Learning from Errors in Entrepreneurship

Camille Hebert *

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Abstract

This paper studies how entrepreneurs form new beliefs after making forecast errors. I use survey-based micro data that are representative of the population of French entrepreneurs, and I find that 21% of entrepreneurs make optimistic errors, while 36% make pessimistic errors, suggesting that a minority of entrepreneurs are initially well-calibrated. Although optimism and pessimism are persistent types over time, I show that the likelihood of making errors declines *within* individuals over time. After overestimating their development and hiring prospects, optimistic entrepreneurs revise their beliefs downward, whereas pessimistic entrepreneurs, who underestimate their prospects, revise upward. The evidence is consistent with entrepreneurs who learn from their past errors. In addition, the ability to correctly forecast sales and employment and revising beliefs are correlated with better performance and growth, and even more so for entrepreneurs who started with pessimistic beliefs.

Keywords: Entrepreneurs, beliefs, optimism, learning, start-ups' growth

JEL Codes: D83, D84, E37, G02, G41

*University of Toronto. email: camille.hebert@rotman.utoronto.ca. I would like to thank Anat Admati, Pat Akey, Daniel Andrei, Paul Beaumont, Kai Baron, Sabrina Howell, Michelle Lowry, Song Ma, David Thesmar and Ting Xu for helpful comments, as well as participants at the Junior Entrepreneurial Finance and Innovation lunch, the Workshop on Entrepreneurial Finance and Innovation seminar series, the Early-Career Behavioral Economics conference 2021, the University of Toronto, York University, McGill University and the University of Oklahoma. This work is supported by a public grant overseen by the French National Research Agency as part of the "Investissements d'avenir" program (reference: ANR-10-EQPX-17 – CASD).

1. Introduction

Is it best to expect the best? Research on optimism finds that positive beliefs are associated with well-being and positive health outcomes (Scheier and Carver, 1985; Scheier, Carver and Bridges, 1994). There is also evidence that unrealistic optimism comes with costs (Puri and Robinson, 2013). Entrepreneurs must make choices, often with incomplete information and uncertainty about the future, and hence they must form expectations about the future of their companies, leaving open the possibility to experiment and make mistakes, but also the possibility to learn from these mistakes. Examining how entrepreneurs form expectations is likely to help us to understand why do people start new businesses, despite high chances of failure and low returns, and why do they keep running them (Hamilton, 2000; Moskowitz and Vissing-Jørgensen, 2002).

In this paper, I study how entrepreneurs form their expectations and incorporate newly available information to revise their beliefs. I focus on entrepreneurs' beliefs about their own businesses' future development and hiring prospects. I show that entrepreneurs do not necessarily start with the same priors about the future but learn from their past errors to form new expectations. Despite a large volume of research on behavioral biases in the cross-section of CEOs, managers and analysts, very little is known about the *dynamics* of individuals' beliefs formation.

A valuable strategy to test whether entrepreneurs learn over time consists of observing the dynamics of expectation errors and subsequent updates of expectations *within* individuals over time. An expectation error is defined as the difference between the expectation about the future realization of a micro- or macroeconomic variable and its actual realization later on. However, without a panel dataset of individuals' expectations observed at different points in time, there is no way to analyze the dynamics of entrepreneurs' expectations and thereby tell whether entrepreneurs learn and which learning pattern fits the data best (Bordalo et al., 2020).

I take advantage of the panel structure of a unique survey of French entrepreneurs available from the French Bureau of Statistics (Insee) to study the dynamics of entrepreneurs' beliefs about their own business' future development and hiring prospects. I combine a large-scale survey of more than 200,000 entrepreneurs that is representative of the population of start-ups founders in France (*Système d'information des nouvelles entreprises*, SINE) with the corporate tax files available for every firm in France every year from 1998 to 2017 (see Landier and Thesmar, 2008; Hebert, 2020). The first advantage of using the SINE survey is its high response rate (approx. 90%), which makes it representative of the population of start-up founders in France. Every four years between 1998 and 2014, a new cohort of randomly selected entrepreneurs representing

approximately 25% of the population of new firms founded that year takes the survey. Second, the dataset contains individual entrepreneurs' detailed biographical information and extensive project characteristics, including their development and hiring expectations for the new venture. Third, the availability of corporate performance measures and employment composition early in the firm's life cycle allows for a comparison of entrepreneurs' expectations to realizations (Landier and Thesmar, 2008). Therefore, I identify entrepreneurs who make expectation errors and characterize errors as either optimistic or pessimistic. Fourth, a unique feature of the data is that they follow the same entrepreneur over five years and report his expectations about the future at several points in time, as well as other variables. Thus, I construct a panel dataset of individual expectations to observe whether entrepreneurs update their expectations to characterize potential learning effects *within* individuals.

I formalize the idea that entrepreneurs learn from their past errors by building on the adaptative learning literature that incorporates the role of past experiences in Bayesian updating models (e.g., Malmendier and Nagel, 2016). I introduce in a simple model the possibility that entrepreneurs update their beliefs as a consequence of past errors. I argue that entrepreneurs are influenced more strongly by their past expectation errors experienced during the firm's lifetime than by other firm-level or macroeconomic news. Specifically, I assume that individuals use their experience of past errors to update their own-business' growth expectations. The gain, that is the strength of updating in response to past expectation errors, depends on the sign of the error, i.e., whether the error consisted in over-estimating or under-estimating future prospects.[1]

An advantage of this approach is that it allows entrepreneurs to start with non-uniform priors but to also learn and update beliefs (Morris, 1994; Coval and Thakor, 2005). In the benchmark case, the entrepreneur is well-calibrated and does not make an expectation error, thus, the potential update of expectations does not depend on past errors, and the correlation between updates and errors is equal to zero. By contrast, if the entrepreneur made an optimistic error in the period before, her expectations exceeding the growth realization, she should update her beliefs downward, such that it exists a positive correlation between making an optimistic error and revising downward. In the case of an initial pessimistic error, with expectations that are below the actual growth realizations, an entrepreneur who learns from past errors should update her beliefs upward in the next period.

The raw data highlights that a substantial portion of the population of entrepreneurs make optimistic errors which is in line with the literature on optimistic entrepreneurs (Landier and

[1]Note that this approach overweights realizations observed during the startups' lifetimes and tilts the excess weights toward the most recent observations of errors when forecasting hiring and growth.

Thesmar, 2008; Puri and Robinson, 2013). 21% of entrepreneurs in my representative sample of French entrepreneurs overestimate their development prospects, and 21% overestimate their hiring prospects. More surprisingly perhaps, I find that another important portion of the population of start-up founders underestimate their hiring and development prospects.[2] A total of 37% of entrepreneurs make pessimistic errors. In addition, the raw data also show that an important part of entrepreneurs change their beliefs over time: 39% of entrepreneurs update their hiring expectations and 23% update their development expectations. Interestingly, most of them update their beliefs downward while entrepreneurs who make optimistic errors represent a lower proportion of the population than those who make pessimistic errors, suggesting either that most of entrepreneurs consistently receive bad news or that pessimism is sticker than optimism.

I provide three pieces of evidence that collectively suggest that entrepreneurs learn from their past errors. First, I take the prediction of the model to the data and test whether past expectation errors predict current updates of expectations. I use the panel structure of my data to correlate belief updates with past expectation errors *within* individuals. I find that entrepreneurs who made an optimistic expectation error are more likely to update their beliefs, whereas entrepreneurs who underestimated their prospects in the previous period are less likely to update. This asymmetric updating behavior is consistent with individuals being more sensitive to negative news (Kahneman and Tversky, 1979; Kuhnen, 2015).

I then dig into the direction of the update, i.e. upward or downward, following an optimistic or a pessimistic error. I show that entrepreneurs are more likely to update downward if they hold optimistic beliefs in the previous period. Consistently, the evidence shows that they are less likely to update upward if they overestimated their forecasts in the previous period. Regarding pessimistic expectation errors, I find that entrepreneurs who underestimated their prospects are more likely to update their hiring and development beliefs upward. They are also significantly less likely to update their expectations downward. The evidence suggests that entrepreneurs who have made expectation errors are significantly more likely to revise and correct their expectations in the next wave of the survey in the opposite direction of the error. The results are consistent with entrepreneurs who learn from their past errors, even when starting with different priors.

Second, I correlate current updates and future expectation errors in the spirit of Coibion and Gorodnichenko (2015); Bordalo et al. (2020).[3] I find that current updates to hiring ex-

[2]Expectation errors are based on expectations: 24% of entrepreneurs in France report that they plan to hire in the next period, and 39% of entrepreneurs plan to develop or continue to develop the new venture.

[3]The approach in the macro-behavioral literature consists in correlating current forecast revisions of macroeconomic variables with future forecast errors (Coibion and Gorodnichenko, 2015). One strand of this literature

pectations have ambiguous effects on future expectation errors which depends on the update's direction. Entrepreneurs who update their expectations upward are significantly more likely to make optimistic errors and they are less likely to make pessimistic errors. Consistently, I find that entrepreneurs who update downward are less likely to make optimistic errors in the next period but are also more likely to underestimate their hiring prospects, thus making pessimistic errors in the future. Overall, the evidence shows that entrepreneurs who learn make less errors in the subsequent periods. It also highlights the importance of the priors, i.e., whether the errors was optimistic or pessimistic, which determines the direction of the update.

Third, I look at the dynamics of expectation errors within individuals. In my representative panel of French entrepreneurs, I find that expectation errors decline over time within individual entrepreneurs. Entrepreneurs who made errors in the previous periods are also significantly less likely to make forecast errors again in the future. The autocorrelation coefficient of optimistic (pessimistic) hiring forecast errors is -.47 (-.34) within an individual entrepreneur over time. This test suggests not only that the likelihood of making the same errors over time decreases but also that the entrepreneurs' updating behavior found earlier is inconsistent with a mean-reversion pattern overtime within individuals.

Next, I remove the individual fixed effects and I look at the dynamic of expectations across entrepreneurs who started in the same sector who started the same year. In contrast with the within-individuals evidence, I find a positive auto-regressive coefficient on expectation errors. This result suggests that expectation errors are persistent across individual entrepreneurs. Entrepreneurs who are likely to make optimistic errors in the first period are likely to continue to do so in the subsequent periods compared those in the same industry who started the same year but who correctly forecast future outcomes (Landier and Thesmar, 2008; Ma et al., 2020). The evidence shows that even if optimistic and pessimistic types are persistent over time across individuals, the likelihood of expectation errors are declining within individuals over time, which is consistent with adaptative learning.

I examine two alternative explanations for the documented learning effects. First, entrepreneurs may have different risk attitudes or perhaps different abilities to learn and may update their expectations as a result of these unobservable individual effects. I include individual fixed effects in the main specifications to neutralize any fixed individual factors that may confound my results. Note that this kind of specification is only possible when using a

argues that the predictability of forecast errors arises from information frictions, and it documents an underreaction to new information (Coibion and Gorodnichenko, 2015; Bouchaud et al., 2019). Another strand finds evidence of extrapolative behaviors and an overreaction to new information (Greenwood and Shleifer, 2014; Bordalo et al., 2019; Barrero, 2020; Bordalo et al., 2020). Consistent with Bordalo et al. (2020), I investigate this correlation within individual entrepreneurs over time.

panel dataset of individual expectations and has shortcomings. Specifically, the introduction of individual fixed effects requires observing the entrepreneur over at least two periods, thereby excluding from the analysis start-ups that survive fewer than three periods and creating a survival bias in the sample. I discuss the observable differences between start-ups that survive and those that do not. However, without looking at expectation formation within individual entrepreneurs, there is no way to analyze expectation formation dynamics and empirically characterize learning patterns.

Second, entrepreneurs may update their expectations not only as a consequence of their past expectation errors but also due to the arrival of new information. I include sector $\times$ year fixed effects in all models to neutralize the effect of unobservable sector-level shocks that may also lead entrepreneurs within a given sector to update their beliefs. In additional tests, I correlate recent firm-level news (i.e., employment growth and sales growth) with expectation errors and updates to expectations, respectively (Barrero, 2020; Ma et al., 2020). I find that when news is in the positive domain, entrepreneurs form overly optimistic beliefs about their hiring and development prospects. If, instead, the firm experiences shrinking employment, the entrepreneur tends to be over-pessimistic. The evidence suggests that entrepreneurs overestimate the persistence of recent growth and is consistent with extrapolative expectations.[4] Regarding updates to expectations, I find that micro-level changes in employment size and sales growth are associated with less positive updates and more negative updates to development expectations. However, the evidence shows that firm-level news appear to have little to no effect on updates relative to past expectation errors.

In the next part of the paper, I examine the cross-section of entrepreneurs' personal characteristics that correlate with expectation errors and updates to expectations. I show that female entrepreneurs and entrepreneurs older than 40 years old are less likely to make optimistic errors and are more likely to make pessimistic errors. I also find that female entrepreneurs are overall less likely to update their beliefs regarding the development of their firm. Regarding older entrepreneurs, they are overall less likely to update their beliefs relative to younger entrepreneurs. Serial entrepreneurs are significantly more likely to overestimate their development expectations but they are also more likely to revise these beliefs downward suggesting that they are more likely to learn from their past errors (Lafontaine and Shaw, 2016). Finally, the evidence shows that entrepreneurs who make the choice to incorporate the new venture and who self-report that they want to grow their business, as opposed to just create their own job, are more likely to

[4]Other studies in the forecasting literature find evidence of extrapolative behaviors: Bordalo et al. (2019) and Bordalo et al. (2020) among analysts, Rozsypal and Schlafmann (2017) among US households, and Barrero (2020) among US CEOs.

make both optimistic and pessimistic expectation mistakes. In addition, I find that they are also more likely to correct these expectation errors in the next period, suggesting that high-growth orientation in entrepreneurship correlates with learning.

In the last part of the paper, I show that making errors and then learning from these errors have real effects on corporate performance. I find that entrepreneurs who overestimate their hiring prospects then hire less in the three years after relative to years when they do not make errors. I also find that start-ups generate lower sales when entrepreneurs overestimate their development prospects. Finally, start-ups whose entrepreneurs make hiring or development expectation errors have a lower probability of surviving five years after creation relative to start-ups run by entrepreneurs who do not make expectation errors within the same sector cohort. In summary, expectation errors are associated with worse corporate performance in the cross-section and in the time series of start-ups.

However, my results show that although updates to expectations are not significantly associated with better performance in isolation, the interaction of current updates and past expectation errors is positively and significantly associated with corporate growth and a higher probability of surviving five years or longer. I show that learning from past expectation errors is associated with 8% more sales and 11% more employment growth over the three years after the expectations are revised. The start-ups of these entrepreneurs have a higher probability of surviving five years or longer. A broader implication of my results is that learning mitigates entrepreneurial optimism's negative effects and leads to better corporate performance within and across firms.

Related literature. This paper is primarily related to recent works documenting that firm managers, entrepreneurs, households, and professional forecasters have biased beliefs and make forecast errors as a result. A growing body of work tests the systematic predictability of forecast errors using survey data and looking at inflation and other macro forecasts (Malmendier and Nagel, 2011, 2016; Coibion and Gorodnichenko, 2012, 2015; Coibion, Gorodnichenko and Ropele, 2020), the stock market (Greenwood and Shleifer, 2014; Bordalo et al., 2019), credit spreads bordalo2018diagnosticcredit, and corporate decisions and earnings (Ben-David, Graham and Harvey, 2013; Bachmann, Elstner and Sims, 2013; Bachmann and Elstner, 2015; Gennaioli, Ma and Shleifer, 2016; Bouchaud et al., 2019; Tanaka et al., 2019; Altig et al., 2020; Barrero, 2020; Ma et al., 2020).[5] Another strand of the literature focuses on the real effects of managerial

[5]Expectation errors have also been studied in laboratory-controlled experiments (Hommes et al., 2005; Kuhnen, 2015; Beshears et al., 2013; Frydman and Nave, 2017; Landier, Ma and Thesmar, 2019).

optimism (Malmendier and Tate, 2005, 2008, 2015; Hirshleifer, Low and Teoh, 2012; Graham, Harvey and Puri, 2013; Gennaioli, Ma and Shleifer, 2016), including specifically, in the context of entrepreneurship, see Cooper, Woo and Dunkelberg (1988); Åstebro, Jeffrey and Adomdza (2007); Landier and Thesmar (2008); Puri and Robinson (2013).[6][7] My contribution to this literature is twofold. First, I show that entrepreneurs who start are not necessarily optimistic, but some also make pessimistic errors while others correctly predict their start ups' growth. Second, I show that entrepreneur's biased beliefs have real effects on corporate growth and the probability the firm survives.

My findings also contribute to the strands of literature in economics and psychology that investigate the determinants of belief formation. This paper contributes to studies of learning. Several studies have also focused on the specific role of attention (Enke and Zimmermann, 2019; Hartzmark, Hirshman and Imas, 2019; Enke, 2020), domain-specific stereotypes (Coffman, 2014; Bordalo et al., 2016, 2019; Hebert, 2020) and the importance of prior experience in beliefs formation and financial decision making (Kuhnen and Knutson, 2011; Kuhnen, 2015; Malmendier and Nagel, 2011, 2016; Nagel and Xu, 2019; Malmendier, Nagel and Yan, 2020).[8] Relatedly, models of associative memory highlight how memory recall affects decision making (Mullainathan, 2002; Bordalo, Gennaioli and Shleifer, 2020; Wachter and Kahana, 2020). Overall, the empirical evidence on the role of learning in belief formation remains scarce due to the data limitation. The evidence presented in this paper sheds light on the process by which entrepreneurs, who do not start from homogeneous and objective priors, use their experience of past errors to form new beliefs. Indeed, although optimism and pessimism are persistent types over time, entrepreneurs learn from their expectation errors and correct their beliefs accordingly.[9]

Finally, this paper is related to a recent literature about experimentation in entrepreneurship. According to this view, the value of entrepreneurship arises from the real options available from experimenting with new ideas (Kerr, Nanda and Rhodes-Kropf, 2014; Manso, 2016). Related to my study, Howell (2019) studies how entrepreneurs learn from negative feedback received in venture competitions and finds that entrepreneurs delay their exit, and therefore

[6]Further evidence of overconfidence or optimism among entrepreneurs includes Camerer and Lovallo (1999); Arabsheibani et al. (2000); **?**); Hayward, Shepherd and Griffin (2006); Koellinger, Minniti and Schade (2007).

[7]Related papers in household finance show that individuals' expectations are central to explaining their savings, consumption, and investment choices Kuhnen and Miu (2017); Das, Kuhnen and Nagel (2020); Fermand et al. (2018); D'Acunto et al. (2019, 2020).

[8]The literature on the informational role of financial markets considers that stock prices contain valuable information from which firm managers can learn to guide their real decisions (see e.g., Bakke and Whited, 2010; Bond, Edmans and Goldstein, 2012; Foucault and Fresard, 2014).

[9]The literature studying entrepreneurs' expectation errors has primarily focused on the persistence of entrepreneurial optimism over time (Bernardo and Welch, 2001; Coval and Thakor, 2005; Landier and Thesmar, 2008).

consider continuation as a real option.[10] However, very little is known about the link between experimentation and behavioral attitudes of entrepreneurs. This paper shows that entrepreneurs who hold pessimistic beliefs survive longer, whereas those with initial optimistic beliefs are more likely to fail early, except if they correct their biased beliefs. The evidence suggests that entrepreneurs who experiment may be those with prudent initial expectations and those who learn from their past errors.

2. Model of Learning in Entrepreneurship

Consider an entrepreneur who forms expectations about next period growth for her business. The formation of such expectations about the future depends on learning from the last period's expectations errors, which reflects the difference between the entrepreneur's past expectation and the subsequent past realization.

I model the next period growth of entrepreneur i's business as the expectation for the next period's growth formed at time t and an error:

$$\Delta x_{t,i} = \underbrace{\mu_{t,i}}_{\text{Expectation}} + \underbrace{\varepsilon_{t,i}}_{\text{Error}} \text{ with } \varepsilon_{t,i} \sim \mathcal{N}(0, \sigma) \tag{1}$$

A Bayesian entrepreneur uses the history of growth $H_{t,i} = (\Delta x_{1i}, \Delta x_{2i}, \Delta x_{3i}, ...\Delta x_{t,i})$ to estimate the posterior mean $\mu_{t,i}$, which is the equal-weighted average of all available information on corporate growth until time t, as follows $\hat{\mu}_{t,i} = \frac{1}{t}\sum_{s=1}^{t} \Delta x_{s,i}$ with t, the size of the data. (see e.g., Evans and Honkapohja 2001).

I rewrite equation 1 using a recursive representation with gain γ, as in Malmendier and Nagel (2016).

$$\underbrace{\hat{\mu}_{t,i} - \hat{\mu}_{t-1,i}}_{\text{Update}} = \underbrace{\frac{1}{t}}_{\gamma} \underbrace{(\Delta x_{t-1,i} - \hat{\mu}_{t-1,i})}_{\text{Past Error}} + \underbrace{\frac{1}{t}(\Delta x_{t,i} - \Delta x_{t-1,i})}_{\text{Average corporate growth}} \tag{2}$$

The difference in expectations formed at time t and $t-1$, $\hat{\mu}_{t,i} - \hat{\mu}_{t-1,i}$, corresponds to the expectation update between periods. The decreasing gain $\gamma = \frac{1}{t}$ determines the degree of updating an entrepreneur applies when faced with a past expectation error $\Delta x_{t-1,i} - \hat{\mu}_{t-1,i}$. If the past expectation error is negative, such that $\Delta x_{t-1,i} < \hat{\mu}_{t-1,i}$, corporate growth realizations

[10] Xu (2018) finds evidence that, crowdfunding which provides early market feedback, reduces the risk of experimentation. Other papers show that constraints on the ability to experiment impacts entry into entrepreneurship (Gottlieb, Townsend and Xu, 2018; Hombert et al., 2020), financing (Ewens, Nanda and Rhodes-Kropf, 2018) and re-entry (Landier, 2005; Cahn, Girotti and Landier, 2020).

are below the expectation. Hence, the expectation error is optimistic and the gain γ is positive to compensate for overly optimistic expectations. In contrast, if the past expectation error is positive, such that $\Delta x_{t-1,i} > \hat{\mu}_{t-1,i}$, the realization exceeds the expectation. The expectation error is pessimistic, and in this case, γ is negative to balance expectations that are overly negative. In addition, when the entrepreneur does not make any expectation errors, $\Delta x_{t-1,i} = \hat{\mu}_{t-1,i}$, $\gamma = 0$. $\gamma = 0$ means that the entrepreneur is rational or good at planning for the future; it also means that the entrepreneur in this framework does not have the opportunity to learn from her past errors since she did not make any errors. Thus, the gain $|\gamma|$ indicates the degree to which the entrepreneur learns. When $|\gamma|$ is large, the entrepreneur learns a lot and is more likely to update her expectations as a consequence of her past mistakes.

In addition to past mistakes, I allow other information to affect expectations. First, the arrival of new information between $t-1$ and t directly related to corporate growth can affect the formation of entrepreneurs' expectations about their own firms. $\Delta x_{t,i} - \Delta x_{t-1,i}$ can be interpreted as the average corporate growth between $t-1$ and t, which I denote by A_i. Second, I capture the influence of information other than learning from their past errors and the average corporate growth by assuming the existence of a common component F_t that is available to all entrepreneurs at time t; examples are an economic crisis, the contraction of credit in the economy or a pandemic that affects all firms in the economy. Let $U_{T;T-1|\delta,i}$ be the expectation update between period T and the past period $T-1$ made by entrepreneur i, given that expectations are formed at time T and $T-1$ regarding the future times $T+\delta$ and $T-1+\delta$, respectively. The past-error-based component of entrepreneurs' future-time-δ expectations is obtained from equation 2 as $\Phi_{T-1|\delta,i} = \gamma(\Delta x_{T-1+\delta,i} - \hat{\mu}_{T-1,i})$.

I assume that the update of subjective expectations is a weighted average of the learning-from-past-error component $\Phi_{T-1|\delta,i}$ and the average corporate growth and other macroeconomic information as follows:

$$U_{T;T-1|\delta,i} = \beta\Phi_{T-1|t+\delta,i} + (1-\beta)(F_t + A_i) \tag{3}$$

The coefficient β captures the incremental contribution of past errors $\Theta_{T-1|\delta,i}$ to the update of subjective expectation $U_{T;T-1|\delta,i}$, over and above common and individual news. Hence, entrepreneurs not only rely on the past errors realized during their firms' lifetimes but also use these experiences to form new expectations about their own firms' future.

Empirically, I estimate a modification of equation 3:

$$U_{T;T-1|t+\delta,i} = \beta\Phi_{T-1|t+\delta,i} + \alpha_i + \lambda_t + \varepsilon_{t,i} \tag{4}$$

where $U_{T;T-1|\delta,i}$ is the estimated expectation update computed from survey data. The fixed effects λ_t absorb the unobserved F_t vector of macroeconomic news and the individual fixed effects α_i absorb the time-unvarying firm-level variables, including the average corporate growth A_i. An important advantage of including individual fixed effects α_i in the equation is that they also account for an individual's persistent unobservable attitudes toward learning (e.g., different abilities to learn). Heterogeneity of this type may create a downward bias if estimated in the cross-section of the data. Specifically, optimistic entrepreneurs tend to make negative expectation errors and thus update negatively too often, leading to a spurious positive correlation between expectation updates and expectation errors.

The presence of individual fixed effects in equation 4 implies that I identify and γ and, hence, the learning-from-past-errors effect from the time series of differences in subjective expectations over time within individuals. Thus, lagged values of individual entrepreneurs' expectation errors and updates allow the identification of learning patterns at the individual level.

However, the introduction of individual fixed effects also comes with shortcomings. First, individual fixed effects do not allow individual-firm fixed effects to be disentangled from individual-entrepreneur fixed effects. Doing so would necessitate observing all potential companies founded by the same entrepreneur and her expectations about the future prospects of each of them (i.e., serial entrepreneur). In this case, the effect would be identifiable only for these entrepreneurs who have founded multiple companies and may be fundamentally different from that for first-time founders.

Second, specifications with individual fixed effects require at least two observations over time per entrepreneur to identify the effect, and thus the start-ups must survive at least two periods to provide two observations of the entrepreneur's expectations. This second shortcoming has two implications for the empirical analysis of entrepreneurs' expectation formation. First, it creates a survival bias. Start-ups that survive at least two periods (5 years) may be fundamentally different from those that do not. I discuss the observable differences between firms that survive at least five years and those that do not in section **??**. Second, it limits the number of observations for each entrepreneur for each series, decreasing statistical power and making it difficult to reliably estimate β and γ. However, without looking at expectation formation within individual entrepreneurs, there is no way to analyze the dynamics of entrepreneurs' expectations and tell

whether entrepreneurs learn and which learning pattern best fits the data.

3. Data and Descriptive Statistics

3.1. Data sources

My dataset merges the SINE survey with the corporate tax files and the matched employer-employee dataset available from the French Bureau of Statistics (Insee).

Survey of entrepreneurs. The *Système d'Information des Nouvelles Entreprises* (SINE) survey is a large-scale survey of entrepreneurs conducted by the French Bureau of Statistics every four years. For each cohort, questionnaires are sent to approximately 25% of the population of entrepreneurs who started or took over a business in France in 1998, 2002, 2006, 2010, and 2014 (cohorts). The surveyed firms are randomly selected from the firm registries. However, the SINE survey is adjusted at the margin to be representative of the industrial composition and geographic repartition of new firms in France. The response rate to the SINE survey is high (approximately 90%) because the tax authorities supervise the sending of questionnaires. The business owner is responsible for completing the documents.[11]

Three years after creating the new start-up or the takeover by a new entrepreneur, these firms are presented with follow-up questionnaires. A total of 65% of the firms in the initial wave of questionnaires responded after three years. This attrition is explained by failed businesses and businesses changing locations and not being located by survey administrators. Five years after business creation/takeover, a last wave of questionnaires is sent, and the average attrition rate is 45%. Hence, each firm selected to be part of a cohort is followed up to five years after creation if it survives. The dataset consists of a repeated panel of 30,000 to 60,000 firms per cohort, which are then matched to the corporate tax files and the matched employer-employee dataset.

Figures 1 compares the distribution of firms in the regression sample (SINE survey matched to the tax files) and in the firm registry by firm size at the end of the first year of operation, and by French SIC-1 industry. The evidence shows that the distributions of the number of firms in the regression sample and in the population of firms are fairly similar, suggesting that the regression sample of firms is representative of the distributions of firms in the French economy.

[11] More information about these data sources: www.insee.fr/sine and www.cnis.fr/sine. See also Landier and Thesmar (2008); Hebert (2020) for other uses of the data.

Tax Files and the Matched Employer-Employee Dataset. *Bénéfices Industriels et Commerciaux* and *Bénéfices Non-commerciaux* augmented by the matched employer-employee dataset (*Déclarations Annuelles des Données Sociales*) provide detailed yearly accounting (balance sheet and income statements) and employment information at the firm level between 1994 and 2017. The tax files cover all firms annually subject to either the regular corporate tax regime or the simplified corporate tax regime from creation to death.[12] From the tax files, I retrieve sales, employment size, total assets, earnings before interest and tax (EBIT), and net income. Location and industrial activity are also collected from the tax files.[13]

3.2. Main Variables

Expectations. The entrepreneur is asked about his development and hiring expectations, respectively, for the next six or twelve months after the firm is started/taken over. The first question is, "What do you plan to do over the next 6 months?", and the possible answers are as follows: (1) "To develop the company", (2) "To maintain the current balance", (3) "To recover from a difficult situation", (4) "To shut down the firm", (5) "To sell it", and (6) "I do not know". The variable *Development Expectation* takes the value of one if the entrepreneur answers (1) and zero otherwise. The entrepreneur is then asked about his hiring expectations. The question is, "Do you plan to hire over the next 12 months?". The variable *Hiring Expectation* takes the value of one if the entrepreneur answers "Yes" and zero otherwise. The dummy variables *Uncertainty Development* and *Uncertainty Hiring* equal one when the entrepreneur answers "I don't know" and zero if he answers with any of the other items.

The responses are confidential and collected by the French Statistical Institute for national statistics purposes, so entrepreneurs have few motives to misreport their beliefs. A critical advantage of the SINE survey is that it covers a large and representative sample of the population of French start-ups.[14] The panel structure of the data allows me to document variations in the reported expectations over time within individuals. Thus, we often observe entrepreneurs to modify their expectations over time, which mitigates the concerns about subjective answers found in surveys (see Bertrand and Mullainathan, 2001).

[12] Small firms with annual sales below €32,600 (€81,500 in retail and wholesale trade) can opt out and choose a special micro-business tax regime (called *micro-enterprise*). Income falling into this category is taxed at the personal level. These firms do not, therefore, appear in the corporate tax files.

[13] France is divided into 101 counties (*départments*). The French SIC is the *Nomenclature des Activités Françaises* (NAF) and consists of 540 sectors at the 4-digit level.

[14] Note that the questions asked in the SINE survey do not allow us to elicit subjective probability distributions about future own-firm sales and employment growth, as in Ben-David, Graham and Harvey (2013); Altig et al. (2020); Barrero (2020). Consequently, the analysis of entrepreneurs' beliefs focuses on the first moment of the probability distribution, which allows to identify optimistic and pessimistic beliefs. However, the SINE survey does not allow to identify uncertainty and overconfident attitudes.

Expectation errors. I assess *Expectation Errors* by comparing entrepreneurs' expectations about the next year to the venture's actual sales and employment growth, which I observe using the tax files and the matched employer-employee dataset (see Landier and Thesmar, 2008). An entrepreneur makes an expectation error if there is a difference between the entrepreneur's *expectation* and subsequent realizations. The expectation can be optimistic or pessimistic depending on the sign of initial expectation and the subsequent realization.

The variable *Optimistic Development Error* takes the value one if the entrepreneur answers that she wants to develop the company and if sales remain 5% lower in the baseline measure. The variable takes the value of zero if the entrepreneur matches her expectations and achieves sales growth or if she does not have positive expectations and does not grow. The variable *Pessimistic Development Error* takes the value of one if the entrepreneur answers that she does not intend to develop the company and if sales growth exceeds 5% in the baseline measure, and zero if the entrepreneur does not intend to develop the company, and in fact the subsequent realized sales growth is lower than the baseline 5% threshold, or if the entrepreneur has positive expectations about the future. For robustness, I also consider 3%, 10% and 20% as alternative sales growth thresholds for both *Optimistic Development Error* and *Pessimistic Development Error*.

Similarly, the variable *Optimistic Employment Errors* takes the value of one if the entrepreneur answers that she expects to hire employees over the next year and if the firm's employment size remains unchanged or decrease at the end of the next year. The variable takes the value of zero if the entrepreneur matches her expectations and grows by at least one employee or if she does not have any positive hiring expectations. The variable *Pessimistic Employment Error* takes the value of one if the entrepreneur answers that she does not intend to hire over the next year and if the firm's employment size grows by at least one employee in the baseline measure, and zero if she has positive hiring expectations or if she does not have any and if the firm's employment size remains unchanged or decrease at the end of the next year. For robustness, I also use two and zero as alternative employment growth thresholds.

Figures 2 plots the distributions of initial development expectation error by French SIC-1 industries. The results show that about 50% of entrepreneurs within industries do correctly estimate their development prospects, about 35% underestimate their development prospects and about 15% of entrepreneurs correctly estimate them. The evidence also displays a significant variations of the proportion and the number of entrepreneurs who make optimistic, pessimistic and no development error, respectively. The medical industry count the largest proportion of entrepreneurs who underestimate their development prospects (53%), and the smallest propor-

tion of entrepreneurs who overestimate their prospects (5%). In contrast, the Information and Communication industry and the Finance and Insurance industry have the highest propositions of optimistic entrepreneurs (17% and 16%), and a relatively low population of entrepreneurs who underestimate their development prospects (33% and 29%).

Updates. Entrepreneurs can update and revise their expectations over time. A unique feature of the data is their panel structure, which allows me to measure entrepreneurs' expectations regarding sales and employment growth over the next year at three points in time: at the end of the first year of creation (t=1), at the end of the third year (t=3) and at the end of the fifth year (t=5) after the initial period. I create the variables *Update Development* and *Update Hiring* by comparing reported expectations over time. If the entrepreneur changes her expectations, the dummy variable *Update* takes the value of one and zero if her expectations remain unchanged.[15] The update can be *Positive* if the entrepreneur expects to hire or to develop the firm in the next year. It can also be positive if she does not expect this in the period before or if her development or hiring forecasts remain unchanged relative to the previous period.The update can be *Negative* if the entrepreneur does not expect to hire or develop the firm. It can also be negative if positive expectations in the previous period or if her development or hiring forecasts remain unchanged relative to the previous period.

Entrepreneurs' biographical information. Gender, age, and citizenship dummy variables are also collected from the SINE survey. Education information is recoded such that cohorts can be compared over time. Education dummy variables include *No degree*, *High school*, *Bachelor's*, *Master's/PhD*, and *Elite engineering school*. Additionally, entrepreneurs are asked about the number of years they have worked in the industry and the number of start-ups they have founded. I code a dummy *Expert* if the entrepreneur reports at least three years of industry experience. The dummy variable *Serial* indicates whether the entrepreneur had founded a start-up before the one targeted by the questionnaire.

In the survey, entrepreneurs are asked about their motivations for founding a start-up and their desire to grow the founded start-up. I identify an entrepreneur as *High-growth oriented* if she aims "to develop the company" as opposed "to create her own job". In a separate question, entrepreneurs report up to three of their main motivations for founding a start-up among the following propositions: *Add earnings* to the household; desire for *Independence*;

[15] Note that the different expectations concern the year following the year in which the questionnaire is conducted and are not a pure update of expectations measured at different dates and concern the same time horizon of a given variable (e.g., Coibion and Gorodnichenko, 2015).

address unemployment; pursue a *Taste* for entrepreneurship and new challenges; take on an *Opportunity*; and explore a *New idea* for a product, service, or market. I use information that is time-invariant in cross-sectional tests.

3.3. Descriptive Statistics

Table 1 reports the statistics of the raw data for entrepreneurs' expectations about their hiring and development prospects, their expectation errors and updates to expectations.

Expectations, errors and updates. In total, 39% of entrepreneurs in my sample expect to develop their company over the next year. Other entrepreneurs expect to stabilize the current situation (42%) or recover from a difficult situation (10%); 5% of them expect to shut the firm down and 3% to sell it. After three years of operations, 3% of entrepreneurs expect to shut down, and 5% expect to sell the firm. Regarding hiring forecasts, 24% of entrepreneurs expect to hire workers over the next year. However, 24% of them indicate that they do not know whether they will hire or not, and 13% do not know what they will do in the coming year.

When we compare entrepreneurs' development and hiring forecasts to their firm's subsequent sales and employment growth realizations, the evidence reveals that a significant proportion of entrepreneurs make forecast errors: 16% of entrepreneurs in my sample make optimistic forecast errors when growing by at least one employee in the next year, and 19% of entrepreneurs are optimistic when I set the employment growth threshold to two employees. In addition, 44% of entrepreneurs make pessimistic hiring forecast errors, meaning that they still hire when they did not expect to. Regarding entrepreneurs who expected to develop the company, 21% make optimistic forecast errors, and 36% make pessimistic development forecast errors.

A substantial proportion of entrepreneurs revise their forecasts between periods. Thirty-five percent of entrepreneurs in my sample revise their development, and 22% revise their hiring forecasts. More specifically, 13% of entrepreneurs revise their development forecasts upward. Those who did not plan to develop their start-up during the previous period indicate the next period that they plan to do so over the coming year. In addition, 21% of entrepreneurs revise their development forecast downward. While they planned to develop the firm the last time they were asked, they do not plan to do so anymore. In addition, 7% of entrepreneurs in my sample revise their hiring forecasts upward, and 15% revise their hiring forecasts downward. Thus, entrepreneurs revise their forecasts downward more often than upward. In addition, even though the evidence shows that a significant proportion of entrepreneurs revise their development

or hiring forecasts, the average entrepreneur does not revise her exceptions either because she was right in the first place or possibly because she does not learn from new information.

Entrepreneurs' biographical characteristics In my sample, 30% of start-ups are female-led, and the median entrepreneur is between 35 and 44 years old at the year of creation/takeover. Regarding higher education, 35% of surveyed entrepreneurs graduated with a bachelor's or/and a master's/PhD degree. In addition, 61% of entrepreneurs indicated having at least three years of experience in the sector before starting up. Thirty-four percent of them have 10 years or more experience in the sector. Most of the entrepreneurs in my sample (42%) were employed before starting up, whereas 34% were unemployed. Others were independent workers, CEOs, or students (3%). Regarding entrepreneurial experience, 27% of entrepreneurs in my sample had already founded a start-up, and 3% of them had founded more than three start-ups.

In my sample, 79% of firms are newly created firms, and 21% are private firms taken over by new entrepreneurs. In total, 52% are incorporated firms. However, only 30% of entrepreneurs indicate that their main objective is to grow the company instead of creating their own jobs. Digging into motivations for creating a start-up, the average entrepreneur's main motivation is to become independent (63%) and, to a lesser extent, because of a taste for entrepreneurship (47%). Other motivations include founding a company to seize an opportunity (28%), to explore a new idea (15%), or to add earnings (25%).

4. Main Results

In this section, I provide three pieces of evidence suggesting that entrepreneurs learn over time from their past errors. First, I show that entrepreneurs who make expectation errors are more likely to update their beliefs. Second, I find that entrepreneurs who updated their expectations are less likely to make expectation errors in the future. Third, I provide evidence that entrepreneurs who made expectation errors are less likely to make expectation errors again in the future. Notably, all tests presented in this section include individual fixed effects and rely on the time series of entrepreneurs forming expectations about their own businesses.

4.1. Updates and past expectation errors

I begin by testing the model's main prediction, which is that entrepreneurs update their beliefs as a result of past expectation errors. Table 2 reports the relationship between updates to

hiring (columns 1 to 3) and development (columns 4 to 6) expectations and past optimistic and pessimistic errors within individuals. I report the decomposition between positive and negative updates to hiring and development expectations. All specifications include individual fixed effects to compare the same entrepreneur over time and to offset unobservable confounding effects toward individual attributes and the ability to learn. I also include SIC-2-industry-cohort-year fixed effects to control for any potential industry shocks the year initial beliefs are formed. Standard errors are clustered at the firm level.

The results show that entrepreneurs are significantly more likely to update their expectations when they make optimistic errors in the previous period (columns 1 and 4). In addition, I find that entrepreneurs who make pessimistic errors are less likely to update their beliefs in the next period. This asymmetric updating effects is consistent with the idea that entrepreneurs assess gains and losses differently (Kuhnen, 2015).

Next, I decompose these effects between upward and downward updates. The evidence shows that entrepreneurs who overestimated their hiring and development prospects are significantly more likely to change their forecasts from positive (in the initial period) to negative (in the next period) (columns 2 and 5). In contrast, entrepreneurs who made a pessimistic expectation error following the initial period are significantly more likely to update their beliefs upward.

Consistently, entrepreneurs who made a pessimistic expectation error following the initial period are significantly less likely to update their beliefs downward, whereas those who made an optimistic expectation errors are more likely to update their beliefs upward (columns 3 and 6). Note that negative updates represent the larger part of updates and thus drive the pooled effects in columns 1 and 4.

Overall, the evidence shows that entrepreneurs update their forecasts in reaction to past expectation errors. I also find evidence that pessimism is stickier than optimism within individuals. Entrepreneurs who make pessimistic errors are relatively less likely to update their expectations (positively) than entrepreneurs who overestimate their prospects and are likely to update (negatively). Although this finding suggests the existence of asymmetric learning between pessimistic and optimistic entrepreneurs, my results show that the average entrepreneur update her hiring and development beliefs over time as a function of her past expectation errors.

Cross-sectional tests. In table 6, I regress entrepreneurs' hiring and development expectation updates on past optimistic and pessimistic errors in the cross-section of entrepreneurs within

the same industry in the same year. I include SIC-2-industry-year fixed effects, as well as time-invariant observable biographical characteristics of entrepreneurs such as gender, age, citizenship, education, industry, and entrepreneurial experience, as well as dummies for a new firm and for the entrepreneur's high-growth orientation.

Consistent with the findings in table 2, I find that optimistic expectation errors about both hiring and development prospects are associated with a higher probability of updating expectations in the next period (columns 1 and 2). In addition, pessimistic errors or underestimating hiring and development prospects are associated with a lower probability of updating expectations in the next period (columns 3 and 4). The evidence for the cross-section of entrepreneurs within an industry cohort is consistent with results for the time series, suggesting that learning attitudes depend on the initial type of mistakes made.

4.2. Expectation errors over time within individuals

Finally, I analyze the likelihood of making expectation errors within (panel A) and across (panel B) individuals. In table 3 columns 1 and 2, I report the relationship between current optimistic expectation errors and past optimistic errors within individuals. In columns 3 and 4, I report the same relationship for pessimistic expectation errors. The regression models include individual and sector-cohort year fixed effects. The individual fixed effects allow me to compare the expectation formation and potential errors by the same individual over time, neutralizing time-invariant characteristics, including entrepreneur's risk aversion. However, the inclusion of individual fixed effects requires us to observe the same individual several times over time, leading to a decrease in the number of observations and potentially inducing survival bias. Standard errors are clustered at the individual firm level.

Using panel structure of the data, I show that entrepreneurs learn from their past mistakes and make fewer expectation errors over time. Entrepreneurs who made an optimistic expectation error regarding their hiring and development prospects in the previous period are, respectively, 36% and 61% significantly less likely to make an optimistic expectation error in the current wave of the survey (panel A, columns 1 and 2). The same conclusion applies to entrepreneurs who made pessimistic expectation errors. Entrepreneurs who used to make pessimistic expectation errors are 37% and 44% less likely to make pessimistic errors regarding their future hiring and development prospects over time, respectively (panelA, columns 3 and 4, respectively).

In panel B of table 3, I regress entrepreneurs' optimistic and pessimistic errors on past optimistic and pessimistic errors, respectively, in the cross-section of entrepreneurs within the

same industry for the same year. I include SIC-2-industry-year fixed effects control for any potential industry shocks in the year initial expectations are formed. I also control for several time-invariant observable biographical characteristics of entrepreneurs, including gender, age, citizenship, education, industry, and entrepreneurial experience. In addition, I include dummies for the new firm's incorporation status and the entrepreneur's high-growth orientation. Standard errors are clustered at the firm level.

Consistent with Landier and Thesmar (2008), I find that expectation errors are positively correlated across individuals over time. Entrepreneurs who made optimistic expectation errors in the previous period are more likely to also make optimistic expectation errors in the future (panel B, columns 1 and 2). This finding is robust to both the use of entrepreneurs' hiring expectations and development expectations compared to their respective realizations one year ahead. Similarly, entrepreneurs who made pessimistic errors in the previous period are more likely to make pessimistic expectation errors in the next wave of the survey (panelB, columns 3 and 4). In other words, optimism and pessimism biases are persistent over time across individuals but decline within individuals over time.

4.3. Updates and future expectation errors

Next, I investigate the relationship between future expectation errors and updates between the period before and the current period. Table 4 reports the relationship between optimistic and pessimistic expectation errors and updates to development expectations. Importantly, all specifications exploit the panel structure of the data and include individual fixed effects to compare the same entrepreneur over time and control for entrepreneurs' unobservable individual learning abilities. Standard errors are clustered at the individual firm level.

The evidence in column 1 shows that entrepreneurs who update their beliefs upward between two waves of the survey are significantly more likely to make optimistic errors in the future, whereas those who update downward are less likely to make optimistic expectation errors later on. The effect is robust to optimistic errors defined using hiring expectations and development expectations (columns 1 and 2).

Regarding expectation updates and the likelihood of making future pessimistic expectation errors, I find an overall negative and significant relationship (columns 3 and 4) that is driven by positive updates to hiring expectations. Entrepreneurs who update their beliefs upward are less likely to make pessimistic errors in the future, whereas entrepreneurs who update downward are significantly more likely to make a pessimistic expectation error in the future.

Overall, the evidence shows that upward beliefs updates of hiring and development expectations are associated with higher chances of making optimistic expectation errors, but reduces the likelihood to make pessimistic expectation errors. Symmetrically, downward belief updates are associated with la lower probability of future optimistic errors but more frequent pessimistic errors.

From table 3, we know that optimism and pessimism are persistent behavioral types across individual entrepreneurs, highlighting the importance of initial expectation errors for understanding the dynamics of expectation formation and drawing conclusions regarding learning patterns.

5. Heterogeneous Expectations, Errors and Updates

5.1. Who forms expectations?

Appendix table A1 reports entrepreneurs' expectations about their start-ups' future prospects, which I correlate with individual characteristics. I compare expectations about the future in the cross-section of entrepreneurs within the same SIC-2 sector in the same cohort. I report correlations for hiring and development expectations (columns 1 and 2) and expectations to stabilize the start-up and recover from a difficult situation (columns 3 and 4, respectively). Entrepreneurs can also answer that they plan to shut down the operations or sell the company, which I combine into one answer (column 5). In the second and third waves of the survey, entrepreneurs also report that they plan to downsize the company and let employees go. The expectation to downsize is reported in column 6.

The results show that female entrepreneurs are 3.3% less likely to plan to hire employees in the next year relative to male entrepreneurs who started in the same industry the same year (column 1). They are 1.1% less likely to say that they plan to develop their business in the coming year (column 2). However, female entrepreneurs are 1.1% more likely to report that they expect to stabilize the company (column 3). Regarding expectations to recover from a difficult situation, to shut the operations down, or to downsize, male and female entrepreneurs are equally likely to report these expectations.

Entrepreneur age is also an important factor in entrepreneurs' hiring and development expectation formation. Older entrepreneurs are less likely to have positive hiring and development prospects. The magnitude of the effect increases with age. Entrepreneurs with a college education are more likely to expect to hire employees and develop the company and mechanically

less likely to plan to only stabilize the company or recover from a difficult situation. Industry expertise is positively related to hiring expectations but negatively correlated with development expectations. Similarly, serial entrepreneurs are more likely to plan to hire but not significantly more likely to develop the company overall than those with no prior entrepreneurial experience.

Finally, the results show that high-growth-oriented entrepreneurs and incorporated start-ups are strongly more likely to hire and strongly more likely to plan to develop the company. Accordingly, those entrepreneurs are less likely to plan to keep the current balance, to recover from a challenging situation, or to shut down the new venture. Thus, the evidence suggests that stated motivations are an important predictor of expectation formation.

5.2. Who makes expectation errors?

In this section, I report the correlations between optimistic and pessimistic errors and entrepreneurs' individual characteristics in the initial wave of the survey. If expectation errors were random, they would not correlate with some entrepreneurs' characteristics. Table 5 reports the results for entrepreneurs who started the same year in the same industry. In columns 1 and 2, I compare entrepreneurs who make optimistic expectation errors to entrepreneurs who do not make mistakes or make pessimistic expectation errors. Similarly in columns 3 and 4, I compare entrepreneurs who make pessimistic expectation errors to entrepreneurs who do not make mistakes or make optimistic expectation errors.

Female entrepreneurs are approximately 1.9% less optimistic than their male counterparts regarding their hiring expectations. However, female entrepreneurs are 2.8% more likely to underestimate their hiring prospects and make pessimistic errors. However, note that, even if female entrepreneurs are less optimistic than men in hiring, my results show no significant gender differences regarding development forecasts.

A more persistent predictor of entrepreneurs' expectation errors is age. Older entrepreneurs (40 or older) are significantly less optimistic and significantly more pessimistic than younger entrepreneurs. A college education (bachelor's degree or a higher degree) is consistently associated with more optimistic errors and significantly less pessimistic errors.

The results on industry and entrepreneurial experience are more ambiguous. Industry experts who have at least three years of working in the industry before starting up are more likely to make optimistic errors regarding their hiring prospects and make less pessimistic errors regarding this aspect. However, my results also show that they are significantly less likely to make optimistic errors regarding their development overall. In addition, serial entrepreneurs are

optimistic overall; they overestimate both their hiring and development prospects. At the same time, some other serial entrepreneurs are overly pessimistic about their hiring prospects. Thus, the evidence suggests that prior entrepreneurial experience reinforces disagreements about their company's future hiring prospects, which highlights the importance of the hiring decision for start-up companies.

Finally, entrepreneurs who self-identify themselves as high-growth oriented or who choose an incorporated company are strongly and significantly more likely to make optimistic errors about their hiring and development and are symmetrically less pessimistic.

5.3. Who updates their beliefs?

Heterogeneity in expectation errors in the later periods can be related to heterogeneity in the likelihood of updating hiring and development expectations. If entrepreneurs were all Bayesian individuals, updates in expectations would be concentrated among some characteristics of entrepreneurs. Table 6 reports a significant heterogeneity in entrepreneurs' likelihood to revise expectations across periods. On the one hand, female entrepreneurs update their hiring expectations as often ad their male counterparts (columns 1 to 3). On the other hand, they are equally likely to update their development expectations, both upward and downward (columns 4 to 6).

In addition, the evidence shows that older entrepreneurs are significantly less likely to revise both their hiring and development expectations. The magnitude of the effect is stronger for older age categories. Entrepreneurs who are 40 years old or older are 2.6% less likely to revise their hiring expectations relative to younger entrepreneurs (columns 1).

Besides, college education does not appear to be correlated with the likelihood of updating to hiring and development beliefs. Prior entrepreneurial experience is positively ans significantly correlated with downward updates to development expectations (column 6). Finally, entrepreneurs with self-described high-growth orientation and those who have chosen to incorporate their firm are significantly more likely to update in every situation (columns 1 to 6).

Overall, the evidence in this section motivates the wide use of individual fixed effects to neutralize concerns about entrepreneurs' unobservable and personal traits that may confound the formation of expectations and the likelihood of learning from past mistakes.

5.4. The Real Effects of Learning

Figures 3 plot the average firm performance by initial type of entrepreneur's expectation error from the first year of operation to 8 years after. Expectation errors are measured in the first wave of the survey, and the figures plot the long-run effects on performance of making initial mistakes.

Figure 3-a shows that the average optimistic entrepreneur employs 1.8 employees at the end of the first year of operation, whereas the average entrepreneur who correctly forecasts his startup's growth employs 2.48. The average entrepreneurs who initially underestimates his prospects, employs 2.27 employees after one year. Pessimistic entrepreneurs and those who do not make any expectation errors have very close average employment size's profile,, with 3.59 and 3.47 employees, respectively, 8 years after creation. By contrast, initially optimistic entrepreneurs never catch up and employ 2.72 employees after 8 years. The sales profile of startups founded by optimistic versus pessimistic and rational entrepreneurs is very similar (figure 3-b). The average log sales of entrepreneurs who make optimistic errors at start are significantly lower than other entrepreneurs even 5 years after creation.

Figure 3-c reports the average ROA of firms over the years. The evidence shows that entrepreneurs with pessimistic beliefs outperform from year one any other entrepreneurs, even those who correctly predict their initial growth. After five years of operation, entrepreneurs with pessimistic belifes have a ROA of .49 whereas entrepreneurs with optimistic beliefs have an average ROA of .16. Figure 3-c reports the survival rate of firms over the years. The evidence also shows that entrepreneurs with optimistic beliefs under-perform other entrepreneurs. However, even if entrepreneurs with pessimistic beliefs are more likely to survive in the earlier years, after 5 years their probability to survive is no longer higher than optimistic entrepreneurs, with a survival rate close to 52%. Overall the evidence shows that entrepreneurs with initial optimistic are likely to underperform entrepreneurs who hold pessimistic and rational beliefs about the development of their start-up.

In table 7, I investigate the real effects of belief updates on a firm's growth measured as the variation in sales and employment size between the year before the new expectation is formed and three years after it is formed (columns 1 and 2). In columns 3 and 4, I test the real effects of learning from past expectation errors on the likelihood that the firm will survive at least five years after creation. Specifications in columns 1 and 2 include individual firms and year fixed effects, which allows me to compare the same firm over time, as the effect is identified for firms that make expectation errors, and update their forecasts. Specifications in columns 3

and 4 include sector × cohort-year fixed effects and individual biographical entrepreneur and time-invariant firm characteristics, as the probability to survive 5 years or more, $Survival_{t+5}$, does not vary at the firm level.

The evidence shows that entrepreneurs who made expectation errors at a given point in time are significantly likely to perform worse in terms of all start-up performance measures. Their sales are 7% lower in the next three years when they make expectation errors about their development prospects (column 1). Their employment size is 10% lower in the next three years when they make expectation errors about their development prospects (column 2). Finally, start-ups run by optimistic entrepreneurs are also significantly less likely to survive five years or more.

Entrepreneurs who update their hiring and development forecasts do not experience significantly more significant employment and sales growth, respectively. However, my results show that entrepreneurs who made an expectation error and updated their expectations in the next period experience significant growth in the three years after updating their expectations. Learning from past errors is associated with 8% more sales and 11% more employment growth over three years (columns 1 and 2).

In the cross-section of entrepreneurs, I also find that updating expectations after past errors is positively associated with a higher probability of surviving at least five years (from 3% to 4% more likely, columns 3 and 4). However, the cross-sectional evidence also reveals that entrepreneurs who update their expectations are also associated with a lower probability of surviving five years or more relative to entrepreneurs who do not update their expectations. One possible explanation for this finding is that learning is associated with a negative selection bias. Only entrepreneurs who made expectation errors can update and learn from their past mistakes in my setting. Overall, the evidence shows that expectation errors and updates to expectations have real, significant, and long-lasting effects on firms' growth.

6. Conclusion

This paper studies how entrepreneurs form and update their expectations over time. I rely on a large and unique survey of French entrepreneurs that is representative of the population of start-ups founded in France. Specifically, my analysis is based on self-reported entrepreneurs' expectations about their hiring and development prospects. I identify optimistic and pessimistic entrepreneurs by comparing their hiring and development prospects to actual realizations in

terms of employment and sales growth. A unique feature of the survey is its panel structure, which allows us to track detailed information about an entrepreneur from the start-up's creation year to five years onward. I compute the update to hiring and development expectations by comparing changes in expectations over time.

The raw data show that more than half of entrepreneurs make expectation errors. Approximately 20% of new entrepreneurs make optimistic expectation errors, whereas approximately 30% of entrepreneurs make pessimistic errors. The surprisingly high number of pessimistic entrepreneurs is explained by the fact that the dataset is representative of the population of newly created firms and includes not only high-growth oriented start-ups but also new small businesses. I begin by documenting that the average entrepreneur extrapolates new information. Indeed, I find a positive correlation between expectation errors and recent changes in employment and sales growth within individuals.

Next, I ask whether entrepreneurs learn from their past errors. A valuable strategy in the macroeconomics behavioral literature consists of observing the dynamics of expectation errors and subsequent updates of expectations over time *within* individuals. I formalize the intuition that entrepreneurs learn from their past mistakes by building on the existing Bayesian learning literature. I introduce into these standard models updates to expectations as a consequence of past expectation errors. The model shows that if the entrepreneur does not make expectation errors, the update of expectations does not depend on past errors. In contrast, if the entrepreneur is optimistic, the entrepreneur learns and negatively updates her expectations. If the entrepreneur makes pessimistic errors, the entrepreneur learns and positively updates her expectations.

I take these predictions to the data. I document three stylized facts consistent with entrepreneurs who learn from their past mistakes over time. First, I show that optimistic errors lead to negative updates of expectations and pessimistic expectation errors to positive updates. The finding is robust for both hiring and development expectations. Second, although optimistic and pessimistic types are persistent across entrepreneurs, my results show that expectation errors decline within individuals over time. Third, I show that updates to expectations lead to fewer future expectations errors.

Finally, I show that expectation errors have real effects and lead to lower sales growth, employment growth, and survival by comparing the same firm over time. However, my results also prove that learning from past errors mitigates these real negative effects. Entrepreneurs who correct past errors experience high sales, employ more employees after three years, and have

a higher probability of surviving five years or longer. Overall, my findings show that making expectation errors influence corporate success but is not deterministic since entrepreneurs learn over time from them.

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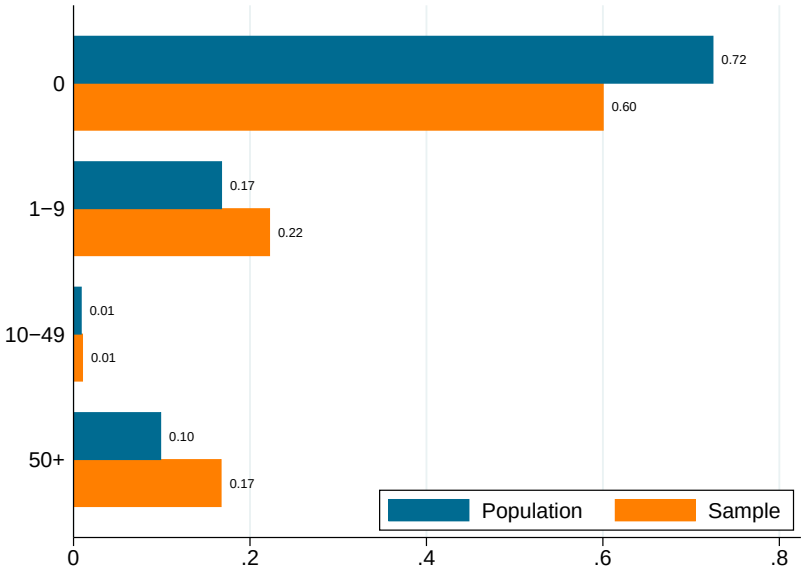
Tables

Figure 1. Representativeness of the SINE Survey and Distribution of Firms by Size and Industry

Source: This figures plot the distributions of firms in the population of firms in France (*Source:* Firm registry 2000–2018, N=6,971,794) and in the regression sample (*Source:* SINE surveys 1998, 2002, 2006, 2010, and 2014 cohorts linked to the tax files, N=158,249). Figure (a) plots the distribution by employment size at creation. Figure (b) plots the distribution by French SIC-1 industry.

(a) Distribution of firms by employment size



(b) Distribution of firms by industry

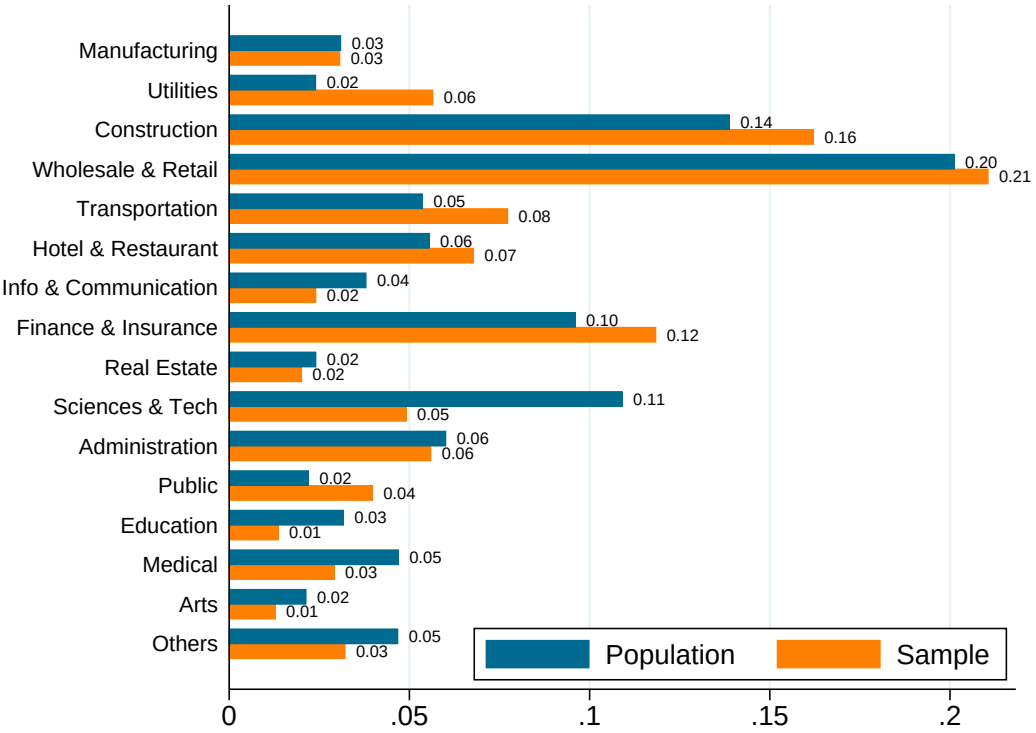


Table 1. Entrepreneurs' Characteristics

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. The table presents entrepreneurs' expectations, errors and updates (panel A), biographical characteristics (panel B), motivation items and composition of the founding team (panel C), micro and macro signals (panel D), and corporate outcomes (panel E). Variable definitions and data sources are provided in Appendix table B.

Variables	Count	Mean	Sd	P10	Median	P90
Panel A. Expectations, errors and updates						
Hiring	289431	0.24	0.43	0.00	0.00	1.00
Development	383080	0.39	0.49	0.00	0.00	1.00
Stabilize	383053	0.42	0.49	0.00	0.00	1.00
Recover	383053	0.10	0.29	0.00	0.00	1.00
Shut down	336485	0.05	0.21	0.00	0.00	1.00
Sell	292711	0.03	0.18	0.00	0.00	1.00
Lay-off	105628	0.04	0.20	0.00	0.00	1.00
Uncertainty Development	383048	0.13	0.34	0.00	0.00	1.00
Uncertainty Hiring	383080	0.24	0.43	0.00	0.00	1.00
Optimistic Errors$_T$:						
Sales $\geq 3\%$	243908	0.14	0.35	0.00	0.00	1.00
Sales $\geq 5\%$	243908	0.15	0.36	0.00	0.00	1.00
Sales $\geq 10\%$	243908	0.17	0.38	0.00	0.00	1.00
Employment ≥ 1	289431	0.10	0.30	0.00	0.00	1.00
Employment ≥ 2	289431	0.12	0.33	0.00	0.00	1.00
Employment ≥ 0	289431	0.03	0.16	0.00	0.00	1.00
Pessimistic Errors$_T$:						
Sales $< 3\%$	243908	0.33	0.47	0.00	0.00	1.00
Sales $< 5\%$	243908	0.31	0.46	0.00	0.00	1.00
Sales $< 10\%$	243908	0.26	0.44	0.00	0.00	1.00
Employment < 1	289431	0.39	0.49	0.00	0.00	1.00
Employment < 2	289431	0.36	0.48	0.00	0.00	1.00
Employment < 0	289431	0.71	0.45	0.00	1.00	1.00
Updates:						
Update Development $_{T;T-1}$	190506	0.39	0.49	0.00	0.00	1.00
Upward	190506	0.17	0.37	0.00	0.00	1.00
Downward	190506	0.22	0.41	0.00	0.00	1.00
Update Hiring $_{T;T-1}$	117113	0.23	0.42	0.00	0.00	1.00
Upward	117113	0.07	0.26	0.00	0.00	1.00
Downward	117113	0.16	0.37	0.00	0.00	1.00
Panel B. Biographical characteristics						
Female	383080	0.30	0.46	0.00	0.00	1.00
24 or younger	383080	0.05	0.23	0.00	0.00	1.00
25-34	383080	0.31	0.46	0.00	0.00	1.00
35-44	383080	0.33	0.47	0.00	0.00	1.00
45-54	383080	0.22	0.41	0.00	0.00	1.00
55 or older	383080	0.08	0.28	0.00	0.00	1.00
French citizen	383080	0.92	0.27	0.00	1.00	1.00
Bachelor's	383080	0.16	0.37	0.00	0.00	1.00
Master's/PhD	383080	0.19	0.39	0.00	0.00	1.00
College education	383080	0.35	0.48	0.00	0.00	1.00
Industry expert	382375	0.61	0.49	0.00	1.00	1.00
Serial entrepreneur	383080	0.29	0.45	0.00	0.00	1.00

Entrepreneurs' Characteristics

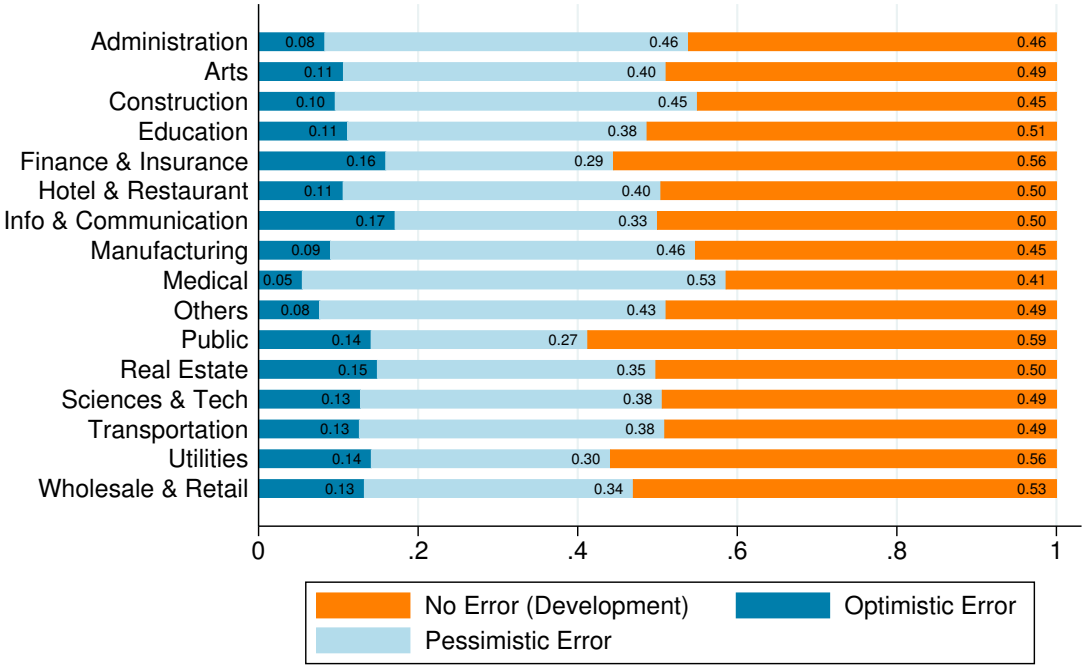
Source: SINE survey and tax files.

Variables	Count	Mean	Sd	Min	Median	Max
Panel C. Motivations						
New firm	383080	0.79	0.41	0.00	1.00	1.00
Incorporated	334084	0.52	0.50	0.00	1.00	1.00
High-growth oriented	291463	0.30	0.46	0.00	0.00	1.00
Motivation for entry:						
Independence	334081	0.63	0.48	0.00	1.00	1.00
Taste	383067	0.47	0.50	0.00	0.00	1.00
Add earnings	245754	0.25	0.43	0.00	0.00	1.00
Opportunity	383063	0.28	0.45	0.00	0.00	1.00
New idea	383065	0.15	0.35	0.00	0.00	1.00
Example relatives	383060	0.10	0.31	0.00	0.00	1.00
Unemployed	383064	0.21	0.41	0.00	0.00	1.00
Team composition:						
Spouse	383080	0.23	0.42	0.00	0.00	1.00
Siblings	383080	0.23	0.42	0.00	0.00	1.00
Associates	383080	0.09	0.29	0.00	0.00	1.00
Alone	383080	0.36	0.48	0.00	0.00	1.00
Independent worker	334087	0.14	0.35	0.00	0.00	1.00
Former occupation:						
CEO	334087	0.07	0.26	0.00	0.00	1.00
Employed	334087	0.42	0.49	0.00	0.00	1.00
Student	334087	0.03	0.17	0.00	0.00	1.00
Unemployed	334087	0.34	0.47	0.00	0.00	1.00
Panel D. Micro and Macro signals						
Micro signals:						
ΔEmployment size$_{t-1,t}$	78210	-0.10	0.96	-2.00	0.00	2.00
ΔSales$_{t-1,t}$	155764	0.02	0.45	-2.00	0.02	2.00
Panel E. Outcomes						
Survival 3 years	414736	0.80	0.40	0.00	1.00	1.00
Survival 5 years	411373	0.67	0.47	0.00	1.00	1.00
ΔEmployment$_{t,t+1}$	77578	0.02	0.82	-0.67	0.00	0.67
ΔEmployment$_{t,t+2}$	67964	0.03	0.87	-1.00	0.00	1.00
ΔEmployment$_{t,t+3}$	53353	0.06	0.89	-1.00	0.00	1.00
ΔEmployment$_{t,t+4}$	48168	0.08	0.90	-1.00	0.00	1.00
ΔEmployment$_{t,t+5}$	40463	0.11	0.91	-1.00	0.00	1.20

Figure 2. Distribution of Optimistic and Pessimistic Entrepreneurs by Industry

Source: SINE surveys 1998, 2002, 2006, 2010, and 2014 cohorts linked to the tax files (N=158,249). This figure plots the distributions of entrepreneurs in the regression sample by French SIC-1 industry and by initial type of development expectation error at creation ($T = 1$). *Optimistic Development Error* equals one if the entrepreneur over-estimate her development expectation relative to the one-year ahead sales growth realization. *Pessimistic Development Error* equals one if the entrepreneur under-estimate her development expectations relative to the one-year ahead sales growth realization. *No Error* equals one if the entrepreneur correctly forecasts her development expectation relative to the one-year ahead sales growth realization.

(a) Percentages



(b) Number

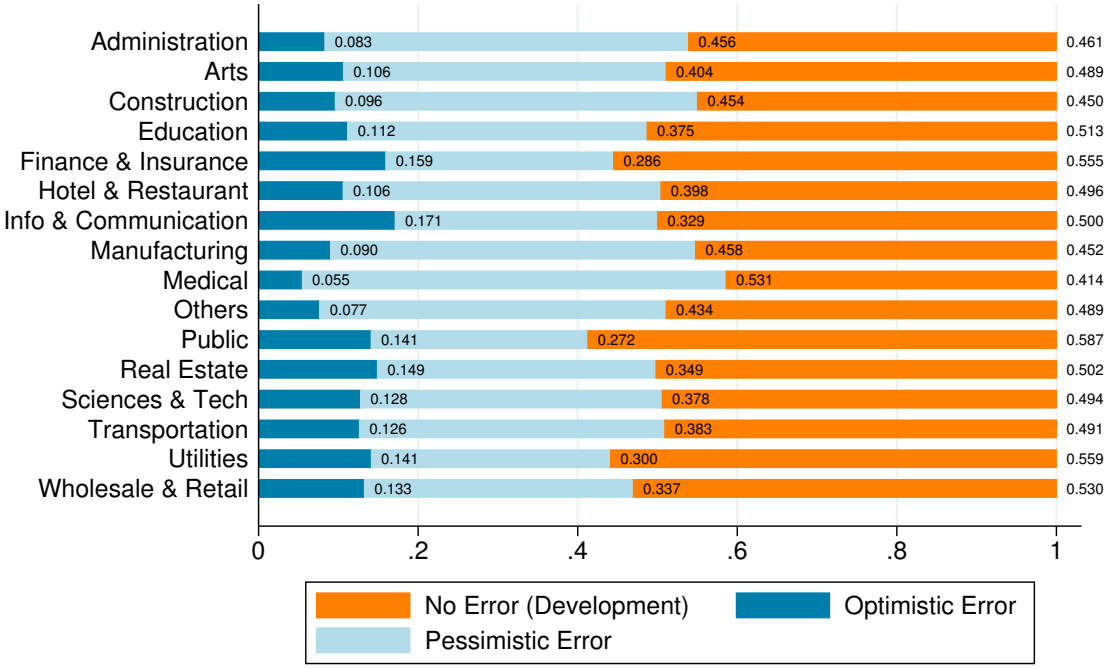


Table 2. Updates and Expectation Errors

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether entrepreneurs update their expectations as a result of past expectation errors. The dependent variable in columns (1) to (3) is the *Update Hiring*$_{T;T-1}$, which equals one when the entrepreneur changes her hiring expectation between two successive periods of the survey. The update is *Positive* if the entrepreneur changes her hiring expectation to "hire", while she did not plan to do so in the previous period. The update is *Negative* if the entrepreneur changes her hiring Expectation to "not hire", while she planned to hire in the previous period. The dependent variable in columns (4) to (6) is the *Update Development*$_{T;T-1}$, which equals one when the entrepreneur changes her development expectation between two successive periods of the survey. The update is *Positive* if the entrepreneur changes her development expectation to "develop," while she did not plan to do so in the previous period. The update is *Negative* if the entrepreneur changes her Development Expectation to "not develop," while she planned to "develop" in the previous period. The independent variable in columns (1) to (3) are the past *Optimistic Error Employment*$_{T-1}$, which equals one if the entrepreneur over-estimate her hiring expectations relative to the one-year ahead employment growth realization, and *Pessimistic Error Employment*$_{T-1}$, which equals one if the entrepreneur under-estimate her hiring expectations. The independent variable in columns (4) to (6) are the past *Optimistic Error Development*$_{T-1}$, which equals one if the entrepreneur over-estimate her development expectations relative to the one-year ahead sales growth realization, and the past *Pessimistic Error Development*$_{T-1}$, which equals one if the entrepreneur under-estimate her development expectations. All models include individual fixed effects and French SIC-2 sector × cohort-year fixed effects. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Type of update:	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
Sign of the update:	Pooled	Positive	Negative	Pooled	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Optimistic Error Employment$_{T-1}$	0.388***	-0.256***	0.644***			
	(0.013)	(0.008)	(0.009)			
Pessimistic Error Employment$_{T-1}$	-0.163***	0.106***	-0.269***			
	(0.012)	(0.011)	(0.022)			
Optimistic Error Development$_{T-1}$				0.239***	0.074***	0.165***
				(0.013)	(0.012)	(0.005)
Pessimistic Error Development$_{T-1}$				-0.138***	0.131***	-0.268***
				(0.016)	(0.008)	(0.009)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector × Cohort Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71300	71300	71300	92772	92772	92772
R^2	0.675	0.536	0.657	0.584	0.741	0.683

Table 3. Expectation Errors over Time

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether entrepreneurs' expectation errora are correlated over time within and across individuals. The dependent variable in columns (1) and (2) is the *Optimistic Error*$_T$, which equals one if the entrepreneur over-estimate her hiring or development expectations relative to the one-year ahead employment growth or sales growth realization threshold. The dependent variable in columns (3) and (4) is the *Pessimistic Error*$_T$, which equals one if the entrepreneur under-estimate her hiring or development expectations relative to the one-year ahead employment growth or sales growth realization threshold. The independent variables in columns (1) and (2) are the corresponding past *Optimistic Error*$_{T-1}$. The independent variables in columns (3) and (4) are the corresponding past *Pessimistic Error*$_{T-1}$. All models in panel A include individual fixed effects and French SIC-2 sector × cohort-year fixed effects, whereas all models in panel B include French SIC-2 sector × cohort-year fixed effects and human capital and start-up controls. The human capital controls include the dummy variables *Female*, *Age≥40*, *College education*, *Expert* and *Serial* entrepreneurs. The start-up controls include the dummy variables *New firm*, *Incorporated*, and *High-growth oriented*. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Panel A: Expectation errors within individuals

Type of Error:	Optimistic Errors$_T$		Pessimistic Errors$_T$	
Realization threshold:	ΔEmployment<1	ΔSales<5%	ΔEmployment≥1	ΔSales≥5%
	(1)	(2)	(3)	(4)
Optimistic Error Employment$_{T-1}$	-0.361***			
	(0.018)			
Optimistic Error Development$_{T-1}$		-0.612***		
		(0.011)		
Pessimistic Error Employment$_{T-1}$			-0.373***	
			(0.024)	
Pessimistic Error Development$_{T-1}$				-0.443***
				(0.008)
Individual FE	Yes	Yes	Yes	Yes
Sector × Cohort Year FE	Yes	Yes	Yes	Yes
Observations	71300	81740	71300	81740
R^2	0.678	0.702	0.733	0.627

Panel B: Expectation errors across individuals

Type of Error:	Optimistic Errors$_T$		Pessimistic Errors$_T$	
Realization threshold:	ΔEmployment<1	ΔSales<5%	ΔEmployment≥1	ΔSales≥5%
	(1)	(2)	(3)	(4)
Optimistic Error Employment$_{T-1}$	0.057***			
	(0.006)			
Optimistic Error Development$_{T-1}$		0.043***		
		(0.006)		
Pessimistic Error Employment$_{T-1}$			0.235***	
			(0.015)	
Pessimistic Error Development$_{T-1}$				0.017***
				(0.006)
Individual FE	No	No	No	No
Human capital controls	Yes	Yes	Yes	Yes
Sector × Cohort Year FE	Yes	Yes	Yes	Yes
Observations	88303	77615	88303	77615
R^2	0.064	0.031	0.265	0.037

Table 4. Future Errors and Updates

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether entrepreneurs who update their expectations still make expectation errors in the future. The dependent variable in columns (1) and (2) is the *Optimistic Error*$_T$, which equals one if the entrepreneur over-estimate her hiring expectations relative to the one-year ahead employment growth realization threshold. The dependent variable in columns (3) to (4) is the *Pessimistic Error*$_T$, which equals one if the entrepreneur under-estimate her hiring expectations relative to the one-year ahead employment growth realization threshold. The independent variable is the *Update Development*$_{T;T-1}$, which equals one when the entrepreneur changes her hiring expectation between two successive periods of the survey. The update is *Downward* if the entrepreneur changes her Hiring Expectation to "not hire", while she planned to hire in the previous period. All models include individual fixed effects and and French SIC-2 sector × cohort-year fixed effects. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Type of Error:	Optimistic Errors$_T$		Pessimistic Errors$_T$	
Realization threshold:	ΔEmployment<1	ΔSales<5%	ΔEmployment≥1	ΔSales≥5%
	(1)	(2)	(3)	(4)
Update development	0.370***	0.122***	-0.346***	-0.097***
	(0.022)	(0.017)	(0.034)	(0.015)
× Downward	-0.143***	-0.048***	0.068***	0.060***
	(0.010)	(0.010)	(0.014)	(0.007)
Individual FE	Yes	Yes	Yes	Yes
Sector × Cohort Year FE	Yes	Yes	Yes	Yes
Observations	71302	51768	71302	51768
R^2	0.714	0.558	0.714	0.527

Table 5. Who Makes Expectation Errors?

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table investigates predictive power of entrepreneur's and start-up's characteristics on the likelihood of making expectation errors. The dependent variable in columns (1) and (2) is *Optimistic Error*$_T$, which equals one if the entrepreneur over-estimate her hiring or development expectations relative to the one-year ahead employment growth or sales growth realizations. The dependent variable in columns (3) and (4) is *Pessimistic Error*$_T$, which equals one if the entrepreneur under-estimate her hiring or development expectations relative to the one-year ahead employment growth or sales growth realizations. Individual predictors are the dummy variables *Female*, *Age* dummies, *College education*, *Expert* and *Serial* entrepreneurs, as well as the start-up's dummy variables *New firm*, *Incorporated*, and *High-growth oriented*. All models include SIC-2 sector × cohort-year fixed effects and year fixed effects. Clustered standard errors at the sector-cohort level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Type of error:	Optimistic Errors$_T$		Pessimistic Errors$_T$	
Realization threshold:	ΔEmployment<1	ΔSales<5%	ΔEmployment≥1	ΔSales≥5%
	(1)	(2)	(3)	(4)
Female	-0.019***	0.004	0.028***	-0.007
	(0.003)	(0.003)	(0.007)	(0.004)
Age ≥ 40	-0.013***	-0.007***	0.018***	0.006*
	(0.002)	(0.003)	(0.006)	(0.003)
College education	0.005	0.011***	-0.024***	-0.035***
	(0.003)	(0.003)	(0.005)	(0.005)
Industry expert	0.010***	-0.016***	-0.040***	0.027***
	(0.002)	(0.003)	(0.004)	(0.004)
Serial entrepreneur	0.004	0.012***	0.002	-0.026***
	(0.003)	(0.003)	(0.004)	(0.005)
New firm	-0.012***	0.035***	0.097***	-0.088***
	(0.005)	(0.003)	(0.017)	(0.006)
Incorporated	0.067***	0.015***	-0.168***	-0.040***
	(0.008)	(0.004)	(0.019)	(0.007)
High-growth oriented	0.176***	0.053***	-0.252***	-0.137***
	(0.005)	(0.004)	(0.007)	(0.006)
Individual FE	No	No	No	No
Sector × Cohort Year FE	Yes	Yes	Yes	Yes
Observations	103456	90402	103456	90402
R^2	0.100	0.031	0.165	0.068

Table 6. Who Updates their Beliefs?

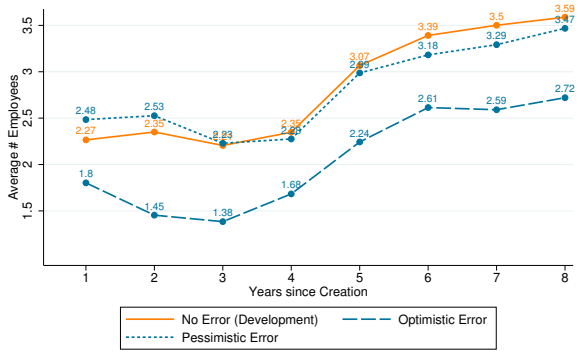
Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table investigates predictive power of entrepreneur's and start-up's characteristics on the likelihood of updating expectations. The dependent variable in columns (1) and (3) is *Update Hiring*$_{T;T-1}$, which equals one when the entrepreneur changes her hiring expectation between two successive periods of the survey. The dependent variable in columns (4) and (6) is the *Update Development*$_{T;T-1}$, which equals one when the entrepreneur changes her development expectation between two successive periods of the survey. Individual predictors are the dummy variables *Female*, *Age* dummies, *College education*, *Expert* and *Serial* entrepreneurs, as well as the start-up's dummy variables *New firm*, *Incorporated*, and *High-growth oriented*. All models include French SIC-2 sector × cohort-year fixed effects. Clustered standard errors at the sector-cohort level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Type of update:	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
	Pooled	Upward	Downward	Pooled	Upward	Downward
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.004	-0.002	0.006*	-0.021***	-0.004*	-0.017***
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
Age ≥ 40	-0.026***	-0.013***	-0.013***	-0.032***	-0.012***	-0.020***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
College education	0.008**	0.001	0.007*	0.002	0.003	-0.001
	(0.004)	(0.003)	(0.003)	(0.005)	(0.002)	(0.004)
Industry expert	-0.012***	-0.007**	-0.005*	0.008**	0.003	0.005**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Serial entrepreneur	0.001	-0.002	0.003	0.014***	0.003	0.011***
	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)
New firm	0.048***	0.009*	0.039***	0.006	-0.009***	0.015***
	(0.005)	(0.005)	(0.004)	(0.007)	(0.003)	(0.005)
Incorporated	0.032***	0.010***	0.022***	0.112***	0.040***	0.072***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)
High-growth oriented	0.062***	-0.011***	0.073***	0.182***	-0.008**	0.191***
	(0.007)	(0.004)	(0.004)	(0.005)	(0.003)	(0.005)
Individual FE	No	No	No	No	No	No
Sector × Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	142350	142350	142350	88327	88327	88327
R^2	0.019	0.017	0.044	0.111	0.020	0.122

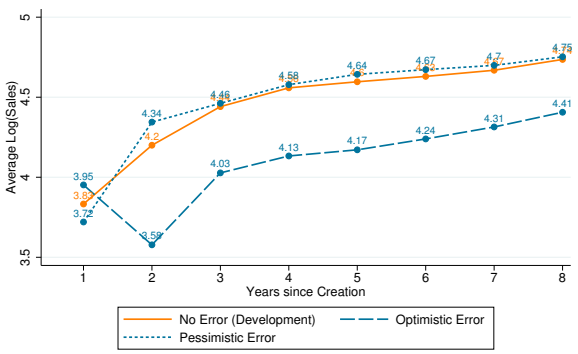
Figure 3. Firm Performance, Optimism and Pessimism

Source: SINE surveys 1998–2014 and tax files. *Source:* New firms founded in the 1998, 2002, 2006, 2010, and 2014 cohorts and that are present in the SINE surveys. The figures plot the average performance of start-ups over time by initial type of expectation error at creation ($T = 1$). Figure (a) plots the average start-ups' employment size at the end of the year. Figure (b) plots the average start-ups' sales in logarithm. Figure (a) plots the average start-ups' returns on assets. Figure (d) plots the percentage of firms that survive over time. *Optimistic Error* equals one if the entrepreneur over-estimate her development expectation relative to the one-year ahead sales growth realization. *Pessimistic Error* equals one if the entrepreneur under-estimate her development expectations relative to the one-year ahead sales growth realization. *No Error (Development)* equals one if the entrepreneur correctly forecasts her development prospects relative to the one-year ahead sales growth realization.

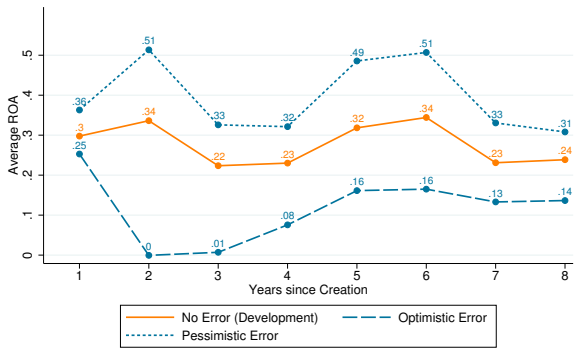
(a) Employment size



(b) Sales



(c) ROA



(d) Survival

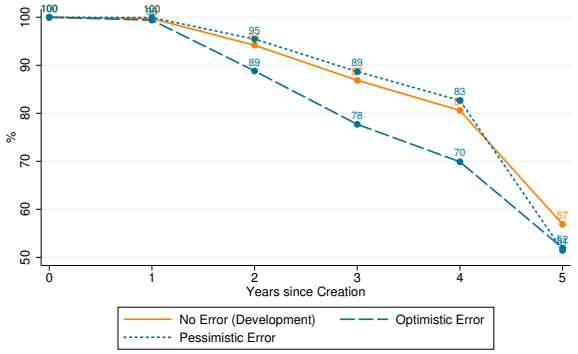


Table 7. Real Effects of Learning from Errors

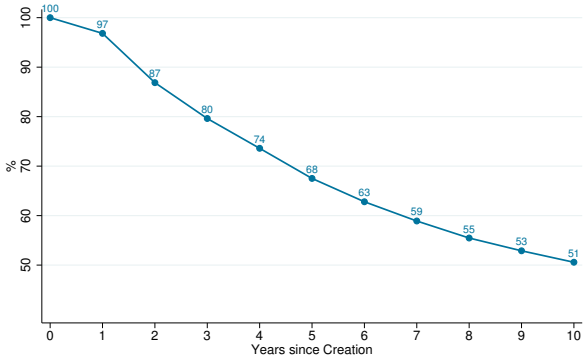
Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether the real effects of entrepreneurs' expectation errors and updates to expectations on corporate performance. The dependent variable in column (1) is the firm's sales growth between years $t-1$ and $t+3$. The dependent variable in column (2) is the firm's employment size growth between years $t-1$ and $t+3$. The dependent variable in columns (3) and (4) is a dummy variable which equals to one if the firm survives at least five years after creation. The independent variables in columns (1) to (3) are the *Optimistic Error Development*$_T$, which equals one if the entrepreneur over-estimate her development expectations relative to the one-year ahead sales growth realization threshold, the *Update Development*$_{T;T-1}$, which equals one when the entrepreneur changes her development expectation between two successive periods of the survey, and the interaction of these two variables. The independent variables in columns (2) to (4) are the *Optimistic Error Employment*$_T$, which equals one if the entrepreneur over-estimate her hiring expectations relative to the one-year ahead employment size growth realization threshold, the *Update Hiring*$_{T;T-1}$, which equals one when the entrepreneur changes her hiring expectation between two successive periods of the survey, and the interaction of these two variables. Models in columns (1) and (2) include individual fixed effects and year fixed effects. Models in columns (3) and (4) include SIC-2 sector × cohort-year fixed effects, as well as Human capital and Start-up's controls. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

	Δ Sales$_{t-1;t+3}$	Δ Employment$_{t-1;t+3}$	Survival$_{t+5}$	Survival$_{t+5}$
	(1)	(2)	(3)	(4)
Optimistic Error Development$_{T-1}$	-0.075***		-0.012**	
	(0.012)		(0.005)	
Update Development$_{T;T-1}$	-0.009		-0.029***	
	(0.013)		(0.006)	
Update Development$_{T;T-1}$ × Optimistic Error$_{T-1}$	0.086***		0.030***	
	(0.022)		(0.009)	
Optimistic Error Employment$_{T-1}$		-0.105***		-0.015**
		(0.022)		(0.007)
Update Hiring$_{T;T-1}$		-0.026		-0.038***
		(0.028)		(0.009)
Update Hiring$_{T;T-1}$ × Optimistic Error$_{T-1}$		0.113***		0.041***
		(0.041)		(0.012)
Individual FE	Yes	Yes	No	No
Sector × Cohort FE	No	No	Yes	Yes
Controls	No	No	Yes	Yes
Observations	40752	10390	44868	37653
R^2	0.632	0.657	0.033	0.033

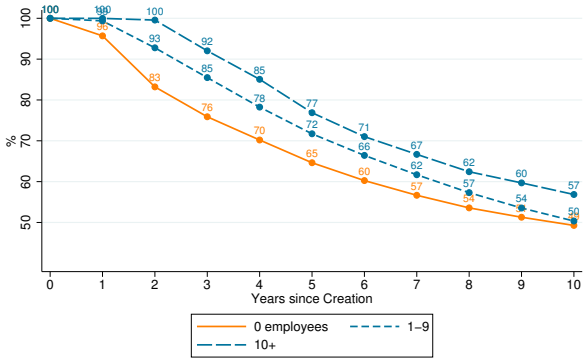
Figure 4. Firm Survival over Time

Source: Firm registry 2000–2018 and SINE surveys. This figures plot the percentage of firms that survive after several years since creation ($t = 0$). Figure (a) includes all new firms founded between 2000 and 2018 (N=43,390,785). Figure (b) includes all new firms founded between 1998 and 2018 and split the distributions by employment size categories. Figure (c) includes new firms founded in the 2002, 2006, 2010, and 2014 cohorts and that are present in the SINE surveys.

(a) All firms



(b) All firms by employment size at start



(c) SINE cohorts

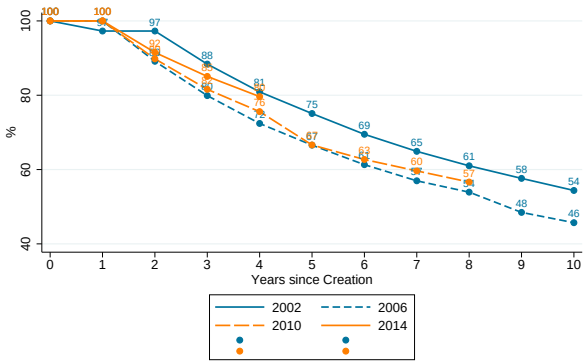


Table 8. Firm Survival and Entrepreneurs' Characteristics

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table investigates predictive power of entrepreneur's and start-up's characteristics on the likelihood that the firm survives at least three or five years. The dependent variable is a dummy variable which equals one if the start-up survives three (columns (1) and (2)) or five years (columns (3) and (4)) or longer, and zero if it fails before. Individual predictors are the dummy variables *Female*, *Age* dummies, *College education*, *Expert* and *Serial* entrepreneurs, as well as the start-up's dummy variables *New firm*, *Incorporated*, and *High-growth oriented*. In column (2), I add the motivation dummy variables. All models include SIC-2 sector × cohort-year fixed effects and year fixed effects. Clustered standard errors at the sector-cohort level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

	$1(\text{Survival}_{t+3})$		$1(\text{Survival}_{t+5})$	
	(1)	(2)	(3)	(4)
Female	-0.024***	-0.020***	-0.033***	-0.025***
	(0.006)	(0.006)	(0.008)	(0.008)
Age $\geq$ 40	0.007*	0.010**	0.009*	0.016**
	(0.004)	(0.005)	(0.005)	(0.006)
French citizen	0.045***	0.041***	0.065***	0.062**
	(0.011)	(0.012)	(0.020)	(0.025)
College education	0.009*	0.005	0.020***	0.011
	(0.005)	(0.005)	(0.007)	(0.007)
Industry expert	0.042***	0.038***	0.058***	0.049***
	(0.004)	(0.005)	(0.006)	(0.007)
Serial entrepreneur	-0.013***	-0.003	-0.035***	-0.020***
	(0.005)	(0.005)	(0.007)	(0.007)
New firm	-0.086***	-0.082***	-0.105***	-0.115***
	(0.009)	(0.011)	(0.012)	(0.014)
Incorporated	0.144***	0.161***	0.148***	0.161***
	(0.009)	(0.009)	(0.013)	(0.016)
High-growth oriented	-0.003	-0.000	-0.010	-0.001
	(0.004)	(0.005)	(0.008)	(0.008)
Independence		0.018***		0.023***
		(0.003)		(0.005)
Add earnings		-0.003		0.002
		(0.003)		(0.004)
Opportunity		0.011***		0.020***
		(0.004)		(0.006)
New idea		-0.009		-0.006
		(0.006)		(0.007)
Example relatives		0.031***		0.028***
		(0.005)		(0.007)
Sector × Cohort FE	Yes	Yes	Yes	Yes
Cluster	266	221	190	145
Observations	130435	99033	98139	67822
R^2	0.055	0.058	0.060	0.067

Internal Appendix

Table A1. Who Has Positive and Negative Expectations About the Future?

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table investigates predictive power of entrepreneurs' and start-ups' characteristics on expectations about the future. Dependent variables come from two questions available in the survey. The first question is, "What do you plan to do over the next 6 months?", and the possible answers are as follows: (1) "To develop the company", (2) "To maintain the current balance", (3) "To recover from a difficult situation", (4) "To shut down the firm", (5) "To sell it", and (6) "I do not know". The second question is, "Do you plan to hire over the next 12 months?". Possible answers are "Yes", "No", "I don't know". Dependent variables are coded accordingly. Independent variables are the dummy variables *Female*, *Age* dummies, *College education*, *Expert* and *Serial* entrepreneurs, as well as the start-up's dummy variables *New firm*, *Incorporated*, and *High-growth oriented*. All models include SIC-2 sector × cohort fixed effects and year fixed effects. Clustered standard errors at the sector-cohort level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

	Expectations		Other Expectations			
Dependent variable:	Hiring	Development	Stabilize	Recover	Shut down	Downsize
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.033***	-0.011***	0.011***	-0.003	0.002	-0.000
	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
Age ≥ 40	-0.030***	-0.034***	0.000	-0.001	0.007***	-0.002
	(0.003)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)
French citizen	-0.039***	0.028***	0.023***	-0.002	0.002	-0.003
	(0.010)	(0.006)	(0.007)	(0.003)	(0.003)	(0.003)
College education	0.021***	0.046***	-0.030***	-0.005**	-0.002	0.003*
	(0.004)	(0.004)	(0.003)	(0.002)	(0.001)	(0.002)
Industry expert	0.015***	-0.027***	0.063***	-0.012***	-0.006***	-0.002
	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
Serial entrepreneur	0.011***	-0.004	-0.019***	0.007***	0.006***	0.002
	(0.002)	(0.004)	(0.004)	(0.002)	(0.001)	(0.002)
New firm	0.008	0.104***	-0.103***	-0.006**	-0.015***	-0.007**
	(0.005)	(0.006)	(0.005)	(0.003)	(0.003)	(0.003)
Incorporated	0.133***	0.058***	-0.024***	0.001	-0.003	0.016***
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
High-growth oriented	0.269***	0.154***	-0.095***	0.013***	-0.002*	0.014***
	(0.008)	(0.006)	(0.007)	(0.002)	(0.001)	(0.002)
Sector × Cohort FE						
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	268	265	265	265	265	259
Observations	220790	183190	183187	183187	183190	66032
R^2	0.202	0.087	0.055	0.021	0.815	0.017

Table A2. Who Does Not Have any Idea about the Future?

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table investigates predictive power of entrepreneur's and start-up's characteristics on uncertainty about the future. The dependent variables come from two questions available in the survey. The first question is, "What do you plan to do over the next 6 months?", and the possible answers are as follows: (1) "To develop the company", (2) "To maintain the current balance", (3) "To recover from a difficult situation", (4) "To shut down the firm", (5) "To sell it", and (6) "I do not know". The second question is, "Do you plan to hire over the next 12 months?". Possible answers are "Yes", "No", "I don't know". Dependent variables are coded accordingly. They equal to one if the entrepreneur answer "I don't know" to the question, and zero otherwise. Independent variables are the dummy variables *Female*, *Age* dummies, *College education*, *Expert* and *Serial* entrepreneurs, as well as the start-up's dummy variables *New firm*, *Incorporated*, and *High-growth oriented*. All models include SIC-2 sector × cohort fixed effects and year fixed effects. Clustered standard errors at the sector-cohort level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

	Uncertainty	
Dependent variable:	Hiring	Development
	(1)	(2)
Female	-0.009***	0.002
	(0.003)	(0.002)
Age ≥ 40	-0.025***	0.013***
	(0.002)	(0.002)
French citizen	-0.031***	-0.046***
	(0.003)	(0.004)
College education	-0.026***	-0.026***
	(0.002)	(0.002)
Industry expert	0.014***	-0.017***
	(0.002)	(0.002)
Serial entrepreneur	-0.014***	0.002
	(0.002)	(0.002)
New firm	-0.008**	0.017***
	(0.004)	(0.003)
Incorporated	0.044***	-0.030***
	(0.004)	(0.003)
High-growth oriented	0.047***	-0.033***
	(0.005)	(0.002)
Sector × Cohort FE	Yes	Yes
Year FE	Yes	Yes
Cluster	269	265
Observations	292114	183187
R^2	0.041	0.022

Table A3. Heterogeneous Updates and Expectation Errors

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether entrepreneurs update their expectations due to recent corporate or economy-wide news. The dependent variable is the *Update Hiring*$_{T;T-1}$, which equals one when the entrepreneur changes her Hiring Expectation between two successive periods of the survey. The main independent variable in columns (1) to (3) is the past *Optimistic Error Employment*$_{T-1}$, which equals one if the entrepreneur over-estimate her hiring expectations relative to the one-year ahead employment growth realization. The main independent variable in columns (4) to (6) of panel B is the past *Pessimistic Error Employment*$_{T-1}$, which equals one if the entrepreneur under-estimate her hiring expectations relative to the one-year ahead employment growth realization. The main independent variable is interacted with *Female* gender in panel A, with *Age≥40* in panel B, and with *High-growth oriented* in panel C. All models include individual fixed effects and year fixed effects. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Panel A: Gender

Type of update:	Update Hiring$_{T;T-1}$					
Direction of the update:	All	Positive	Negative	All	Positive	Negative
Type of error:	Optimistic Error$_{T-1}$			Pessimistic Error$_{T-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Expectation Error$_{T-1}$	0.448***	-0.204***	0.652***	-0.207***	0.097***	-0.305***
	(0.011)	(0.007)	(0.010)	(0.006)	(0.005)	(0.005)
Expectation Error$_{T-1}$ × Female	0.005	-0.052***	0.057***	0.055***	-0.022**	0.077***
	(0.021)	(0.015)	(0.018)	(0.010)	(0.009)	(0.009)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39866	39866	39866	57920	57920	57920
R^2	0.639	0.520	0.596	0.647	0.496	0.558

Panel B: Age

Type of error:	Optimistic Error$_{T-1}$			Pessimistic Error$_{T-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Expectation Error$_{T-1}$	0.423***	-0.222***	0.645***	-0.199***	0.093***	-0.293***
	(0.013)	(0.008)	(0.011)	(0.007)	(0.006)	(0.006)
Expectation Error$_{T-1}$ × Age≥40	0.058***	0.011	0.047***	0.020**	-0.006	0.026***
	(0.018)	(0.012)	(0.016)	(0.010)	(0.008)	(0.009)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39866	39866	39866	57920	57920	57920
R^2	0.640	0.519	0.596	0.646	0.496	0.557

Panel C: High-growth oriented

Type of error:	Optimistic Error$_{T-1}$			Pessimistic Error$_{T-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Expectation Error$_{T-1}$	0.446***	-0.310***	0.756***	-0.119***	0.087***	-0.206***
	(0.016)	(0.012)	(0.013)	(0.006)	(0.006)	(0.006)
Expectation Error$_{T-1}$ × High-growth oriented	0.024	0.170***	-0.147***	-0.300***	0.030**	-0.330***
	(0.022)	(0.015)	(0.020)	(0.015)	(0.012)	(0.013)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28306	28306	28306	41720	41720	41720
R^2	0.647	0.528	0.606	0.663	0.498	0.582

Table A4. Expectation Updates and Micro-Macro Signals

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether entrepreneurs update their expectations due to recent corporate or economy-wide news. The dependent variable in columns (1) to (3) is the *Update Hiring*$_{T;T-1}$, which equals one when the entrepreneur changes her Hiring Expectation between two successive periods of the survey. The update is *Positive* if the entrepreneur changes her Hiring Expectation to "hire", while she did not plan to "hire" in the previous period. The update is *Negative* if the entrepreneur changes her Hiring Expectation to "not hire", while she planned to hire in the previous period. The dependent variable in columns (4) to (6) is the *Update Development*$_{T;T-1}$, which equals one when the entrepreneur changes her Development Expectation between two successive periods of the survey. The update is *Positive* if the entrepreneur changes her Development Expectation to "develop," while she did not plan to "develop" in the previous period. The update is *Negative* if the entrepreneur changes her Development Expectation to "not develop," while she planned to "develop" in the previous period. The independent variable in panel A is the firm's employment size growth between years t and $t-1$. The independent variable in panel B the firm's sales growth between years t and $t-1$. In panels C to D, the independent variables are the change in GDP, the change in the inflation rate, and the change in the unemployment rate between years t and $t-1$, respectively. Models in panels A and B include individual fixed effects and year fixed effects. Models in panels C, D, and E include individual fixed effects only. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Panel A: Delta employment

Type of update:	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
Sign of the update:	All	Positive	Negative	All	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Employment size$_{t-1,t}$	-0.004	0.003	-0.007	-0.000	-0.006***	0.006**
	(0.005)	(0.004)	(0.006)	(0.004)	(0.002)	(0.003)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21954	21954	21954	53386	53386	53386
R^2	0.568	0.447	0.400	0.542	0.704	0.634

Panel B: Delta sales

	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
	All	Positive	Negative	All	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Sales$_{t-1,t}$	-0.007	0.005	-0.012**	-0.012**	-0.019***	0.008**
	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54246	54246	54246	111396	111396	111396
R^2	0.615	0.467	0.445	0.554	0.719	0.624

Expectation Updates and Micro-Macro Signals
(continued)

Panel C: Delta GDP

	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
	All	Positive	Negative	All	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Δ GDP$_{t-1,t}$	-2.061***	0.301***	-2.362***	-2.116***	1.482***	-3.598***
	(0.092)	(0.062)	(0.097)	(0.095)	(0.058)	(0.072)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No
Observations	71372	71372	71372	145512	145512	145512
R^2	0.603	0.466	0.423	0.547	0.720	0.598

Panel D: Delta inflation rate

	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
	All	Positive	Negative	All	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Inflation$_{t-1,t}$	-0.044***	0.006***	-0.050***	-0.047***	0.031***	-0.077***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No		No	No	No	No
Observations	71372	71372	71372	145512	145512	145512
R^2	0.604	0.466	0.425	0.548	0.720	0.602

Panel E: Delta unemployment rate

	Update Hiring$_{T;T-1}$			Update Development$_{T;T-1}$		
	All	Positive	Negative	All	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Unemployment rate$_{t-1,t}$	0.041***	-0.007***	0.048***	0.031***	-0.024***	0.055***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No
Observations	71372	71372	71372	145512	145512	145512
R^2	0.601	0.465	0.420	0.545	0.719	0.591

Table A5. Expectation Errors and Micro Signals

Source: SINE survey and tax files. *Sample:* New firms founded in 1998, 2002, 2006, 2010, and 2014. This table uses OLS to test whether entrepreneurs over- or under-react to recent corporate news. The dependent variable in panel A is *Optimistic Error*$_T$, which equals one if the entrepreneur over-estimate her hiring or development expectations relative to the one-year ahead employment growth or sales growth realizations. The dependent variable in panel B is *Pessimistic Error*$_T$, which equals one if the entrepreneur under-estimate her hiring or development expectations relative to the one-year ahead employment growth or sales growth realizations. The independent variable in columns (1) to (3) are the firm's employment size growth between year t and $t-1$. The independent variable in columns (2) to (4) are the firm's sales growth between year t and $t-1$. All models include individual fixed effects and year fixed effects. Clustered standard errors at the firm level are reported in parentheses. *, **, and *** indicate significantly different from zero at the 10, 5, and 1% levels, respectively.

Panel A: Optimistic expectation errors

Type of error:	Optimistic Error$_T$			
Expectation threshold:	Employment growth$_{t,t+1} \geq 1$		Sales growth$_{t,t+1} \geq 5\%$	
	(1)	(2)	(3)	(4)
Δ Employment size$_{t-1,t}$	0.033***		0.006	
	(0.005)		(0.004)	
Δ Sales$_{t-1,t}$		0.012***		0.016**
		(0.005)		(0.006)
Individual FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	9798	22304	17722	33876
Observations	19596	44608	35444	67752
R^2	0.590	0.604	0.563	0.564

Panel B: Pessimistic expectation errors

Type of error:	Pessimistic Error$_T$			
Expectation threshold:	Employment growth$_{t,t+1} < 1$		Sales growth$_{t,t+1} < 5\%$	
	(1)	(2)	(3)	(4)
Δ Employment size$_{t-1,t}$	-0.116***		0.008*	
	(0.005)		(0.004)	
Δ Sales$_{t-1,t}$		-0.104***		0.015**
		(0.005)		(0.007)
Individual FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	11873	31530	17533	37830
Observations	23746	63060	35066	75660
R^2	0.581	0.616	0.530	0.509

Variable Descriptions

Variable	Description
Expectations (Source: SINE):	
Development expectations items stem from the question "What do you plan to do over the next 6 months?":	
Development Expectation	Dummy variable that equals one when the entrepreneur answers "Develop the company" and zero otherwise.
Stabilize	Dummy variable that equals one when the entrepreneur answers "Maintain the current situation" and zero otherwise.
Recover	Dummy variable that equals one when the entrepreneur answers "Recover from a difficult situation" and zero otherwise.
Shut down	Dummy variable that equals one when the entrepreneur answers "Shut down the company" and zero otherwise.
Sell	Dummy variable that equals one when the entrepreneur answers "Sell the company" and zero otherwise.
Development Uncertainty	Dummy variable that equals one when the entrepreneur answers "I don't know" and zero otherwise.
Hiring forecasts items stem from the question "Do you plan to hire over the next 12 months?":	
Hiring Forecast	Dummy variable that equals one when the entrepreneur answers "Yes" and zero otherwise.
Hiring Uncertainty	Dummy variable that equals one when the entrepreneur answers "I don't know" to the question "Do you plan to hire over the next 12 months?" and zero otherwise.
Expectation Updates (Source: SINE):	
Update Development	Dummy variable that equals one when the entrepreneur changes her *Development Expectation* between two successive periods of the survey and zero otherwise. The variable is computed between periods 1 and 3 and 3 and 5.
Positive	Dummy variable that equals one if the entrepreneur changes her *Development Expectation* to "Develop the company" when the entrepreneur provided another answer in the period before and zero if she does not change her growth expectations.
Negative	Dummy variable that equals one if the entrepreneur changes her *Development Expectation* to any other expectation item when the entrepreneur answered "Develop the company" in the period before and zero if she does not change her growth expectations.
Revision Hiring	Dummy variable that equals one when the entrepreneur changes her *Hiring Expectation* between two successive periods of the survey and zero otherwise. The variable is computed between periods 1 and 3 and 3 and 5.
Positive	Dummy variable that equals one if the entrepreneur changes her *Hiring Expectation* to "hire" when the entrepreneur answered "no" in the period before and zero if she does not change her growth expectations.
Negative	Dummy variable that equals one if the entrepreneur changes her *Hiring Expectation* to "no" when the entrepreneur answered "hire" in the period before and zero if she does not change her growth expectations.
Expectation Errors (Sources: SINE, DADS):	
Optimistic Development Error	Dummy variable that corresponds to the difference between the variable *Development Expectation* and its subsequent realizations. Realization is a dummy variable that equals one if the firm sales *do not* reach a higher sales bucket in the following year, while the entrepreneur expects to "Develop the company", and zero otherwise. The variable equals zero if Realization = Expectation.
Pessimistic Development Error	Dummy variable that corresponds to the difference between the variable *Development Expectation* and its subsequent realizations. Realization is a dummy variable that equals one if the firm sales *does* reach a higher sales bucket in the following year, while the entrepreneur *does not* expect to "Develop the company", and zero otherwise. The variable equals zero if Realization = Expectation.
Optimistic Hiring Error	Dummy variable that corresponds to the difference between *Hiring Expectation* and subsequent realizations. Realization is a dummy variable that equals one if the firm employment size does not increase by at least 1 employee (or 2 depending on the threshold) in the following year, while the entrepreneur expects to "hire", and zero otherwise. The variable equals zero if Realization = Expectation.

Continued on next page

Variable	Description
Pessimistic Hiring Error	Dummy variable that corresponds to the difference between *Hiring Expectation* and subsequent realizations. Realization is a dummy variable that equals one if the firm employment size *increases* by at least 1 employee (or 2 depending on the threshold) in the following year, while the entrepreneur *does not* expect to "hire", and zero otherwise. The variable equals zero if Realization = Expectation.
Entrepreneurs' Characteristics (Source: SINE)	
Female	Dummy variable that equals one if the start-up is led by a female entrepreneur and zero if it is led by a male entrepreneur.
Age	Dummy variables that equals one if the entrepreneur is one of the following age categories at creation: 24 or younger, 25-34, 35-44, 45-54, 55 or older.
French	Dummy variable that equals one if the entrepreneur is a French citizen and zero otherwise.
Bachelor's	Dummy variable that equals one if the entrepreneur's highest diploma is a three-year bachelor's degree (License) and zero otherwise.
Master's/PhD	Dummy variable that equals one if the entrepreneur has at least a five-year master's degree, including engineering, JD, MD, and PhD degrees (Master, Grande école, Doctorat), and zero otherwise.
Expert	Dummy variable that equals one if the entrepreneur has at least three years of prior work experience in the sector in which the start-up is incorporated and zero otherwise.
Serial	Dummy variable that equals one if the entrepreneur has already founded a start-up and zero otherwise.
Start-up	Dummy variable that equals one if the entrepreneur starts a new company and zero if she purchases, inherits or leases an already existing company.
High-growth oriented	Dummy variable that stems from the question, "What is your main objective?" and equals one if the entrepreneur answers, "to develop the company" but zero if she answers, "mainly to create my own job".
Motivation items stem from the question, "What are your three main motivations? ":	
New idea	Dummy variable that equals one if the entrepreneur ticks the box, "a new idea for a product, service, or market" and zero otherwise.
Taste	Dummy variable that equals one if the entrepreneur ticks the box, "taste for entrepreneurship or new challenges" and zero otherwise.
Opportunity	Dummy variable that equals one if the entrepreneur ticks the box, "an opportunity to create a start-up" and zero otherwise.
Independence	Dummy variable that equals one if the entrepreneur ticks the box, "desire to be independent" and zero otherwise.
Founding Team:	
Alone	Dummy variable that equals one if the entrepreneur indicates having started the company on her own and zero otherwise.
Spouse	Dummy variable that equals one if the entrepreneur indicates having started the company with her spouse and zero otherwise.
Siblings	Dummy variable that equals one if the entrepreneur indicates having started the company with a sibling, a relative or a friend and zero otherwise.
Associates	Dummy variable that equals one if the entrepreneur indicates having started the company with a professional partner or an associate and zero otherwise.
Micro and Macro Signals (Source: DADS, Tax files, Insee.fr)	
ΔEmployment size$_{t,t-1}$	Change in the firm's employment size between years t and t-1.
ΔSales$_{t,t-1}$	Change in the firm's sales bucket between years t and t-1.
ΔGDP$_{t,t-1}$	Change in the French GDP between years t and t-1.
ΔInflation$_{t,t-1}$	Change in the French inflation rate between years t and t-1.
ΔBusiness climate$_{t,t-1}$	Change in the French business climate index between years t and t-1.
ΔUnemployment$_{t,t-1}$	Change in the French unemployment rate between years t and t-1.