} > 0 \; ; \; \frac{ds_L}{d\phi} > 0 \text{ and } \frac{d(s_L - s_N)}{d\phi} > 0$$

As is apparent from [23-24], financial development affects the economy through two channels. The direct channel, acting only on listed firms s_L corresponds to the *improvement of risk sharing*: more

[16] In fact two countervailing effects are at work. As usual in monopolistically competitive frameworks, more production reduces prices through the standard demand externality of Dixit Stiglitz models, which props up aggregate demand and therefore profits. Given that $\sigma \geq 2$, this demand externality effect is however dominated by the pro competitive effect described in the text.

numerous investors are on average smaller equity holders, who are therefore willing to pay more for a larger s_L. The indirect effect corresponds to the s_L terms on the right hand sides of [23-24]: both s_L and s_N are increasing functions of s_L. More risk taking s_L implies that the average listed firm will want to produce more and therefore hire more. Real wages go up and profits π_0/P decline. As firms' profits become smaller, owners of all firms are willing to bear more risk because their risk aversion is constant. This increases the willingness of privately held firms to take on risk and amplifies the direct effect for listed firms. Finally $d(s_L - s_N)/d\phi > 0$ means that the difference between listed and non listed firms in term of risk taking increases with ϕ; this last result will be useful for our empirical analysis which relies on a *difference-in-difference* strategy.

A simple extension of this model, available from the authors upon request, endogenizes the listing decision of firms. In this case, it is easy to show that similar comparative statics can be derived with respect to listing costs. A decrease in listing costs raises the number of listed, on average more profitable, firms. This puts upward pressure on wages which reduces the size of all profits. As a result, risk taking increases for all firms. The reason why we do not stress these results in the paper is that the number of listed firms is fairly constant in our empirical application to France (see below). Such a theoretical result would, however, be of interest in the US background.

4.2 Firm Level Uncertainty

It is straightforward to see that the *size-adjusted variances* of labor demand $\tilde{l}$ and sales $\tilde{y}$ for listed and private firms are increasing with their degrees of customization s_L and s_N. Indeed basic computations give for listed and private firms respectively:

$$\frac{VAR(\tilde{y}_L)}{E(\tilde{y}_L)^2} = \frac{VAR(\tilde{l}_L)}{E(\tilde{l}_L)^2} = \frac{s_L^2}{(1+s_L)^2}.\Sigma \tag{25}$$

$$\frac{VAR(\tilde{y}_N)}{E(\tilde{y}_N)^2} = \frac{VAR(\tilde{l}_N)}{E(\tilde{l}_N)^2} = \frac{s_N^2}{(1+s_N)^2}.\Sigma \tag{26}$$

As a consequence, all the results related to s_L and s_N can be expressed in terms of firm level uncertainty of sales and labor demand.

Result 2: *After a broadening of the shareholder base ϕ, the size adjusted uncertainty of sales, employment and profits rises in both listed and non listed firms.*

Hence, the size adjusted uncertainty borne by listed firms increases when their own shareholders become more diversified. Less obviously, this rise in uncertainty arises *for those firms who are not directly related to the stockmarket.* Hence, because of product market competition, the rise in firm level uncertainty can be both large and pervasive even if the share of listed firms is a priori small.

Let us now turn to the interpretation of result 2. We think that the *domestic* development of the stock market as it is here modelled is a good candidate to explain the recent rise in firm level uncertainty within industrialized economies: as more domestic investors are thrown into the stockmarket, firms

change strategies and uncertainty increases. Our model however also suggests that the *globalization* of capital flows across countries can be seen as a factor of rising firm uncertainty. Take the following extension: there are now two small open economies A and B, each with firms facing uncorrelated shocks. These two economies are identical. When investors of these two economies are prevented from investing in foreign equity, the economies replicate the results described above. Assume now that cross border equity investment between A and B becomes feasible. In this case, the number of investors with access to the stock markets in each country rises from ϕL to $2\phi L$; in both countries, both listed and non listed firms change strategies and uncertainty rise.

Hence, both stock market development and equity flow globalization can be seen as plausible factors behind the rise in firm level uncertainty. A good reason to believe in this thesis is the historical sequence of events in France and the US: even though they happened at different times in history, in both countries stockmarket development and globalization actually *preceded* the rise in firm level uncertainty.

In the US, the rise of the capitalization based retirement system, starting in the 1960s, can be argued to have triggered the rise in firm level uncertainty. As a result from this new demand for equity, pension and mutual funds emerged as large owners of stocks in the 1960-70s (see figure 1). The volatilities of sales and employment are grossly stable in the 1960s. They start to increase approximately in the late 1970s up until the late 1980s, after which they become stable again (see figure 1 in Chaney, Gabaix and Philippon [2002]). The increase in firm level stock return volatility evidenced by Campbell et alii [2001] took place roughly at the same moment. Gottschalk and Moffit [1994] locate the increase in wage volatility in the 1980s. Other labor market evidence surveyed by Neumark [2001] also confirm that all the changes occurred in the 1980s. As opposed to the evolution of the retirement system, the rise of foreign investment in US equities is less likely to have mattered because it has been both late (most of it took place in the 1980s) and much weaker than the institutionalization of ownership.

A similar sequence of events took place in France, albeit at a different point in time: as we will argue below, most stockmarket reforms took place in the mid 1980s and resulted in increased participation on the equity market by both domestic and foreign investors from the late 1980s onwards. The increase in job turnover documented by Maurin and Givord [2002] mostly took place in the next decade. In sharp contrast to the US, however, the dominant factor seems to have been the progressive replacement of French households by *foreign* investors (see figure 1). The rise in domestic financial institutions, while non negligible, has remained moderate when compared to this movement. In the next section, we will provide more details on the French case from both historical and microeconomic viewpoints.

4.3 Product Market Competition

This section looks at comparative statics properties in product market competition. Let us measure product market competition as the total number n of firms on the product market. We obtain easily that:

Result 3: *The effects of stockmarket liberalization are stronger when competition on the product market is tougher.*

$$\frac{d^2 s_L}{d\phi dn} > 0 \; ; \; \frac{d^2 s_N}{d\phi dn} > 0 \text{ and } \frac{d^2(s_L - s_N)}{d\phi dn} > 0 \tag{27}$$

The economic intuition of this result is simple: we have seen above that product market competition generates two effects: first, it allows risk taking to diffuse to non listed firms. Secondly, it amplifies the extent of risk taking by listed firms. As a result, an increase in competition will increase both transmission mechanisms. Diffusion for privately held firms will increase, and amplification for listed firms will also be on the rise. The latter effect dominates the former and as a result the difference between listed and non listed firms in terms of risk taking is larger in competitive industries. This last feature will help us in designing our empirical tests.

This effect is robust to the way we interpret the degree of competition: Similar comparative statics obtain with respect to σ, the market power of firms. It is also possible to endogenize the number of firms n by allowing for free entry. In appendix we analyze this situation by introducing an entry cost Γ; this cost can be considered as a measure of competition. We find that the previous result still applies but faces a countervailing force: Free entry limits the indirect effect of financial development on non listed firms.

4.4 Job Protection

In a large number of countries, some institutions on the labor market are specifically designed to protect existing jobs and prevent their excessive destruction (firing costs for instance). The existence of such institutions limits the gains that firms may experience by choosing riskier strategies. If labor market rigidity increases the costs of choosing a risky strategy, it is likely that the rise in uncertainty caused by stockmarket liberalization is smaller in countries with rigid labor markets. If this theoretical prediction is correct, we expect to see empirically a larger effect of stockmarket liberalization on corporate uncertainty in economies with flexible labor markets (such as UK and US), rather than in economies with rigid labor markets (such as Continental Europe). In particular, it would mean that our empirical investigation, based on French evidence, underestimate the effects of financial liberalization that we could observe in the US or the UK.

This argument can be made more formally.[17] Assume some firms operate under *flexible* labor contracts and can hire workers in period 3. These are the firms described in the model. Other firms operate under *rigid* labor contracts, and have to hire their employees in period 1, before the demand shock is observed. If these firms choose riskier strategies, the chances increase that their labor force is unadapted to the level of demand (they are more likely to have too little, or too much workers). Such costs of *ex-post misallocation* reduce the incentive of firms who operate in a rigid environment to choose risky strategies.

[17] Formal proofs are available from the authors upon request.

5 Stylized facts and Data

We have proposed a theory of the relation between the degree of financial market development and firm level uncertainty, and argued it might apply to explain the rise in firm level uncertainty documented in France, the US and the UK. This section focuses on the French experience: we start by providing detailed historical evidence about the reforms carried out on the French stockmarket in the mid 1980s. In particular, we explain why these reforms have fostered the emergence of new, more diversified, domestic and foreign holders of listed shares. The French experience therefore constitutes a natural event to test our theory of the relation between risk sharing and firm uncertainty. The rest of the section presents our firm-level dataset which we use for econometric tests in section 6.

5.1 Big Bang of the Paris Bourse: 1984-1988

The early 1980s in France were characterized by very weak economic growth, monetary disorders and the progressive awareness within the French bureaucracy that current dirigiste approaches to economic policy had become flawed in the new economic environment (see appendix B for more details). Against this background, financial reforms affected both capital markets and the banking industry (Bertrand, Schoar, Thesmar [2004]), but we focus here on the stock market reforms since these are the ones most likely to affect risk sharing among investors.

The first change in legislation came as soon as 1982 ("Plan Delors"). Savings in the stockmarket were encouraged : tax on bonds and stocks were reduced by a significant amount (25% for bonds), while tax free schemes were set up for those willing to hold stocks and investment certificates for long enough. Simultaneously, it was made fiscally interesting and simpler for corporations to raise equity and bonds. Finally, the "second marché", designed for the public listing of safe, medium sized, mature corporations, was created in 1983, partially in order to fill the gap created on the French stockmarket by nationalizations.

The second wave of reforms came in 1984 and 1985: The process of bond issue was further relaxed, the issue of commercial paper was authorized and the financial market was modernized through greater transparency and computerization. Commercial paper for banks were allowed in 1985. A market for future, the MATIF, was created - the first one in continental Europe. Then competition among intermediaries on the financial market was promoted: brokers on the Paris Bourse were until then "state officers", and there were a few of such positions (61 in 1986). This quasi monopoly was broken up in 1987: entry was made easier, and it became possible for banks - French or foreign - to become brokers too. The increase in competition was further promoted by allowing commercial banks to have investment banking activities, which was before forbidden.

Transparency - in particular for small shareholders - was further improved in 1988, by reinforcing the powers held by the Commission des Opérations de Bourse (the French SEC). It approved a code of good practices for brokers, based on the duty of loyalty to investors. It set up punishment levels for offenders, that were largely accepted by the financial community. Takeover procedures were also

made more transparent. The stockmarket index was reformed and simplified in order to encompass the 40 largest capitalizations.

In parallel with reforms of the stockmarket itself, foreign investment inflows were stimulated through a progressive lifting of capital controls. After a temporary tightening in 1982-1983, capital controls were progressively relaxed from 1984 to 1990. In October 1984, a law was passed removing the tax on interests paid to non residents. The market for eurofrancs - closed in may 1981 - was reopened that same year, allowing Franc denominated bonds to be traded outside France. In 1985, French corporations were allowed to purchased derivative on foreign currencies to shelter from risk. The duration of these derivatives was progressively extended until 1986. When elected in 1986, the right wing government went on relaxing capital control, allowing French residents to purchase real estate abroad and simplifying the process to buy securities listed abroad. The final step toward complete liberalization was taken on January 1st, 1990, six month ahead of the deadline set by the European commission.

5.2 Consequences

These stockmarket reforms had the effect of making the average shareholder of French firms smaller and better diversified. First, the rapid lifting of all capital controls propped up foreign ownership of French firms. Figure 2 uses the Flow of Funds data produced at the Bank of France to display the evolution of the share of foreign owners in private and listed firms. Both types of firms have experienced a rise in foreign ownership, but the increase has been much more dramatic for listed corporations (from 5 to 35% between 1984 and 2000) than for private ones (from 10 to 15%). Hence, the lifting of capital controls, in addition to other stockmarket's reforms, resulted in an increase in foreign investment (direct and portfolio) biased in favor of listed firms. Foreign investors are not individuals, but financial institutions and multinationals; we thus interpret the rise in foreign ownership as evidence of increased shareholder diversification.

[Insert figure 2]

Aside from times series considerations, international comparisons lend credence to the fact that other stockmarket reforms actually caused part of the rise in foreign ownership in France. Among continental European countries, stock market liberalization went the furthest in France (as a result, the share of stockmarket capitalization over GDP is the highest among those countries). As it turns out, France is also in 2000 the country where the share of stockmarket capitalization held by foreign investors is the highest (see, for example, Plihon and Ponssard [2001]).

[Insert figures 3]

Third, these reforms resulted also in a broadening of the shareholder base within French households. While the share of French households owning French equity declined, the share of outstanding equity

held by domestic mutual funds went up over the past 25 years from 7 to 20% of the total (see figure 3, from Bank of France's Flows of Funds data). Hence, the new French owners of equity tend to be more diversified than the former ones. They also tended to be smaller: the dismantlement of the Paris brokers monopoly on the Paris stock exchange, as well as the very fast pace of the privatization process fostered a shareholder culture in France and simplified access to the stockmarket, even for moderate amounts of savings. As a result, the number of French owners of listed shares went up from less than 1.6 millions before 1980 to some 6 millions after 1988 (see Chocron, Grandjean and Vernois [2001]).

All in all, we are going to interpret the financial liberalization as fostering the emergence of smaller, more diversified shareholders. Although the reforms that were taken were spread over the 1983-1990 period, we are going to take 1990 as the date after which these reforms had their full effect. This choice is partly inspired by the timing of the reforms (most of the financial market deepening was done in 1987, but capital controls were fully lifted in 1990) and partly by what we observe in the macroeconomic data from the Bank of France (which tend to place the break in trend in 1990 for foreign ownership).[18]

5.3 Data

5.3.1 Sources

We have accounting data for all large French firms whose total sales exceed 30 million euros or whose labor force exceeds 500 employees. These accounting data are extracted from tax files used by the Ministry of Finance to collect the corporate tax. We restrict ourselves to firms that are present at least three years in a row between 1984 and 1999, which corresponds to a period without any change in the accounting framework for French corporations. This restriction leaves us with some 126,007 observations, corresponding to some such 8,000 firms per year. These accounting data provide very detailed information on the balance sheet, the breakdown of the operating profit, the industry and employment of these firms.

Our empirical strategy is based on the comparison between private and listed firms. As it turns out, only some 700 firms each year are listed on the French stockmarket, and only some 400 of them are in our database.[19] This comparison, however, does not do full justice to the size of the French bourse, since many of the firms in our sample are affiliated to a group, whose controlling entity is itself listed. Hence, in order to have a proper idea of whether the firm belongs to a listed group or not, we need to recover, for each firm, the identity of its group leader when there is one.

This is done by using the Financial Relation Survey (LIFI in French), conducted each year from 1985 to 1999 by the French Statistical office (INSEE). This survey is exhaustive on all firms whose sales are worth more than 30 million euros or whose employment exceeds 500 employees (this is

[18] All following microeconometric results are, however, robust to shifting the breakpoint to 1988.

[19] Many firms listed on the French bourse take the form of open ended funds ("sociétés de portefeuille") that holds tiny amounts of share in various listed or private firms. These are not part of our data.

why we chose this threshold to select our basic sample of accounting data). These firms are sent questionnaires to, and are required to fill them by law. The information thus collected is of two forms. First, respondents provide the structure of their ownership by large category: shares held by known French individuals, known French firms, known Foreign firms, known foreign individuals and the state. The rest corresponds to shares held by people or firms that are unknown to the firm when it fills in the form. Second, firms are required to provide the identity of the firms that hold more than 50% of their equity ("mothers") as well as the identity of other corporations in which they hold more than 50% of the capital ("daughters"). This identity is coded using a 9 digit number that is also available in the accounting data. In addition to surveying the firms that cut one of the two thresholds referred to above, firms that were either daughters or mothers of firms surveyed a year earlier are included in the sample the year after. This data thus allows to get a fairly detailed information on the structure of French groups.

[Insert Table 1]

Table 1 presents information about the panel we use. We have approximately 8,000 firms each year, some 380 (less than 4.8%) of them being directly listed each year (out of a total of some 600-700). This, however, underestimates the relation of large French firms with the stockmarket: among these 8,000 firms, 61% belong to a group, i.e. at least 50% of their capital is owned by another firm. Group leaders, in turn, tend to be more often listed. All in all, roughly 19.5% of all observations correspond to firms (1) that are affiliate to a group and (2) whose group leader is listed. Thus, if we consider as listed a firm that is either directly listed or belongs to a listed group, the percentage of listed firms in our sample totals some 24% over the years. Notice also that it is fairly stable across the period. Hence, if stockmarket reforms indeed seem to have changed the nature of the average investor, it is much less clear whether they have increased the number and/or size of firms listed. This is the reason why we do not stress the analysis of listing costs in our theoretical analysis.

Finally, we want to abstract from the vast movement of privatization that took place after the 1986 general elections. We therefore restrict the sample to firms (1) where the state never held any equity and (2) who never were in a group where the state ever had any equity. This removes 22,271 observations from the sample, or an equivalent of 1,420 firms each year. This is not surprising given the importance of the public sector before 1986 in France.[20]

5.3.2 Consistency With Macroeconomic Evidence

Before turning to the tests of our theoretical predictions, we can check easily whether listed firms in our micro data-set indeed received more inflow of foreign capital, as our Flow of Fund macroeconomic data suggested. Indeed, the financial relation survey provides us with the share of known foreigners

[20] Only part of which was due to the application of 1981 left wing platform; the bulk of the public sector came from the nationalisations of some key actors of the financial sector and industry in 1945.

in outstanding equity.[21] This suggests that we run the following regression, for firm i at date t:

$$\%\text{foreign}_{it} = \alpha_i + \beta \text{list}_{it} + \gamma \text{list}_{it} \times 1_{\{t>1990\}} + \sum_T \delta_T 1_{\{t=T\}} + \sum_T \delta'_T \log(\text{assets}) \times 1_{\{t=T\}} + \varepsilon_{it} \quad (28)$$

where $\%\text{foreign}_{it}$ measures the share of foreign owners (individuals and corporate, *known to the firm*), list_{it} a dummy variable, equal to one when the firm is currently listed. Year dummies have been included to capture possible year to year changes in the sampling methodology or short term fluctuation of foreign ownership. Note that this equation allows for time varying size effects, in order to disentangle as much as it is possible the impact of being listed from the mere impact of being large onto the share of foreign ownership.

[Insert Table 2]

Table 2 reports the regression results of (28). The first column includes no fixed effect α_i, no year dummy nor any time varying size effects, and shows that an aggregate effect is indeed there: on average, the share of foreign owners in listed firms' equity increases by 5 more percentage points then for privately held firms. The second column confirms that there is some endogeneity is this point estimate, part of it is due to the fact that foreign owners tend in general to prefer large firms, be they public or private (captured by the time varying size effects in (28)). Another part of this upward bias is due to the fact that some firms that are owned by foreigners tend, in general, to go public after 1990 (this is captured by the firm effects in the second column). All in all, however, the share of foreign ownership goes up by a strongly significant 3 percentage points for listed firms after the financial liberalization took place. This figure seems small but conceals at least two important facts about foreign ownership. First, our dataset underestimates foreign ownership, in particular for listed firms, since this variable corresponds to the share of foreign owners that *are known to the firm*. However, nothing forces owners of listed equity below 5% of capital to signal themselves to the company. Given that foreign institutional shareowners tend to hold very small stakes, they are invisible in our dataset. Second, an equity weighted regressions (not reported) gives a larger coefficient (5 percentage points instead of 3): given that listed firms tend to be larger, the unweighted point estimate underestimates the real effect of foreign ownership.

6 Empirical Tests

The previous section shows that the French stockmarket reforms resulted in a large broadening of the shareholders base. Hence those reforms can be viewed as a positive shock on the degree of risk sharing within the French economy. It therefore constitutes a natural experiment to test our theory.

In this section we use our firm level dataset to test two predictions of the model: (P1) firm level uncertainty is positively related to risk sharing, thus uncertainty should increase *after* the reforms;

[21] But it does not provide us with the size of individual shareholders, nor with the share held by institutions in general. So it is not possible to check the other macroeconomic facts discussed above.

(P2) this effect is stronger when product market competition is fiercer. These two predictions apply to both listed and non listed firms. However we are not in a position to test these predictions on both groups since the French economy has been hit by many other shocks than stockmarket reforms during the past 20 years: trends in uncertainty could be the result of many different historical forces, such as technical change or globalization of trade flows.

In our empirical approach, we thus focus on the *differential effect* of reforms between listed and non listed firms where non listed firms serve as a *control group*.[22] With this respect our model shows that (P1) uncertainty rises more for listed firms following stockmarket reforms (see result 1); (P2) the amplifying effect of competition is stronger for listed firms (see result 3).

6.1 A direct (but imperfect) Test

This section provides a direct test of (P1), underlines its limitation and introduces a more efficient empirical strategy. Indeed the most direct way to test this is to break our dataset down into two subperiods: 1979-1989 and 1990-1999. We then compute the variance of sales growth, at the firm level, for each period. Our theory predicts that listed firms experienced a larger increase in variance than non listed ones after stockmarket reforms. This amounts to running the following regression:

$$\text{STD}\ (\Delta \log sales_{it}) = \alpha_i + \beta \text{list}_{it} + \gamma \text{list}_{it} \times (an > 1990)_t + (an > 1990)_t + \varepsilon_{it} \tag{29}$$

where $\text{STD}(\Delta \log sales_{it})$ stands for the standard deviation of sales of firm i in period t, $(an > 1990)_t$ is a dummy equal to 1 if the period t is after 1990. Results of this regression for various specifications are provided in table 3.

[Insert Table 3]

Column 1 presents the estimation of equation (29) without fixed effect: as it turns out, the standard deviation of sales growth rose by 1 percentage point more among listed firms than for non listed ones. This represents one fifth of the overall standard deviation in sales volatility in the overall sample. This estimate is robust to fixed effects, as column 2 attests: hence, the effect is not driven by a change in the composition of firms, but a change within firms themselves. Listed status is, however, not exogenous. It could well be that some privately held firms experienced an exogenous increase in uncertainty after 1990. Since the price of risk is lower for listed equity - this is after all the mechanism we rely on in our theory - these firms could have *chosen* to be listed on the stockmarket. This would however have nothing to do with financial markets liberalization, but be triggered by a rise in real uncertainty. To answer this concern, column 3 uses a "listing status" dummy equal to 1 if the firm is listed once before

[22] Such a difference in difference approach allows to alleviate some endogeneity concerns associated with testing of our main mechanism. We seek to find a relation between uncertainty and shareholder concentration. Concentration is, however, itself endogenous; a riskier firm is going to be, in equilibrium, more likely to be held by diversified shareholders. As a result, the relation between risk and shareholding concentration could be the result of the firm's change in strategy. By comparing listed and privately held firms before and after the stockmarket liberalisation, we can attribute the differential change in firm's risk as being caused by the change of shareholders.

1990, and zero else. Along the same lines, column 4 provide an estimate of (29) on the sample of firms either continuously listed, or continuously non listed. The estimates remain robust to these tests. In non reported regressions, we tried to shift the sample breakdown from 1990 to 1988 but this did not affect the results. Moreover, we also tried to filter macro shocks and firm fixed effects from the sales growth process, but this did not affect the results at all.

This approach however suffers from the fact that, given our annual data, and our 20 year coverage, we end up computing variances with at most 10 points for each subperiod. Hence, firm level variances are computed with a very large *measurement error*: this therefore makes it very difficult for us to identify effects of stockmarket reforms on firm level uncertainty.

6.2 Foundations of our empirical Strategy

The presence of measurement error in the previous regression justifies why hereafter we focus instead on the relation of firm sales to industry demand shocks (see Bertrand, Mehta, Mullainathan (2001)). We argue that firms reacting more closely to industrywide demand shocks face more uncertainty (the equivalent of an increase in s). And it turns out that our data allow us to measure quite accurately the industry shocks.

Before proceeding, we show how this view can be derived from our theoretical framework. This can be done by specifying more accurately the functional form [5] for the demand shock. We now assume that firm compete monopolistically in industries that face sectorwide shocks: At date t, a firm i operating within a given industry faces the following demand shock:

$$1 + \tilde{\delta}_{i,t} = 1 + s_i.\tilde{\delta}_t$$

where the industry-level taste shock is such that $\tilde{\delta}_t \sim N(1, \Sigma)$. As in our main model each firm i fixes optimally its monopoly price such that its sales are given by:

$$\tilde{y}_{i,t} = (1 + s_i.\tilde{\delta}_t).\Omega \tag{30}$$

where $\Omega \equiv (\frac{\sigma-1}{\sigma})^{\sigma} \frac{P^{\sigma-1}E}{w^{\sigma}}$ is determined in equilibrium. Hence, denoting $\Delta\tilde{y}_{i,t}$ the time difference $(\tilde{y}_{i,t} - \tilde{y}_{i,t-1})$, and using the fact that $s_i\tilde{\delta}_t$ is small, we have:

$$\Delta \log \tilde{y}_{i,t} = s_i.\Delta\tilde{\delta}_t.\Omega$$

which tells us how much the firm reacts to the industry level structural shock $\tilde{\delta}_t$.

We cannot, however, directly observe $\Delta\tilde{\delta}_t$, but we can observe changes in industry sales. Aggregating [30] at the industry level, taking the logs and differentiating leads to the following value for the industry-level variations of sales:

$$\Delta \log \tilde{y}_{\text{sec},t} = (\mu_L s_L + \mu_N s_N).\Delta\tilde{\delta}_t$$

Combining the two relations, we obtain the relation between firm's sales variations and industry's sales variations:

$$\Delta \log \tilde{y}_{i,t} = \frac{s_i}{(\mu_L s_L + \mu_N s_N)} . \Delta \log \tilde{y}_{\text{sec},t} \tag{31}$$

As it turns out, the elasticity of firm sales to industry sales depends on the ratio of firm's choice of customization s_i to industry average level of customization $(\mu_L s_L + \mu_N s_N)$. From which we derive two insights. Straightforwardly, (1) if a firm's degree of customization s_i increases more than the average, the elasticity of own sales to industry sales should increase. This is what we expect to happen to listed firms after stockmarket liberalization. Less obviously, (2) if a firm's degree of customization increases less than the industry average, its elasticity of own sales to industry should *decrease*. Hence, although the uncertainty borne by privately held firms increases in absolute terms, it decreases *relative* to listed firms. Hence our main theoretical predictions can be recoined in term of elasticity: According to (P1) stockmarket liberalization impacts *positively* the elasticity of listed firms and *negatively* the elasticity of non listed firms; according to (P2) the amplifying effect of product market competition is stronger for listed firms.

6.3 Main Tests (1) : Sales and Labor Demand

Following the structural equation [31] above, the test of the first conjecture requires to run the following regression:

$$\begin{aligned} \log \text{sales}_{it,s} \quad = \quad & \alpha_i + \beta \text{list}_{it} \times 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \gamma \text{list}_{it} \times \log \widehat{\text{sales}}_{st} \\ & + \eta 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \nu \log \widehat{\text{sales}}_{st} + \beta' \text{list}_{it} \times 1_{\{t>1990\}} \\ & + \gamma' \text{list}_{it} + \sum_T \delta_T 1_{\{t=T\}} + \sum_T \delta'_T . \log(\text{assets}_{it}) 1_{\{t=T\}} + \varepsilon_{it} \end{aligned} \tag{32}$$

where it, s denotes firm i at date t within industry s. $\widehat{\text{sales}}_{st}$ represent total sales in the industry s the firm belongs to. The regression includes firm and year fixed effects, as well as time varying size effects given that one might expect listed firms to be larger and large firms to have experienced a different history over the past 20 years. All in all, this regression amounts to computing the elasticity of one firm's sales with respect to the aggregate industry sales. This elasticity is estimated in first differences (hence the firm fixed effect), i.e. it measures the average percent change of one firm's sales when total industry sales increase by 1%. In addition, this elasticity corresponds to the response of the firm to the the part of the industry shock that is *orthogonal* to macro shocks, given that we include year dummies in the estimating equation (the δ's). In the above regression, this elasticity is allowed to depend on the listing status of the firm and the period of observation. For listed firms, it equals $\gamma + \beta + \eta + \nu$ after stockmarket reforms, and $\gamma + \nu$ before. For privately held firms, the elasticity is given by $\eta + \nu$ after reforms and ν before. Statement (P1) predicts a larger increase in elasticity for listed firms after the reforms, ie. $\beta = (\beta + \eta) - \eta$ should be positive, and a decrease in elasticity for non listed firms, ie. η should be negative[23].

[23] Strictly speaking, our empirical strategy allows us to estimate only β, the relative effect of reforms on listed firms.

[Insert Table 4]

Estimates of equation (32) are given in table 4. Industry sales were computed using the two digit classification, excluding own firm's sales and industries that have less than 50 observations. Standard errors account for firm level heteroskedasticity using White's method. The first column sets all coefficients in (32) to zero but ν, in order to prove that there indeed is a correlation between changes in firm and industry sales - this checks the relevance of the industry classification. The second column corresponds to the estimation of the full model.

Reading the first column confirms the fact that there is a strong, positive correlation between industry level changes in sales and firm sales: our industry definition is therefore not spurious. On average, an increase by 1% of industry sales, that is not macroeconomic (i.e. captured by the year dummies), leads to an increase by 0.14% of firm sales. Moving to column 2, this elasticity has increased by $\beta = 0.08$ for listed firms after the reforms, while it has decreased slightly but significantly by $\eta = -0.01$ for privately held ones. Economically, the difference between listed and non listed firms is sizeable since on average across time and listing status this elasticity is 0.14. In unreported regressions we show that this estimation is robust to: (i) the selection of the period (post reform period after 1988 instead of 1990); (ii) the sample (e.g. non financial industries, manufacturing only); (iii) clustering error terms at the group level (instead of firm level) which is the level at which the "listed" variable is defined (see Bertrand, Duflo and Mullainthan [2004]); (iv) it is robust to removing from the sample those firms who belong to the leading French stockmarket index (the CAC40); indeed these firms can be argued to be very large, exceptionally successful multinational firms; as such they could spuriously drive our results.

Columns 3 and 4 of table 4 focus on the reaction of employment to sales shocks. The measure of uncertainty is different: firm sales growth is replaced by firm employment growth in regression [32] as a dependent variable. As a matter of fact the effect of liberalization goes in the right direction, but is weakly significant and economically small. As shown in section 7, the reason for this is that model (32) is not well specified in presence of variables with high persistence, such as employment, or to a lesser extent, sales. Once persistence is taken in account, we find that stockmarket reforms impacts employment volatility (see table 6).

6.4 Main Tests (2): The Competition - Finance Nexus

According to prediction (P2), the impact of liberalization on firm level uncertainty should be amplified by product market competition. We thus expect to see the results from table 3 to be stressed in more competitive industries.

In the following the coefficient η is likely to be misestimated because non listed firms act as a control group here: they are potentially subject to all sorts of shocks beside stockmarket reforms. In particular one of those shocks is purely statistical in nature: the industry classification that we use here was defined in 1973 and became more and more obsolete after the years. Hence, the probability that two firms from the same industry according to this classification are actual competitors declines over the period. As a result, the correlation between industry and firm sales declines for the sample as a whole.

We thus broke down our sample into competitive and non competitive industries, and ran regression (32) separately on each of the samples. To do this, we took three different measures of competition computed at the industry level *in the first year of the firm's existence.* The first measure is the Herfindahl index. The second measure is the number of firms in the industry. Both measures were computed at the 2 digit industry level (our results carry out at the 4 digit level). Our last measure is the industry average mark up computed as (value added - labor costs - 0.08*tangible assets) / sales. The problem with that last measure is that we have to make an assumption over the cost of capital that is most likely to be wrong. For all the measures, the sample is broken down into firms facing a degree of competition "above the median" vs "under the median".

[Insert Table 5]

In table 5, estimates of equation (32) for each half sample are reported. The last line of the table presents the t probability that the effect of liberalization - the β coefficient in regression (32) - is the same in both equations. This test has been performed through running this regression on the whole sample, interacting all coefficients with a dummy variable equal to one when competition was "high". As it turns out, almost all of the effect of liberalization discussed in table 3 is located in competitive industries. The coefficient of the effect of financial liberalization drops to zero for firms facing low competition, while it reaches some 0.10 for firms in competitive industries. It is fairly stable across competition measures and is economically large. This difference is however statistically significant only for the mark-up based definition of industry.

7 Robustness Checks and Alternative Interpretations

7.1 A VAR-like Approach

Sales and employment growth at the firm level are highly persistent from one year to the other. Some firms grow, other decline. Because of adjustment costs, employment cannot always follow short term fluctuations of demand. Hence, a large part of sales or employment growth can be predicted using past information on firm dynamics. This predicted part does not reflect unanticipated risk and our theoretical argument therefore does not apply to it. Hence, we have a noisy measure of the firm's reaction to uncertainty; this is likely to underestimate our empirical results.

To take out the predictable part, we first regress firm's log sales on firm's past log sales (using two lags) including firm and year fixed effects. We then take the residual $Esales_{it}$ of this regression; this residual can be interpreted as the *unanticipated,* statistical innovation of firm's sales viewed as a AR(2) process[24]. For industry sales, the residual $\widehat{Esales}_{st}$ is extracted in the same way, including year and industry fixed effects. We then directly regress $Esales_{it}$ on $\widehat{Esales}_{st}$ and ask whether the

[24] Although we could have added other likely predictors in both equations, or have estimated on prediction equation per firm/industry, we preferred to keep the method as simple as possible.

coefficient has increased more for listed firms after liberalization:

$$\begin{aligned} Esales_{it} &= \alpha_i + \beta \text{list}_{it} \times 1_{\{t>1990\}} \times \widehat{Esales}_{st} + \gamma \text{list}_{it} \times \widehat{Esales}_{st} + \eta 1_{\{t>1990\}} \times \widehat{Esales}_{st} \\ &\quad + \nu \widehat{Esales}_{st} + \beta' \text{list}_{it} \times 1_{\{t>1990\}} + \gamma' \text{list}_{it} + \sum_T \delta_T 1_{\{t=T\}} + \sum_T \delta'_T . \log(\text{assets}_{it}) 1_{\{t=T\}} + \varepsilon_{it} \end{aligned} \tag{33}$$

where this modified version of [32] simply replaces sales shocks by residuals from their forecasting autoregressions.

[Insert Table 6]

Table 6 provides the estimates of equation [33] looking at the effect of industry sales shocks on firm sales and employment. For sales, these results simply confirm table 4; they are larger, in part because the correlation of unexpected firm and industry sales shocks is a priori larger (0.19 instead of 0.14). The effect of liberalization also appears much larger (an increase in elasticity by 0.22 instead of 0.08), both in absolute terms and with respect to the initial value of the elasticity. As could be expected, the estimation is, however, slightly less precise and we lose some statistical significance.

Interesting news also come from employment. Employment is a very inert variable, more so than sales. Hence, the past evolution of employment is a good predictor of the current one and employment growth as we used it in section 6 is therefore likely to be a very poor measure of unexpected shocks. As columns 3 and 4 of table 6 show, employment regression do indeed work much better with this new methodology. The "natural" correlation between unexpected employment and industry sales shocks is significantly positive, albeit small (0.06) compared to sales. The effect of liberalization on labor demand uncertainty also turns out to be both economically large and significant (an increase by 0.20).

7.2 Usual Suspects: Technical Change and International Trade

There are two alternative interpretations for our findings. First it could also be that the rise in firm level uncertainty was triggered by the emergence of new technologies, with no link with financial market development. Information technologies had the effects of increasing the amount of workplace flexibility and the speed of information processing (see [Comin 2000]); this could improve firm reactivity and their ability to take advantage of volatile niches (see Aghion, Howitt and Violante [2002] or Thesmar and Thoenig [2000]). Secondly it is likely that listed firms are very large multinational corporations which now operate on truly global markets, facing more competition and product market uncertainty as a result. In addition, because of globalization, their subsidiaries may have become more sensitive to shocks in other parts of the world. Hence it may be argued that listed firms are the most affected by the globalization of trade flows which took place over the 80s and 90s.

Our use of a control group is supposed to take care of these potentially important competitive mechanisms as long as both listed and non listed firms are similarly exposed to them. It could be argued, however, that this is not the case. If technical change increased the ability of firms to cope with uncertain environments, or if international competition forced them to do so, a natural reaction

for firms with low listing costs would be to go public. Such a move would help them to raise cheap capital, while using new technologies would help them to reach uncertain markets. Firms with high listing costs would remain private and would thus be reluctant to seek uncertain, although more profitable, niches. Hence, the emergence of flexible technologies of the possibility to "go global" would lead us to observe more risk among listed firms than among non listed ones, because going public is an *endogenous decision*. Financial market development could have no role at all, and we would still observe results consistent with ours.

[Insert Table 7]

One solution out of this problem is to estimate equation (32) separately for firms whose listing status did not change and for firms who went public or delisted. This is done in table 7. Column 1 replicates the results for the whole sample and is therefore identical to estimates presented in table 5, column 3. Columns 2 and 3 break the sample down into firms who never changed listing status (some 72,000 observations) and firms who changed listing status at least once between 1984 and 1999 (some 13,000 observations). The effect of the reform turns out to be slightly, though not significantly, stronger among firms who were either continuously listed or never listed (0.09 against 0.08). However, as column 3 shows, firms going public experienced a small, barely significant, increase in their variance too.

Industry-level controls

The previous robustness check might not evacuate all concerns about the "technical change/ international trade hypothesis". As their owners are more diversified, listed firms are less reluctant than non listed firms to bear more risk by adopting those new technologies or by going on international markets; [25]. Hence technical change or international trade could affect our treatment and control groups differently. We address this concern by adding on the right hand side of equation (32) an interaction term between firm's sales and a measure of (technology diffusion / international trade exposure). This term accounts for the fact that firms exposed to technology/trade might experienced a larger increase in volatility. More specifically, we estimate:

$$\begin{aligned}\log \text{sales}_{it,s} &= \alpha_i + \beta \text{list}_{it} \times 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \gamma \text{list}_{it} \times \log \widehat{\text{sales}}_{st} \\ &\quad + \beta' \text{EXP}_i \times 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \gamma' \text{EXP}_i \times \log \widehat{\text{sales}}_{st} \\ &\quad + \nu \log \widehat{\text{sales}}_{st} + \eta 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \text{controls} + \varepsilon_{it} \end{aligned} \tag{34}$$

[25] In term of our theoretical framework, it means that Information and Communication Technologies (ICT) have expanded the set of available risky strategies from $s \in (0, \overline{s}_0)$ to $s \in (0, \overline{s}_1)$ with $\overline{s}_0 < \overline{s}_1$.

As a matter of fact, it could be the case that before IT revolution, listed firms were in fact constrained on their strategy and chose $s_L = \overline{s}_0$. In that case, after the revolution , we should expect to see an increase in the risk s_L of strategies chosen by listed firms.

Yet, this robustness check might not alleviate all concerns about the "technical change / international trade" hypotheses. As it turns out, it might have been that before the IT revolution, listed firms were contrained in their choice of s, such that both listed and non listed firms happened to choose the same, maximal level of $s = \overline{s}$. Against this background, technical change or the rise in international competition simply set the maximal level of flexibility much higher.

where EXP_i measures the exposure of firm i to technology / trade.

Table 8 provides estimates of (34) where EXP_i is proxied by various industry-level variables. Exposure to new technologies is measured either by the industry-level fraction of low skilled white collars using a computer in 1992 or by the total fraction of employees using a computer in 1998 (this is done by using the REPONSE survey which is described in Caroli and Van Reenen [2001]). Estimates are given in columns 2 and 3. Exposure to international trade is measured by the industry-level ratio of export[26] (or import) on value added in 1992. Columns 5 and 6 present the results with those two measures.

[Insert Table 8]

A quick examination of table 8 suggests that our β coefficient in regression [34] holds whatever control is added. Industries exposed to technology did *not* witness an increase in firm volatility. Industries exposed to trade, however, did, and very significantly so. By all accounts, however, none of these alternative explanations affects our coefficient of financial development β. This suggests that while trade and technology might matter, their effect does not translate into a different behavior of listed and non listed firms over the past 20 years. In other words taking the non listed firms as our control group seems to be a correct strategy.

Firm-level controls

It is possible that in table 8 our industry-level proxies for EXP_i, the exposure to technology/trade, are too crude to capture much of the firm level variations in sales. Hence this section tries to provide convincing firm-level proxies for EXP_i.

Regarding technology adoption, it is difficult to obtain good measures at the firm level. Our first measure corresponds to the firm's computer capital built as the amount of fixed assets that fall in the line "Computers and Office Equipment" in the Tax Files; this information is available for a subsample of our firms only but the coverage is reasonable for large firms (see Crépon and Heckel [2004] who use it for constructing series of computer capital). We take the value in 1993 and normalize it by total sales in that year; this consequently restricts the sample to firms that have detailed accounting information and that are present in 1993. To simplify it is assumed that firms have zero computer capital before 1990, and for each year after 1990, a capital equal to the 1993 value. Our second measure uses the share of skilled workers in the labor force at the firm level. In doing this, we rely on the findings of the large literature documenting the skill-technology complementarity (see for example Berman, Bound and Machin [1998]). Interestingly this measure is available from the Employment Structure Survey which covers all establishments of more than 20 employees, from 1982 until 1998 (for a description of this source, see Maurin and Thesmar [2004]). Hence, recovering this information does not remove too many observations from our main sample. Finally the exposure to international trade is measured as

[26] We look at exports and imports of the *product* produced by the industry, not the level of exports and imports by the *firms* classified in the industry. French National Accounts distinguish these two concepts. As a consequence, some industries, like restaurants or retail trade have zero trade openness.

the current share of exports in total sales at the firm level; this information is contained in the Tax File for the full sample.

All these firm level variables are available each year, so we estimate the following, modified version of (34):

$$\begin{aligned}\log \text{sales}_{it,s} &= \alpha_i + \beta \text{list}_{it} \times 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \gamma \text{list}_{it} \times \log \widehat{\text{sales}}_{st} \\ &\quad + \beta' \text{EXP}_{it} \times \log \widehat{\text{sales}}_{st} + \log \widehat{\text{sales}}_{st} \\ &\quad + \nu \log \widehat{\text{sales}}_{st} + \eta 1_{\{t>1990\}} \times \log \widehat{\text{sales}}_{st} + \text{controls} + \varepsilon_{it} \end{aligned} \tag{35}$$

where EXP_{it} is now measured at the firm level and varies with time.

[Insert Table 9]

Table 9 reports estimates of (35) with respectively computer capital, skill structure and propensity to export as controls. Columns 1, 3 and 5 present the basic specification for each subsample where the given control of technology/trade exposure is available. All in all, sample restriction does not affect the estimation of β too much, and it remains very significant. Columns 2, 4 and 6 present the estimates including the controls.

First the estimate of β,the coefficient of financial development, is robust whatever the control used. Secondly there is no effect of computer diffusion on firm level sales volatility. This might mean that our measure of computer capital is a poor proxy of technology diffusion. Indeed the "technology" hypothesis does better with skill structure: firms whose workforce became more skilled tended to respond more to industry shocks.

8 Conclusion

In this paper we relate the development of financial markets to the rise in firm level uncertainty, events which both happened over the past thirty years in the US, the UK and Continental Europe. Theoretically, we focus on the role of risk sharing among investors. We show that a larger pool of investors encourages the adoption by listed firms of riskier business strategies but whose profits are larger on average. This direct effect comes, however, with an *indirect* effect that appears in general equilibrium and affects *both* listed and non listed firms. Hence, the rise in firm level uncertainty goes beyond those firms directly involved in stockmarket activities. The overall result is a pervasive increase in sales volatility and labor market reallocations, amplified by the extent of product market competition.

We then find supportive empirical evidence for our theory on looking at French data, using the 1984-1990 stockmarket's reform as an experiment. Two of the predictions of our model are successfully tested: (1) compared to privately held firms, the uncertainty borne by listed firms increases more following financial development; (2) this effect is stronger when product market competition is tougher.

These results are robust to numerous controls. In particular, they are driven neither by the adoption and diffusion of new technologies nor by the increasing participation to international trade. This supports the view that technical change and globalization of trade flows might not be the sole driving forces behind the past rise in firm level uncertainty: Financial globalization, unleashed capital flows, technological and institutional innovations on stockmarkets, by making the average investor more and more diversified, played also a first order role.

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Appendix

A The Entry Decision

We perform here a robustness check of our model by allowing for free entry on the product market and on the stockmarket: the total number of firms n, the share of publicly listed firms, μ_L, and non listed firms, μ_N, are now endogenously determined. Most of our results are robust to this change.

The entry decision and the decision to go public are made at period 0. The timing is now: $t = 0$, entrepreneurs enter on the market and decide to list or not on the stockmarket; $t = 1$: entrepreneurs choose their customization strategy s; $t = 2$: financial market clears up; $t = 3$: uncertainty is revealed and production takes place.

In a very standard way, the entry decision entails a fixed cost κ (labelled in term of foregone consumption units). In the same way going public entails an extra fixed IPO cost, $\Gamma\mu_L$, that is increasing in the share of listed firms μ_L. An entrepreneur therefore decides to enter on the market and to list (resp. not to list) if her net consumption gain of managing a listed firm (resp. a non listed firm) is larger than the consumption of being a worker only:

$$U^N - \kappa \geq \frac{w}{P} \tag{36}$$

and

$$U^L - (\kappa + \Gamma\mu_L) \geq \frac{w}{P} \tag{37}$$

At equilibrium those conditions hold as equality and using [15], [17] and [22] this gives μ_L, the fraction of listed firms:

$$\mu_L = \frac{\phi L - 1}{2a\Sigma\Gamma} \tag{38}$$

which is increasing in the number of investors ϕ and decreasing in the agents' risk aversion a, the taste shocks' variance Σ and the cost of listing Γ. Using [16], [18], [22], [36], [37] and [38], we get:

$$n = \left(\frac{(\kappa a\Sigma - 1/2)\sigma}{a\Sigma L}\right)^{(\sigma-1)/(2-\sigma)} \cdot \left[1 + (\frac{(\phi L - 1)^2}{2a\Sigma\Gamma} + 1)\frac{1}{\kappa a\Sigma - 1/2}\right]^{-1} \tag{39}$$

and

$$s_N = \frac{1}{\kappa a\Sigma - 1/2} \text{ and } s_L = \frac{\phi L}{\kappa a\Sigma - 1/2} \tag{40}$$

Under free entry, the impact of financial liberalization on non listed firms disappears: the indirect effect is counterbalanced by the decrease in the number of active firms n. The intuition is the following. An increase in ϕ, our measure for financial liberalization, promotes s_L, customization among listed firms; this makes π_0/P smaller and thus promotes s_N, customization among non listed firms (this is the indirect effect). All in all, this makes π_0/P smaller which discourages entry on the product market. As a consequence, the total number of active firms, n, decreases (see equation [39]); this in turn makes π_0/P increase until reaching its level before financial liberalization (the indirect effect cancels out); and so s_N goes back to its pre-liberalization level.

This extreme result is due to the functional form of entry costs assumed here for facilitating computations. A more general form (such as entry costs increasing and convex in n) would keep active the indirect effect but in a attenuated way. Hence we would get that under free entry, the impact of financial liberalization on non listed firms is partially reduced with respect to the basic framework.

B Context of the French Stockmarket Reforms.

France has experienced in the 1980s one of the deepest and most comprehensive financial reforms in Europe (Melitz [1990]). The irony is that it was started by a socialist government, that had nationalized most of the banking system in 1982, and was therefore not known for being friendly to the financial industry. The reasons why such reforms were undertaken then were at the same time institutional, macroeconomic and microeconomic in nature. First, there had already been an attempt to open capital markets of member states of the European Union in the early 1960s, but by the late 1960s, further attempts were blocked by France, while Germany and the Benelux countries seemed to be relatively compliant. By 1984, the european comission took charge again and urged the reluctant member states to comply with a detailed process of deregulation of capital flows that would yield to total freedom of movement by 1990. But this time, the commission's interests coincided with that of the French government, for economic reasons.

After the failed stimulation of 1981-1982, the French economy was entering a severe crisis that had both short and long run causes; the French industry was quickly loosing competitiveness, partly because part of the necessary restructuring had been delayed (as opposed to, for example, Germany), and partly because of a chronic high inflation since the second oil shock. As a result, the French franc lost 20% with respect to the DM in 1981-1982, and the country was quickly accumulating a large external debt. External debt was as high as 9% of GDP in 1984, and while this ratio was small compared to Sweden, Norway, or even Italy, the absolute size of France's GDP made its external debt one of the largest in the world. As often happens in these cases, the rise in external debt was paralleled by a quick rise of the government debt, as successive governements had tried to stimulate the economy, without generating sustainable growth.

The high level of government spending, as well as the increase in interest rates that was required to sustain the Franc's parity with the DM, raised concerns that corporate investment was never going to recover, crowded out by public debt and monetary policy. This was particularly a problem for the then large public sector which needed equity finance to restructure and clean its balance sheets, while a heavily indebted state was not in a position to provide the needed fresh capital. That is why Jacques Delors and Pierre Bérégovoy, its successor as finance minister, undertook reforms of the financial system: the purpose was to channel saving to investment bypassing the banking system, who also needed to get rid of its poorly performing loans and whose ability to lend to the productive sector was temporarily impaired.

C Tables and Figures

Table 1: Sample Description

	Number of Firms	% Directly Listed	% Affiliate To a Group	% Affiliate Listed Group
1984	5,621	5.3	-	-
1985	6,182	5.4	49.4	18.4
1986	6,722	5.3	49.9	21.0
1987	7,096	5.3	50.0	21.7
1988	7,196	5.2	-	-
1989	7,906	5.0	50.9	24.8
1990	7,906	4.9	53.1	23.7
1991	8,283	5.0	54.4	23.9
1992	8,608	4.7	57.3	21.1
1993	8,747	4.6	60.0	20.6
1994	8,817	4.6	62.9	20.5
1995	8,896	4.8	67.0	20.7
1996	8,850	4.7	69.8	19.9
1997	8,728	4.7	71.9	19.7
1998	8,381	4.5	73.2	18.8
1999	8,068	4.4	74.1	17.9
Observations	126,007	6,038	68,942	16,762

Source: Tax files and Financial relation survey (INSEE) over the 1984-1999 period. In 1984 and 1988, the financial relation survey was not conducted.

Table 2: Foreign Ownership of Listed Firms

	% Foreign Owners	
	Model 1	Model 2
Listed × (an>1990)	5.6***	3.7***
	(0.9)	(1.3)
Listed	-1.1	-2.5
	(0.7)	(1.6)
(an>1990)	-0.2	-0.6
	(0.3)	(4.4)
Time varying size effects	no	yes
Firm effects	no	yes
Observations	17,476	15,318

Source: Tax files and Financial relation survey (INSEE) over the 1984-1999 period. The dependant variable is the percentage of equity held by foreign owners known to the firm. The "listed" dummy equals one when the firm is itself listed on the French stock market or when its group leader is. Sample: To control for privatizations, we removed from the sample all firms that were at some point state owned, even partially. In model 2, year dummies are interacted with log(assets) to control for time varying size effects are included. Standard errors correct for firm level heteroskedasticity using the White's method.

Table 3: Standard deviation of Annual Sales Growth in the 1980s and the 1990s and Listing Status

	Model 1	Model 2	Model 3	Model 4
Listed × (an> 1990)	0.009***	0.008***	0.008***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Listed	-0.009***	-0.005	-	-
	(0.002)	(0.003)		
an> 1990	-0.011***	-0.010***	-0.009	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Firm effects	no	yes	yes	yes
Observations	11,232	11,232	11,232	10,676

Source: Tax files and Financial relation survey (INSEE). The standard deviation of annual sales growth is computed separately over 1979 - 1989 and 1990 - 1999 for each firm. In column 1 and 2, the listing status dummy equals one if the firm is said to be listed at least one year during the period considered. Column 1 is the basic model. Column 2 includes firm fixed effects. In column 3, the "listed" dummy equals 1 when the firm is listed in the 1984-1989 period, and zero else. In column 4, the sample if restricted to firms continuously listed or continuously private. Standard errors correct for firm level heteroskedasticity using the White's method.

Table 4: Sales Response to an Industry Shock

	Sales		Employment	
	Model 1	Model 2	Model 1	Model 2
$\log \widehat{\text{sales}}_{st} \times$Listed $\times$ (an>1990)	-	0.08***	-	0.03
		(0.02)		(0.03)
$\log \widehat{\text{sales}}_{st} \times$Listed	-	-0.04*	-	0.01
		(0.02)		(0.04)
$\log \widehat{\text{sales}}_{st} \times$ (an>1990)	-	-0.01**	-	0.05
		(0.01)		(0.01)
$\log \widehat{\text{sales}}_{st}$	0.14***	0.13***	-0.01	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)
Listed $\times$ (an>1990)	-	-1.53***	-	-0.61
		(0.38)		(0.50)
Listed	-	0.81*	-	-0.18
		(0.43)		(0.65)
Time Varying Size effects	yes	yes	yes	yes
Firm effects	yes	yes	yes	yes
Observations	90,968	85,550	88,820	83,559

Source: Tax files and Financial relation survey (INSEE) over the 1984-1999 period. The dependant variable is the logarithm of the sales at the firm level. The "listed" dummy equals one when the firm is itself listed on the French stock market or when its group leader is. Sample: To control for privatizations, we removed from the sample all firms that were at some point state owned, even partially. In model 2, year dummies are interacted with log(assets) to control for time varying size effects are included. Standard errors correct for observation level heteroskedasticity using the White's method.

Table 5: Sales Response to an Industry Shock: 2 digit Level Measure of Competition

Measure of Competition	1/Herfindahl		# of firms		1/Mark-up	
Intensity of Competition	Low	High	Low	High	Low	High
$\log \widehat{\text{sales}}_{st}$ ×Listed × (an>1990)	0.00	0.09***	-0.01	0.08***	0.01	0.12***
	(0.03)	(0.02)	(0.04)	(0.03)	(0.04)	(0.04)
$\log \widehat{\text{sales}}_{st}$ ×Listed	0.00	-0.05**	0.01	-0.06***	-0.06	0.03
	(0.04)	(0.02)	(0.05)	(0.02)	(0.04)	(0.04)
$\log \widehat{\text{sales}}_{st}$ × (an>1990)	0.00	-0.02*	0.01	-0.03***	0.00	-0.03**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\log \widehat{\text{sales}}_{st}$	0.26***	0.07***	0.29***	0.10***	0.15***	0.20***
	(0.05)	(0.02)	(0.05)	(0.02)	(0.03)	(0.03)
Listed × (an>1990)	-0.28	-1.57***	-0.06	-1.49***	-0.39	-2.32***
	(0.59)	(0.56)	(0.71)	(0.48)	(0.64)	(0.84)
Listed	0.24	0.86*	0.06	1.17***	1.20	-0.57
	(0.73)	(0.45)	(0.93)	(0.40)	(0.69)	(0.75)
Time Varying Size effects	yes	yes	yes	yes	yes	yes
Firm effects	yes	yes	yes	yes	yes	yes
Test equality (t-prob)	0.11		0.15		0.01	
Observations	37,332	48,218	39,448	46,102	38,040	47,510

Source: Tax files and Financial relation survey (INSEE) over the 1984-1999 period. The dependant variable is the logarithm of the sales at the firm level. The "listed" dummy equals one when the firm is itself listed on the French stock market or when its group leader is. Sample: To control for privatizations, we removed from the sample all firms that were at some point state owned, even partially. In model 2, year dummies are interacted with log(assets) to control for time varying size effects are included. Standard errors correct for observation level heteroskedasticity using the White's method.

Table 6: Correlation Between Innovation on Sales and Industry Sales

	Log Sales		Log Empl.	
	Model 1	Model 2	Model 1	Model 2
$\log \widehat{\text{sales}}_{st}$ ×Listed × (an>1990)	-	0.22**	-	0.20**
		(0.12)		(0.09)
$\log \widehat{\text{sales}}_{st}$ ×Listed	-	-0.16	-	-0.05
		(0.11)		(0.05)
$\log \widehat{\text{sales}}_{st}$ × (an>1990)	-	-0.11***	-	-0.05**
		(0.03)		(0.02)
$\log \widehat{\text{sales}}_{st}$	0.19***	0.25***	0.06***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)
Listed × (an>1990)	-	-0.02*	-	-0.01
		(0.01)		(0.01)
Listed	-	-0.00	-	-0.00
		(0.01)		(0.01)
Time Varying Size effects	yes	yes	yes	yes
Firm effects	yes	yes	yes	yes
Observations	79,017	78,636	71,035	68,306

Source: Tax files and Financial relation survey (INSEE) over the 1984-1999 period. The dependent variable is the logarithm of employment at the firm level. The "listed" dummy equals one when the firm is itself listed on the French stock market or when its group leader is. Sample: To control for privatizations, we removed from the sample all firms that were at some point state owned, even partially. In model 2, year dummies are interacted with log(assets) to control for time varying size effects are included. Standard errors correct for observation level heteroskedasticity using the White's method.

Table 7: When Listing Status Changes and When It Does Not

	Listing Status Changes		
	All	Stayers	Changers
$\log \widehat{\text{sales}}_{st}$ ×Listed × (an>1990)	0.08***	0.09**	0.04*
	(0.02)	(0.04)	(0.03)
$\log \widehat{\text{sales}}_{st}$ ×Listed	-0.04*	-0.02	-0.04*
	(0.02)	(0.11)	(0.02)
$\log \widehat{\text{sales}}_{st}$ × (an>1990)	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.02)
$\log \widehat{\text{sales}}_{st}$	0.13***	0.11***	0.22***
	(0.02)	(0.02)	(0.06)
Listed × (an>1990)	-1.53	-1.77***	-0.79*
	(0.38)	(0.71)	(0.46)
Listed	0.81	-	0.67*
	(0.44)		(0.34)
Time Varying Size effects	yes	yes	yes
Firm effects	yes	yes	yes
Observations	85,550	72,420	13,130

Source: Tax files and Financial relation survey (INSEE) over the 1984-1999 period. The dependant variable is the logarithm of the sales at the firm level. The "listed" dummy equals one when the firm is itself listed on the French stock market or when its group leader is. Column 1 repeats the estimate of table 4 for the whole sample. Column 2 restricts the sample to firms who never changed listing status. Column 3 restricts the sample to firms who ever changed listing status. Standard errors correct for observation level heteroskedasticity using the White's method.

Table 8: Globalization and Technology Hypothesis: Industry Level Controls

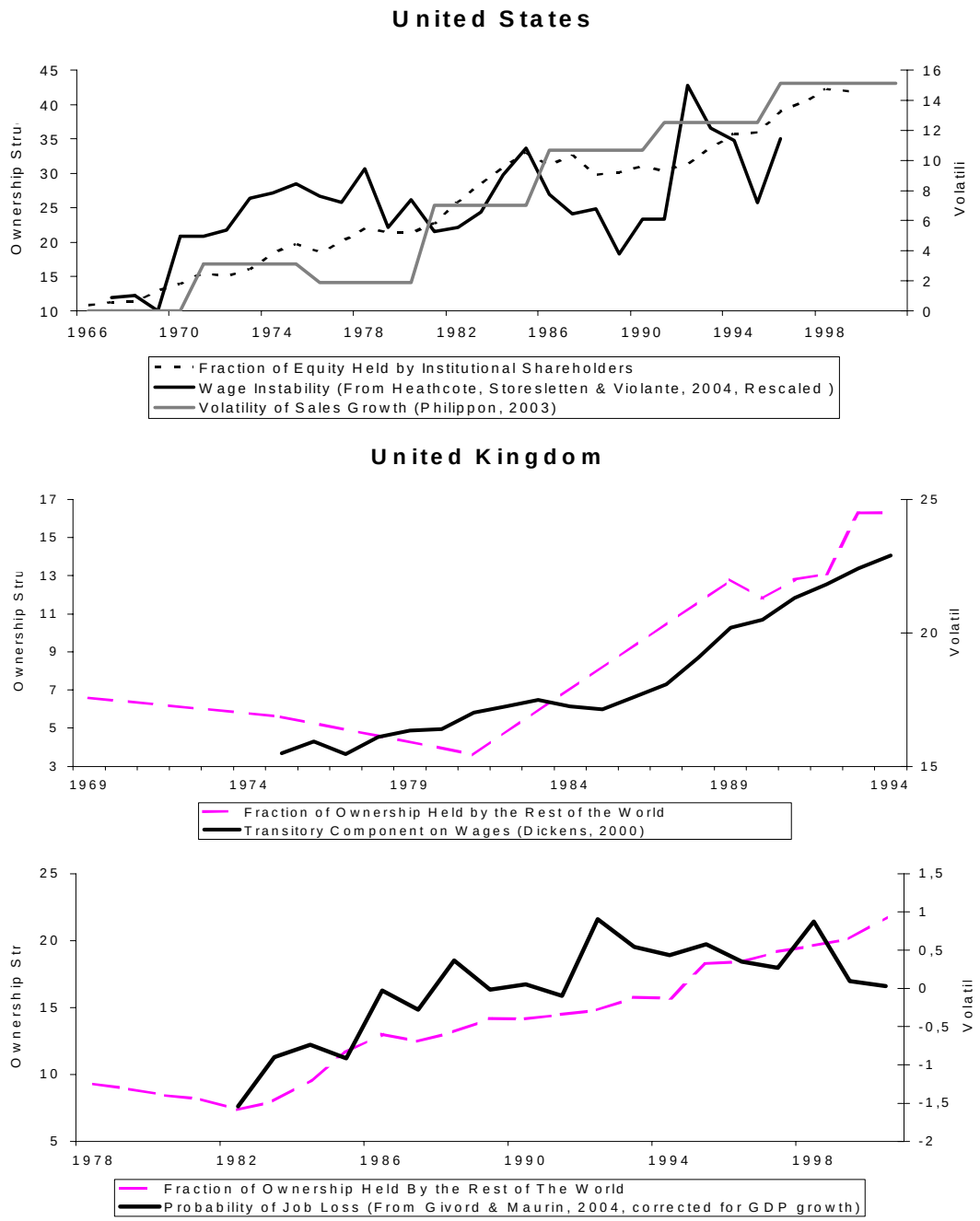
	Technology			Trade		
	Reference	Computer 92	Computer 98	Ref	Exports 92	Imports 92
Finance						
$\log \widehat{\text{sales}}_{st} \times$Listed	0.08***	0.08***	0.08***	0.08***	0.08***	0.08***
$\times$ (year$>$ 1990)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$\log \widehat{\text{sales}}_{st} \times$Listed	-0.04*	-0.05**	-0.05**	-0.04*	-0.05*	-0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Technology / Trade						
$\log \widehat{\text{sales}}_{st} \times$ Tech / Trade	-	-0.00	0.001*	-	0.07***	0.05***
$\times$ (year$>$ 1990)		(0.00)	(0.001)		(0.01)	(0.01)
$\log \widehat{\text{sales}}_{st} \times$ Tech / Trade	-	0.001	0.005***	-	-0.14***	-0.12***
		(0.001)	(0.001)		(0.03)	(0.02)
$\log \widehat{\text{sales}}_{st}$	0.13***	0.02	-0.05	0.13***	0.20***	0.19***
	(0.02)	(0.11)	(0.07)	(0.02)	(0.02)	(0.02)
$\log \widehat{\text{sales}}_{st} \times$ (year$>$ 1990)	-0.01**	0.04	-0.08***	-0.01**	-0.04***	-0.04***
	(0.01)	(0.05)	(0.03)	(0.01)	(0.01)	(0.01)
Time Varying Size effects	yes	yes	yes	yes	yes	yes
Firm effects	yes	yes	yes	yes	yes	yes
Observations	85,550	85,550	85,550	85,550	85,550	85,550

Source: Employment Structure Survey (ESE), Tax files and Financial relation survey (INSEE) over the 1984-1999 period. These estimates seek to control for various measures of industry level technology diffusion and international competition. The first three columns use industry level measures of IT diffusion computed from the REPONSE survey (Ministry of Labor: two waves in 1992 and 1998). The first column reruns the basic specification on industries for which we have the information. The second column uses the average fraction of low skilled white collars using computers in 1992. The third column uses the average fraction of all employees using computers in 1998. The last three columns use industry level measures of exports and imports in 1992. Column 4 reruns the basic specification for firms for which the export and imports data were available at the industry level. Column 5 uses the 1992 ratio of imports to value added in the industry. Column 6 uses the 1992 ratio of imports to value added in the industry. Estimates of direct effects of technology diffusion / trade / listing status on the level of sales are omitted to ease reading. Standard errors correct for observation level heteroskedasticity using the White's method.

Table 9: Globalization and Technology Hypothesis: Firm Level Controls

	Technology (1)		Technology (2)		Trade	
	Reference	Computer 93	Ref.	Skill Struc.	Ref.	Exports
Finance						
$\log \widehat{\text{sales}}_{st} \times$Listed	0.05**	0.05**	0.07***	0.07***	0.07**	0.07***
$\times$ (year> 1990)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
$\log \widehat{\text{sales}}_{st} \times$Listed	0.00	-0.00	-0.04*	-0.04*	-0.03	-0.03
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Technology / Trade						
$\log \widehat{\text{sales}}_{st} \times$ Tech / Trade	-	0.32	-	0.09***	-	-0.14***
		(0.95)		(0.03)		(0.03)
$\log \widehat{\text{sales}}_{st}$	0.12***	0.12***	0.12***	0.07***	0.16***	0.18***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$\log \widehat{\text{sales}}_{st} \times$ (year> 1990)	-0.00	-0.00	-0.00	-0.01	-0.04***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Time Varying Size effects	yes	yes	yes	yes	yes	yes
Firm effects	yes	yes	yes	yes	yes	yes
Observations	63,288	63,288	67,995	67,995	85,857	85,857

Source: Employment Structure Survey (ESE), Tax files and Financial relation survey (INSEE) over the 1984-1999 period. These estimates seek to control for various firm level measures of technology diffusion and international competition. Columns 1, 3, 5 runs the basic specification on firms for which we have the information. Columns 2 and 4 controls for firm-level adoption of technology; column 6 controls for firm-level exposure to international competition. In column 2, the control corresponds to the amount of computer capital as available for a subsample of the Tax Files. In column 4, we use the share of skilled workers in the workforce; this information is extracted from the Employment Structure Survey. Column 6 uses the current share of exports in total sales. Estimates of direct effects of technology diffusion / trade / listing status on the level of sales are omitted to ease reading. Standard errors correct for observation level heteroskedasticity using the White's method.



Note: For the US, the dotted line represents the evolution of the share of institutional owners (pension and mutual funds) in total share ownership (Source, Federal Reserve). The volatility of sales growth is the mean firm level variance of sales, computed over five year periods, using quarterly accounts from Compustat (Philippon, 2004). Wage instability is the part of the variance of wage distribution that is attributed to the transitory component of the wage process (as computed by Heathcote, Storesletten and Violante, 2004, rescaled). For the UK, the pink dotted line represents the evolution of the share of foreign ownership in total outstanding equity (Source: ONS; before 1989, such information is available only for years 1963,1969,1974 and 1981). The plain line represents the evolution of the part of the variance of wage distribution that is attributed to the transitory compnent of the wage process (as computed by Dickens, 2000). For France, the dotted line outlines the evolution of the share of foreign owners in outstanding equity (source: Banque de France). The plain line represents the residual of the regression of the average probability of job loss on GDP growth (from Maurin and Givord, 2004).

Figure 1: Rise in Uncertainty and Changes in Equity Ownership for the US, the UK and France

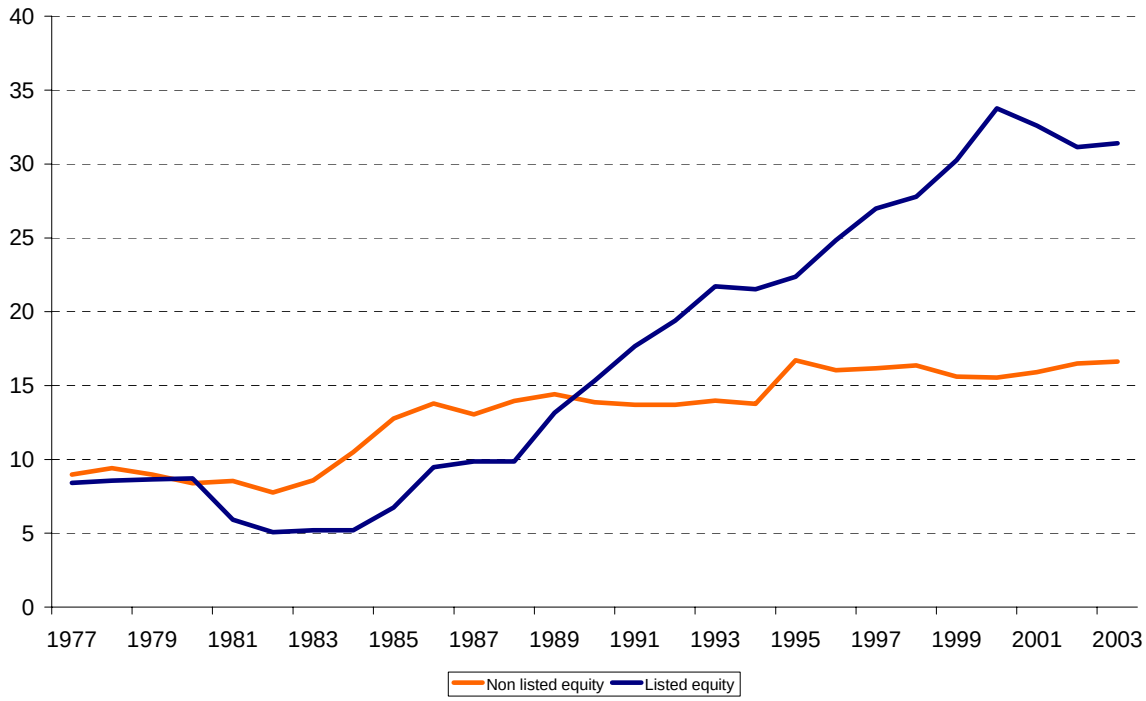


Figure 2: Share of Foreign Ownership by Category of Equity: France 1977 - 2002

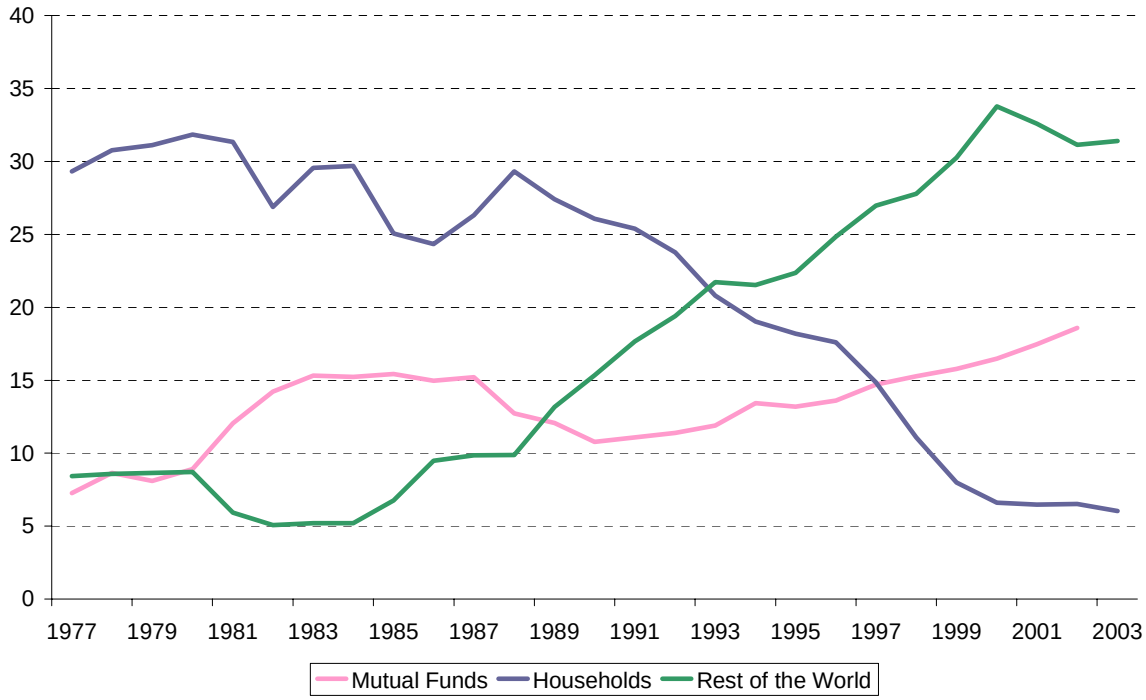


Figure 3: Ownership of Listed Equity: France 1977 - 2002 (Source: Banque de France)