Entrepreneurship along the industry life cycle. Does ownership matter?

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Abstract

When industry enters the maturity stage, the number of incumbents declines (shakeout) and firm size tends to increase. The risk of exiting the market may be substantial for those firms that are not able to adopt an entrepreneurial behavior. Moreover, this risk may be of particular concern for those firms that value the long term control over company assets, as family firms. This paper shows that family firms are more prone to invest in risky entrepreneurial activities during the maturity stage, and this propensity increases as industry matures.

INTRODUCTION

For long time entrepreneurial behavior has been identified by actions of taking risk, introducing innovations and acting proactively (Schumpeter, 1934; Baumol, 1968). Miller (1983) and Covin and Slevin (1991) have formalized this intuition in a set of activities that have been operationalized in the empirical analysis.

Many of these activities are easily found in new ventures, as they bring something new – a new product or a new business model - into the market. Therefore, new firms and start-ups have been considered the quintessential of the entrepreneurial archetype. However, even established organisations must innovate and behave entrepreneurially, especially when consumer preferences and new technologies reshape the competitive arena. This makes corporate entrepreneurship, i.e. the entrepreneurial activities promoted by established organisations with the purpose of renewing the firm's competitive position, a central issue to understand the entrepreneurial intensity of the economy.

If established firms do not renew themselves as industry evolves, they run the risk of exiting the market. Therefore, also established firms may face a significant amount of risk when they adapt their entrepreneurial behavior to the changing industry structure. More importantly, the potential risk of exit faced by the incumbent company increases as the industry moves along its life-cycle stages. After the initial stage, where entry and innovation prevail, growth leaves room to maturity, and efficiency is pursued by the increase in firm size and a marked reduction of the number of players. At this stage, i.e. the shake-out phase, the risk for non-innovating firms of exiting the market becomes even more significant, and it grows with the intensity of the shake-out as a larger number of players is expected to leave the market because of the restructuring of the industry.

Some types of company owners may be particularly concerned with the risk of exit the market in the shakeout stage. Among these owners there are family firms. Because of their peculiar characteristics in terms of risk attitude, committed capital resources and long term horizon, the risk of exiting the market may be particularly undesirable for these firms, as it affects not only company survival but also the long-term perspective of the family behind the company. As a result, family firms may be more likely than nonfamily firms to be innovative and risk-prone when the evolution of the industry makes the risk of exit from the market particularly severe. More generally, if the intensity of the shakeout affects the survival probability of the firm, entrepreneurship turns out to be endogenously-determined by the sectoral structure of the economy, as it depends on the differences in risk tolerance associated with the ownership structure of the corporate sector.

Despite its relevance for understanding the role of the corporate behavior to the entrepreneurial activity in the economy (Morris et al. 2001), this issue has been largely overlooked in the mainstream literature. The present paper aims at providing an empirical contribution to this issue by examining the impact of industry evolution on the entrepreneurial behavior of established companies. In doing this, the paper takes into account the driving role of the industry evolution on the entrepreneurial behavior of the company and uses the family ownership as the main identifying mechanism. We exploit the dissimilarities in the strategic reference points associate to the ownership structure of the company (Kotlar et al., 2011) to explore the impact of the growth-to-maturity switches on corporate entrepreneurship, as measured by firms' innovation profile. Differences in the risk tolerance associated to family ownership provide the mechanism to identify the impact of

the (shakeout–induced) increase of the business risk on the entrepreneurial activities of incumbent firms.

To test the above intuition, we investigate the entrepreneurial behavior of 14750 European companies involved in the EU-EFIGE survey. By drawing firm-level financial data from Orbis-Bureau Van Dijk and 4-digit European industries information from the Eurostat database, we specifically analyze how companies' entrepreneurial activities change when the industry switches from growth to maturity. From a methodological point of view, we adopt the Hamilton's latent state regime switching model to identify industry life cycle stages and Morris et al. (2001)'s classification of corporate entrepreneurship activities.

Our results show that family firms are more prone than nonfamily firms to invest in risky activities during the maturity stage, as expected on the basis of a supposed larger sensitivity of family owners to perspective risk. Furthermore, family firms' propensity to invest in risky initiatives increases as industry matures, thus making the entrepreneurial profile of the company dependent on the shakeout intensity. These results are coherent with an entrepreneurial behavior of family firms expected within a socioemotional wealth framework.

In addition to the above results, the paper contributes to the literature in other ways. First, we add to the corporate entrepreneurship literature. While studies analyzing companies' entrepreneurial behavior in established organizations are common, little research has investigated how industry evolution, as indicated by industry life cycle, affect entrepreneurship dynamics. Second, we add to the literature on family businesses and socioemotional wealth. We argue that the socioemotional wealth perspective may explain the potential divergent entrepreneurial behavior of family businesses during industry life

cycle changes: as the risk of exiting the market increases during the shake out phase, family owners pursuing economic and non-economic goals may be more likely to engage risky entrepreneurship activities. Conversely, companies uninterested in socioemotional wealth, are expected to face the maturity stage by promoting strategic reorganization operations. Third, and more general, we contribute to the literature on entrepreneurship by employing a new definition of entrepreneurship activity. Unlike previous studies, who used to employ the 7-item index developed and validated by Miller (1983) to measure entrepreneurship phenomena, in this research we introduce six different corporate entrepreneurship proxies. As these measures reflect different levels of risk taking, innovation and proactive orientation, they may be used as valid proxies for entrepreneurial behaviors. However, due to their specificity, we may be able to gain additional insights about the characteristics of the entrepreneurial activities promoted by companies. Finally, we try to bravely link our definition of corporate entrepreneurship to the classification proposed by Morris et al. (2001).

The remainder of the paper is structured as follows. After a brief literature review on corporate entrepreneurship, we will develop our hypotheses and outline the methods employed in this study. Then, we will report and discuss our results and conclude with limitations and avenues for future research.

THEORY AND HYPOTHESES

Corporate Entrepreneurship and Industry Life Cycle

Corporate entrepreneurship refers to the entrepreneurial activities promoted by established organizations with the purpose of revitalizing the company's business either by

changing its competitive profile or by emphasizing innovation (Zahra 1995, 1996; Sharma and Chrisman, 1999; Eddleston and Kellermanns, 2006; Eddleston et al., 2012).

The empirical research has shown that corporate entrepreneurship is a key factor contributing to firms' success. It increases revenue streams, empowers employees and improves profitability (Zahra, 1996). Corporate entrepreneurship activities may take different forms, including product innovation, process innovation, the pursuit of new markets and strategic reorganization (Miller, 1983; Covin and Slevin, 1991; Sharma and Chrisman, 1999; Zahra et al., 2000). The current literature has identified two major categories of corporate entrepreneurship activities under which all these entrepreneurial behaviors may fall in: corporate venturing operations, including the methods apt at creating new businesses; and strategic entrepreneurship, involving the adoption of new strategies and the redesign of existing business models (Morris et al., 2001; Kuratko and Audrescht, 2009; Kuratko et al., 2015).

This need for revitalizing the firm's business is strictly related to the company's environment. With the economic context becoming increasingly dynamic and uncertain, it is crucial for firms to develop an entrepreneurial mindset that allows them to identify the existing growth opportunities generated by the industry evolution. Industry sectors evolve over time because of the combined effect of technological innovation and changes in consumers' preferences: as these two factors systematically reshape the industry structure, there is always space for entrepreneurial opportunities to be exploited. In other words, since firms are required to adopt entrepreneurial behaviors to maintain their engagement with industry changes, entrepreneurship follows back from industry dynamics. Therefore, industry evolution, as identified by industry life cycle, results to be a major driver explaining

the observed entrepreneurial intensity within specific industries. More specifically, as industry moves along its life cycle stages, firms need to adjust either their competitive profile or their innovation policy in order to survive.

The industry life cycle theory has identified three main evolutionary phases: growth, maturity, and decline (Agarwal et al., 2002)[1]. While the growth stage is usually characterized by accelerating market development, high technological intensity, increasing entry rates and variable consumers' preferences, in the maturity phase changes become less radical. In that stage, products become more standardized, consumers' preferences stabilize, price competition is exacerbated and profitability reduces. A shake out occurs during the transition from growth to maturity whereby weak competitors exit, concentration increases and scale economies start benefiting larger firms pursuing cost leadership strategies (Karniouchina et al., 2013).

As the industry environment changes over the industry life cycle, companies' entrepreneurial behavior may change as well. In growing industries, where firms' heterogeneity is higher and both product innovation and proliferation are promoted by unstable consumers' preferences, companies are expected to pursue growth opportunities by investing in corporate venturing strategies, as the introduction of product new-to-the-firm and to-the-market or new patent applications. On the contrary, when the competitive scenario is characterized by efficiency-based competition, as in the maturity industry life cycle stage, firms are more likely to promote strategic entrepreneurship activities, based on product range extension, process innovation and strategic reorganization. Accordingly, we propose the following hypotheses:

[1] Although different authors (Klepper, 1996; Grant, 2010) postulate slightly different industry life cycle phases, the approach adopted in this study follows that of Agarwal et al. (2002).

Hypothesis 1a: Industry life cycle significantly affects entrepreneurial phenomena.

Hypothesis 1b: During industry growth stages, firms exhibit higher levels of corporate venturing.

Hypothesis 1c: As maturity phases advance, companies promote strategic entrepreneurship activities.

Corporate Entrepreneurship and Family Firms

The decision to invest in corporate entrepreneurship may be peculiar in family businesses, because of their ownership-specific characteristics. A growing body of the current literature, therefore, has focused on the entrepreneurial behavior of family companies by highlighting the factors preventing and fostering family firms' entrepreneurship orientation (Salvato, 2004; Zahra et al., 2004; Kellermanns and Eddleston, 2006; Eddleston et al., 2012).

Family owners' and managers' concerns for wealth preservation often limit family firms' investments in corporate entrepreneurship because of the risks and changes associated with entrepreneurial behaviors (Carney, 2005; Chrisman et al., 2005). Family businesses may also be reluctant to strategically change because of potential conflicts, increasing expenses, or they may be simply unwilling to lose their status quo and modernize (Beckhard and Dyer, 1983; Gersick et al., 1997). Indeed, this rigidity prevents the business from having the flexibility to adjust to industry evolutionary changes with consequent loss of profitability and market shares (Miller et al., 2003).

Although these factors potentially make family owned firms as stagnant and conservative, some researchers see the family ownership as a unique context that supports

corporate entrepreneurship (Eddleston et al., 2012). Because of their longer-term horizon, their desire to pass the company onto future generations, and the close tie between the firm and the family, corporate entrepreneurship behaviors may be easily implemented in family businesses (Zahra, 2005; Eddleston et al., 2012). Moreover, the aim to sustain firm survival over time and over family generations may lead family firms to seek growth opportunities (Eddleston et al., 2008; Eddleston et al., 2012).

In trying to reconcile these divergent views, part of the current literature (Corbetta and Salvato, 2004; Eddleston et al., 2012) has highlighted the role played by the stewardship theory in explaining family firms' entrepreneurial behavior. When family members acting as stewards set short-term gains apart for pursuing long-term advantages, innovative and proactive behaviors are engaged with beneficial consequences on firm profitability (Corbetta and Salvato, 2004; Miller and Le Breton-Miller, 2005).

This approach also fits with the socioemotional wealth perspective. As largely indicated by the current literature (Gomez-Mejia et al., 2001, 2010; Chrisman and Patel, 2012; Patel and Chrisman, 2014), in running their businesses family owners pursue several non-economic goals, such as the perpetuation of the family dynasty, the ability to exercise family influence, and the preservation of the family reputation. Using a socioemotional reference point, family firms are likely to give a high priority on maintaining family control even accepting increasing risks. Adopting the behavioral agency model, Gomez-Mejia et al. (2010) show that family ownership and managers are loss averse with respect to their socioemotional wealth: they are risk averse to those business opportunities that may reduce that wealth, but they become risk seeking when socioemotional wealth is threatened (Chrisman and Patel, 2012; Patel and Chrisman, 2014). As a consequence, when firm

performance meets aspirations, family firms, with respect to non-family businesses, make exploitative R&D investments, which increase sales' reliability. By contrast, when performance is below aspirations, loss averse family companies, as compared to non-family firms, are more likely to make explorative R&D investments, which tend to increase both sales' level and variability (Chrisman and Patel, 2012; Patel and Chrisman, 2014).

As industry evolution significantly impacts on the risk of exiting the market, and thus on family firms' socioemotional wealth, the entrepreneurial behavior of family businesses, and in particular the decision on whether to promote risky corporate venturing activities or safer strategic entrepreneurship operations, strictly depends on the industry life cycle stage. More specifically, in the growth stage, where socioemotional wealth is not undermined, the entrepreneurial behavior of family businesses, in terms of corporate venturing and strategic entrepreneurship operations, may not be significantly different from the one of non-family owned companies.

During maturity life cycle stages, instead, family owned firms may be willing to accept a higher amount of risk to preserve their socioemotional wealth and survive. Therefore, they are expected to be more likely to engage risky corporate venturing activities, through the creation of new product to the firm and to the market. Conversely, if the need to preserve socioemotional wealth is not a binding concern for the company, as in the case of non-family owned companies, firms may face the shake out phase and the related exit risk, by adopting less risky innovations, such as extended product range, process innovation and strategic reorganization. Hence, we test the following hypotheses:

Hypothesis 2a: The impact of industry life cycle on firms' entrepreneurial orientation is significantly influenced by companies' ownership structures.

Hypothesis 2b: During industry growth phases, family and non-family owned firms have not significantly different entrepreneurial strategies.

Hypothesis 2c: As industry matures, family owned firms enjoy higher levels of corporate venturing, while non-family owned businesses promote strategic entrepreneurship.

METHOD

Sample

In order to test the study's hypotheses, we build our dataset by drawing information from three main sources: (i) the EU-EFIGE Bruegel-UniCredit survey on "European Firms in a Global Economy"; (ii) the BvD-Amadeus database; (iii) the Eurostat database.

The EU-EFIGE survey collects detailed qualitative and quantitative information about firm ownership and governance structure, workforce characteristics, innovation and internationalization activities, financial conditions, market structure and competition. The dataset covers a representative sample (at the country and industry level) of almost 15000 manufacturing firms with more than ten employees coming from seven European countries: Austria, France, Germany, Hungary, Italy, Spain and UK. As the survey was run in early 2010, information is mostly collected as a cross-section for the year 2008, although some questions cover the period 2007-2009 or companies' behavior during the crisis[2]. To all the surveyed firms, we attach balance-sheet data for the period 2001-2009 provided by BvD-Amadeus, the most comprehensive and widely used source of financial information for public and private enterprises in Europe.

[2] For additional information about the EU-EFIGE survey, see Altomonte and Aquilante (2012).

Time series data on production values, employed to identify industry life cycle stages, are finally obtained from the Eurostat website. To perfectly match the business-unit data provided by BvD-Amadeus with the European industry-level information, we use production value data aggregated at the four-digit NACE codes.

By merging the three datasets, and considering only those sectors with continuous coverage for the period 1995-2013, we end up with a final sample of 9602 companies operating in 177 industries during the period 2001-2009.

Variable Definitions

***Entrepreneurship*.** Although most of the current studies on entrepreneurial behavior employs the 7-item index developed and validated by Miller (1983) to measure entrepreneurship activities, in this research we introduce a set of six corporate entrepreneurship proxies, directly gathered from the EU-EFGE survey: (i) *Market Product Innovation*, which is a dummy variable equal to one if the firm introduced either a new good or a significantly improved product onto the market before its competitors, and zero otherwise; (ii) *Firm Product Innovation*, which is a dummy variable equal to one if the firm introduced either a new good or a significantly improved product that was already available in the market from its competitors, and zero otherwise; (iii) *Patent Applications*, which is a dummy variable equal to one if the firm either applied for a patent, registered an industrial design, registered a trademark or claimed copyrights, and zero otherwise; (iv) *Product Range* changes, which is a dummy variable equal to one if the firm changed its product range, and zero otherwise; (v) *Process Innovation*, which is a dummy variable equal to one if the firm adopted either a new or a significantly improved production technology, and zero otherwise;

(vi) *Organizational Innovation*, which is a dummy variable equal to one if the firm introduced new organizational method in its business practice, workplace organization or external relations, and zero otherwise.

As these measures reflect different levels of innovation and risk taking propensity, they may be classified either as corporate venturing or strategic entrepreneurship variables (see Table A3.1). More specifically, since corporate venturing activities involve the creation of new businesses, *Market Product Innovation*, *Firm Product Innovation* and *Patent Applications* are attributed to this category. On the contrary, as strategic entrepreneurship is mainly defined as strategic reorganization, business model redefinition and product categories modification, *Product Range*, *Process Innovation* and *Organizational Innovation* are included in this class of entrepreneurial activities.

In Appendix 1, we provide all the survey questions employed for the definition of the corporate entrepreneurship indicators.

***Industry Life Cycle*.** As life cycle curves are not directly observable, the identification of industry life cycle stages requires some challenging estimations.

A statistical approach widely used to model business cycles and recently adopted to industry life cycle analysis by Karniouchina et al. (2013), is Hamilton's latent state regime switching method (Hamilton, 1989)[3]. This approach, based on aggregate production value changes, allows us to classify industry sectors into growth, maturity and decline stages and to account for multiple shifts back and forth from one stage to another. As our focus is on established companies and we are unable to get information about the exact birth of the

[3] Appendix 2 derives the Hamilton's latent state regime switching model and describes the estimation procedure.

industries, our model omits the initial stage of sector development. Furthermore, since we are interested in investigating the role of industry life cycle in explaining entrepreneurial phenomena by focusing on growth and maturity stages, in order to avoid losing those observations related to declining industry sectors, we consider a wider definition of mature industries by including the decline phase into the maturity one[4]. For a better interpretation of our findings, moreover, we exclude from our sample those industries with multiple shifts back and forth from one stage to another and those sectors with a reverse life cycle (i.e. sectors experiencing a maturity or growth phase after a declining one).

A pre-post descriptive analysis performed on a subsample of companies and sectors experiencing both growth and maturity stages during the period 1995-2013, highlights some differences between the two phases in terms of both firm-specific and industry-specific characteristics[5]. In terms of profitability across the different stages, the univariate analysis reveals that companies' return on assets reduce from 7.3 to 6.9 percent as the industry shifts from growth to maturity. Consistently with the theoretical considerations presented in the previous section about industry life cycle dynamics, also firm size and productivity appear to change with industry life cycle stage switches. As large and highly productive companies are more likely to survive to the shake out phase, it is not surprising that the on average firm size and productivity increase as the industry sector changes from growth to maturity. In particular, while the on average firm size increases from 75.83 to 78.23 employees, the on average productivity (computed as value added per employee) rises from 45.66 to 51.83 when the shift occurs. By combining information on industry life cycle stages

[4] All the estimation results remain statistically significant when we exclude from the definition of mature industries those sectors in declining phases. We have also analyzed the impact of declining industry life cycle stages on entrepreneurship activities. However, the obtained results were mainly non-statistically significant.
[5] See Table A3.2.

and data on the number of active enterprises per industry sector, moreover, we find evidence that, in line with our theoretical arguments about the shake out phenomenon, the variation in the number of active firms changes significantly when the industry shifts from growth to maturity. More specifically, while the number of enterprises increases during the growth stage, when the industry becomes mature the variation in the number of active companies becomes strongly negative (-7.2 percent).

Although we get information about the life cycle stage for each year/country/sector combination for the period 1995-2013, as our entrepreneurship measures refer to 2007, in the multivariate analysis we focus on the industry stage registered in 2007. In particular, we create two different industry life cycle variables: (i) *Growth*, which is a dummy variable equal to one if in 2007 the industry is in the growth stage, and zero otherwise; (ii) *Maturity years*, that is computed, for those companies that in 2007 were in the maturity stage, as the number of years from the end of the industry growth phase and the beginning of the maturity stage. As the risk of exiting the market increases as the maturity phase advances, the Maturity years variable should allow us to get additional insights about the relevance of survival concerns in shaping entrepreneurial phenomena.

Some preliminary statistics about the industry life cycle stages of the companies under analysis indicate that in our reference year (2007), 19 percent of firms operate in growing industries, 67 percent of companies worked in mature sectors, and 14 percent of businesses operated in a declining context. By looking at the number of years from the end of the growth phase and the beginning of the maturity stage, we also know that, on average, the maturity phase has started for about 6 years.

***Family Firms*.** In this research, the identification of family and non-family owned businesses, as the definition of entrepreneurial activities, is based on the qualitative detailed information provided by the EU-EFIGE survey. In particular, as the questionnaire precisely asks whether the company is directly or indirectly family controlled, we build a dummy variable, *Family firm*, which is equal to one if the firm is controlled by an individual or a family owned entity, and zero otherwise[6].

Following this classification, in line with the overall distribution of family firms in Continental Europe, 70 percent of the surveyed companies result to be categorized as family-owned, while only 30 percent of businesses appear to be non-family controlled. Some univariate tests performed on the subsamples of family and non-family companies provide some insights about the characteristics of these types of businesses (Table A3.3). While family owned firms are significantly smaller and less productive than non-family companies, the two subsamples of businesses do not significantly differ in terms of profitability. All these features, moreover, remain substantially stable when we separately analyze firms operating in growing and mature industry sectors.

Some difference-in-mean tests are also performed in relation to the entrepreneurship measures adopted in this research. Interestingly, preliminary results indicate that family and non-family businesses promote different types of entrepreneurship activities. While family controlled companies promote mostly firm product innovation, process innovation and organizational innovation, non-family businesses appear to invest more in product range changes. In spite of that, consistently with the theoretical considerations presented in the previous section, these difference-in-mean tests lose their statistical significance when the

[6] In order to test the validity of our study, we also employed a more restrictive definition of family businesses based on family management instead of family control. However, our empirical findings did not change, neither in terms of statistical significance, nor in terms of magnitude of coefficient estimates.

subsample of companies operating in growing industry sectors is separately analyzed.

***Control Variables*.** In order to correctly evaluate the impact of industry life cycle stages on entrepreneurial phenomena in family and non-family owned firms, and to mitigate the omitted variable concern associated with the cross sectional structure of our dataset, we control for a large set of possible confounding effects.

First, since larger companies may easily enjoy strategic alliances and entrepreneurial activities due to slack resources and well-established connections, in our specification we control for firm size (Size), proxied by the total number of employees[7] (Kellermanns and Eddleston, 2006; Eddleston et al., 2008; Eddleston et al., 2012). Second, as widely suggested by the current literature, we control for firm age (Firm age, measured by the number of years for firm's inception). Although older organizations may undertake entrepreneurial activities less frequently than younger firms because of inertia, the need to renew the business and enter new markets increases with company age (Kellermanns and Eddleston, 2006). Third, as entrepreneurship phenomena may be significantly affected by CEO specific characteristics, we include CEO age as additional control variable (CEO age). Of course, we expect younger managers being more likely to promote innovation activities because of their greater propensity to change. Our fourth control is a proxy for firm profitability (Diff. ROA, computed as the difference between the firm return on asset and the median return on asset of its industry, at the size class and regional level). Although successful businesses may reduce managers' willingness to promote entrepreneurship, good performances may provide slack resources encouraging the exploration of new strategic options. In the same

[7] In order to account for potential non-linearity in the impact of firm size on entrepreneurial activities, we consider four different size classes: 0-20 employees; 21-50 employees; 51-250 employees; more than 250 employees.

vein, the fifth control variables included in the econometric specification is company liquidity ratio (Liquidity ratio, computed as current assets over current liabilities). As more productive companies may decide to focus on economy of scales strategies rather than more innovative and entrepreneurial activities, we also account for firm productivity, proxied by the value added per employee (Productivity). Finally, we control for industry-specific effects by accounting for both the technological intensity of the industry sector (High tech industry, a dummy variable equal to one if the firm's major industry is high tech, and zero otherwise), and its dynamic adjustment in terms of number of active enterprises (Industry adjustment, a dummy variable equal to one if the industry experienced a high drop in the number of active enterprises, and zero otherwise). According to our expectations, companies operating in high-tech and more adjusted industries should pursue innovation more considerably (Zahra et al., 2004)[8].

Baseline Regression

In order to analyze the impact of industry life cycle stages on entrepreneurial phenomena and test our first set of hypotheses, we estimate the following baseline regression:

$$y_i = \alpha + \beta Industry\_Stage_i + \delta X_i + \varepsilon_i \quad (1)$$

where y_i includes all our entrepreneurship proxies; $Industry\_Stage_i$ represents either the $Growth_i$ dummy or the $Maturity\ years_i$ variable, according to the hypothesis to be tested; X_i is a set of firm-specific controls, as described in the previous section; ε_i is the error term.

[8] All of the variables are defined in Appendix 1.

To test whether the impact of industry life cycle phases on entrepreneurship orientation differs significantly between family and non-family controlled businesses, moreover, we estimate a second equation, which includes both the family firm dummy and the interaction term between the industry life cycle stage variables and the family firm control.

Specifically, we have:

$$y_i = \alpha + \beta_I Industry\_Stage_i + \beta_F Family\ firm_i + \gamma(Industry\_Stage_i * Family\ firm_i) + \delta X_i + \varepsilon_i \quad (2)$$

where y_i is our set of entrepreneurship measures; $Industry\_Stage_i$ represents either the $Growth_i$ dummy or the $Maturity\ years_i$ variable, according to the estimated specification; $Family\ firm_i$ is a dummy variable equal to one if the company is family controlled, and zero otherwise; X_i is a set of firm-specific controls, as illustrated in the previous section; ε_i is the error term.

As the entrepreneurship proxies employed in this study are drawn from the EU-EFIGE survey as average indicators for the period 2007-2009, for the empirical analysis we cannot exploit the panel structure of our dataset[9]. Therefore, as we deal with a cross-section, we estimate Equations 1 and 2 through ordinary least squares regression.

RESULTS

The means, standard deviations, and correlation coefficients of all the variables included in the econometric specification are reported in Table 1. As the mean number of employees and the average company's age are, respectively, 77.12 and 24.06, the results of our study

[9] We partially use the panel structure of our dataset by creating the variable Maturity years, which is computed in 2007 as the number of years from the beginning of the maturity stage.

refer mainly to small- and medium-sized enterprises and well established businesses, rather than large corporations and new comers in the market. Moreover, since the percentage of companies operating in high tech industries is about 5 percent, our empirical findings should not be driven by influential technology shocks.

Coefficient estimates of Equation 1 and Equation 2 are reported, respectively, in Tables 2 and 3.

Starting from Table 2, coherently with Hypothesis 1a, estimation results indicate that industry life cycle stages significantly affect most of the entrepreneurship measures employed in this study. In particular, as shown in columns (1)-(6), industry growth phases are significantly associated with higher levels of firm product innovation (β=0.038**) and patent applications (β=0.055***). Conversely, the maturity stage of the industry life cycle, with respect to the growth one, appears to increase organizational innovation, as the coefficient of the Growth dummy is negative and statistically significant (β=-0.059***). The impact of industry life cycle stages on entrepreneurial orientation becomes even more significant as the maturity phase advances. As reported in columns (7)-(12), when the industry sector becomes more mature, and the shake out phenomenon becomes more likely, companies reduce corporate venturing activities to promote strategic entrepreneurship. The industry life cycle variable (Maturity years) has negative and statistically significant coefficients in both the market product innovation, the firm product innovation and the patent applications specifications (respectively, β=-0.004*, β=-0.006** and β=-0.004**), while process and organizational innovation are positively affected by the Maturity years control (the estimated coefficients are, respectively, β=0.006** and β=0.005*). A positive and statistically significant relation is additionally found with respect to the Product Range

variable (β=0.008***): as maturity phase advances, companies are more likely to strategically review their product portfolio. All these findings substantially support Hypothesis 1b and Hypothesis 1c. While industry growth stages foster corporate venturing activities, maturity phases promote strategic entrepreneurship. Moreover, as the industry sector becomes more mature, companies' incentives to strategically innovate becomes stronger.

Regression results about the differential impact of industry life cycle phases on the entrepreneurial behavior of family and non-family controlled businesses are reported in Table 3. Estimation results indicate that family and non-family owned companies react in a different way to industry life cycle switches, as stated by Hypothesis 2a[10]. In particular, while in the growth life cycle stage family and non-family firms do not significantly differ in terms of entrepreneurship activities (columns (1)-(6)), as the maturity phase advances, they concentrate on opposite entrepreneurial strategies. As reported in columns (7)-(12), family owned businesses increasingly promote market and firm product innovation as their industry sector becomes more mature (the regression coefficients of the interaction terms are, respectively, γ=0.009* and γ=0.017**). Non-family owned companies, instead, as the maturity stage advances, strengthen strategic entrepreneurship behavior, being more apt to invest in product range changes and organizational innovation operations (the interaction terms estimated coefficients are, respectively, γ=-0.012** and γ=-0.014**). Both these findings strongly support Hypothesis 2b and Hypothesis 2c. Although the impact of industry life cycle stages on the entrepreneurial behavior of family and non-family owned businesses

[10] In order to account for the potential heterogeneity of the entrepreneurship activities within the subsample of family controlled businesses, we additionally used the detailed information provided by the EU-EFIGE survey to distinguish family firms run by family CEOs and family companies hiring professional managers. Contrary to a-priori considerations, estimation results did not highlight any significant difference in terms of entrepreneurial behavior between family run and professionally managed family businesses.

does not significantly differ during growth phases, as the maturity stage advances family firms concentrate on corporate venturing activities, while their non-family counterparts promote strategic entrepreneurship.

Focusing on the set of firm-specific controls included in the analysis, several firm characteristics are found to significantly influence companies' entrepreneurial behavior. Consistently with the idea that lager corporations may easily promote entrepreneurship activities due to slack resources, regression estimates indicate that firm size positively affect almost all of the entrepreneurship proxies considered in this study. As older CEOs may be more risk averse, less willing to change and less incentivized to strengthen innovation, the estimated coefficients reported in Tables 2 and 3 show that CEO age reduces corporate entrepreneurship. Coherently with our expectations, we also find that successful businesses (i.e. businesses with higher Diff. ROA) reduce managers' willingness to promote entrepreneurship, while the slack resources characterizing more liquid companies encourage the exploration of entrepreneurial behavior. Finally, consistently with our theoretical considerations, firms operating in high-tech and more adjusted industries are associated with higher level of innovation activities.

DISCUSSION

Industry evolution is a major driver explaining the entrepreneurial behavior of established organizations. As the industry moves along its life cycle stages, i.e. growth, maturity and decline, firms need to develop an entrepreneurial attitude that allows them to identify the existing growth opportunities and survive. To become more competitive and adapt to the industry dynamics, companies may either change their innovation policies by

pursuing corporate venturing operations or adjust their competitive profile by promoting strategic entrepreneurship activities. By analyzing the role of industry evolution, as identified by industry life cycle, in explaining corporate entrepreneurship phenomena, the results show that industry dynamics significantly influence companies' entrepreneurial behavior, as predicted by Hypothesis 1a.

The decision on whether to follow strategic entrepreneurship or corporate venturing activities crucially depends on the life cycle stage experienced by the firm's industry sector. Consistently with Hypothesis 1b, our results indicate that during the growth stage of the industry life cycle, companies are more likely to promote corporate venturing activities rather than strategic entrepreneurship operations. As growing industries are characterized by accelerating market development, high technological intensity, increasing entry rates and variable consumers' preferences, companies need to follow product innovation strategies to gain competitive advantage and exploit the growth opportunities generated by the industry dynamics (Agarwal and Gort, 1996; Klepper, 1996; Grant, 2010).

As the maturity phase advances, however, firms gradually reduce corporate venturing activities to engage strategic entrepreneurship behaviors, as predicted by Hypothesis 1c. The maturity stage substantially reduces companies' opportunities for establishing competitive advantages: products become more standardized, consumers' preferences stabilize, price competition is exacerbated and profitability drastically reduces. Increasing entry and survival barriers cause the decline in entry rates and the shake out of weaker firms from the market. As a consequence, to remain competitive and survive, companies focus on strategic reorganization and process innovation strategies, by promoting strategic entrepreneurship activities.

The impact of industry evolution on corporate entrepreneurship behavior, however, is not homogeneous among firms. As family owned businesses, perceive more the risk of exiting the market, because of the socioemotional wealth associated to their companies, their decision on whether to engage corporate venturing or strategic entrepreneurship activities during industry life cycle stages is different from the one of non-family owned firms (Hypothesis 2a). More specifically, in the growth stage, where socioemotional wealth is not undermined, family businesses and non-family firms behave similarly in terms of corporate entrepreneurship activities, as predicted by Hypothesis 2b.

During maturity life cycle stages, instead, when the risk of exiting the market and fail is higher because of the shake out phenomenon, family owned firms are willing to accept a higher amount of risk with respect to their non-family counterparts. In order to preserve their socioemotional wealth, they are more likely to promote long-term oriented and high risk entrepreneurial activities. In particular, when compared to non-family owned companies, family firms invest more in corporate venturing operations, such as product innovation (product new-to-the-market and new-to-the-firm) and patent applications. Conversely, consistently with Hypothesis 2c, as the loss of socioemotional wealth is irrelevant in non-family owned businesses, this type of companies face the shake out phase by promoting less risky innovation through strategic entrepreneurship activities.

Limitations and Conclusion

Before highlighting the main conclusion of our study, we need to mention a few limitations of our findings. First, because of the cross sectional structure of our research, we cannot deduce any causal relationship. Obviously, there are likely to be additional and

relevant insights from future longitudinal studies. Second, our cross sectional information mainly refers to the period 2007-2009. Although the analysis has been performed on European data and the economic recession has not already started in Europe in those years, our findings, and in particular industry evolution, may suffer from the effect of the financial crisis. Third, as we analyze industry evolution and entrepreneurial phenomena for a sample of European companies, our results may not be easily extended to the US context, because of some systemic differences. Fourth, and more relevant, our classification of innovation activities within the Morris et al 2001 classification scheme, i.e. corporate venturing and strategic entrepreneurship, should be considered with caution, because the extant literature has not operationalized yet these types of activities and, most notably, has not ranked these activities according their risk profile.

In conclusion, our results demonstrate that industry dynamics and family ownership significantly influence companies' entrepreneurial behaviors. Following Morris et al. (2001)'s classification of corporate entrepreneurship operations, we find that in growing industries companies promote corporate venturing activities in the form of product innovation and patent applications. Conversely, during the maturity stage of the industry life cycle, when the shake out phenomenon increases the probability of exiting the market, firms are more likely to pursue strategic entrepreneurship operations, such as process, organizational innovation, and product range extensions. However, the impact of industry evolution on companies' entrepreneurship orientation is not homogeneous among businesses. When firms are distinguished on the basis of their ownership structure, empirical results indicate that family-owned companies react differently to the environmental changes with respect to their non-family counterparts. Following the socioemotional wealth theory, when the risk of

exiting the market and fail is higher, family firms, as compared to their competitors, are more willing to accept a higher level of risk in order to support firm survival. Therefore, they are more likely to promote long-term oriented and high risk entrepreneurial behavior, by pursuing corporate venturing activities. Conversely, as survival concerns and socioemotional wealth preservation are less rooted in non-family owned companies, these type of businesses appear to face the maturity phase and the related exit risk by investing in strategic entrepreneurship operations.

REFERENCES

Agarwal, R. & Gort, M. (1996). The evolution of markets entry, exit and survival of firms. *Review of Economics and Statistics*, *78*, 489-498.

Agarwal, R., Sarkar, M. B. & Echambadi, R. (2002). The conditioning effect of time on firm survival: an industry life cycle approach. *Academy of Management Journal*, *45*, 971–994.

Altomonte, C. & Aquilante, T. (2012). The EU-EFIGE/Bruegel-Unicredit Dataset. *Bruegel Working Paper*.

Baumol, W.J. (1968). Entrepreneurship in economic theory. *American Economic Review*, *58*, 64-71.

Beckhard, R. & Dyer, W.G., Jr. (1983). SMR forum: Managing change in the family firm - Issues and strategies. *Sloan Management Review*, *24*, 59–65.

Carney, M. (2005). Corporate governance and competitive advantage in family-controlled firms. *Entrepreneurship Theory and Practice*, *29*, 249–266.

Chrisman, J.J., Chua, J.H., & Steier, L.P. (2005). Sources and consequences of distinctive familiness: An introduction. *Entrepreneurship Theory and Practice*, *29*, 237–248.

Chrisman, J.J. & Patel, P.C. (2012). Variations in R&D investments of family and non family firms: Behavioral agency and myopic loss aversion perspectives. *Academy of Management Journal*, *55*, 976-999.

Corbetta, G. & Salvato, C. (2004). Self-serving or self-actualizing? Models of man and agency costs in different types of family firms: A commentary on "Comparing the agency costs of family and non-family firms: Conceptual issues and exploratory evidence." *Entrepreneurship Theory and Practice*, *28*, 355–362.

Covin, J.G. & Slevin, D.P. (1991). A conceptual model of entrepreneurship as firm behavior. *Entrepreneurship Theory and Practice*, *16*, 7–25.

Eddleston, K., Kellermanns, F.W., & Sarathy, R. (2008). Resource configuration in family firms: Linking resources, strategic planning and environmental dynamism to performance. *Journal of Management Studies*, *45*, 26–50.

Eddleston, K. A., Kellermanns, F. W. & Zellweger, T. M. (2012), Exploring the entrepreneurial behavior of family firms: Does the stewardship perspective explain differences?. *Entrepreneurship Theory and Practice*, *36*, 347–367.

Gersick, K.E., Davis, J.A., Hampton, M.M., & Lansberg, I. (1997). *Generation to generation: Life cycles of the family business*. Boston: Harvard Business School Press.

Grant, R.M. (2010). *Contemporary strategy analysis* (7th ed.). Wiley.

Gomez-Mejia, L.R., Makri, M., & Larraza-Kintana, M. (2010). Diversification decisions in family-controlled firms. *Journal of Management Studies*, *47*, 223-252.

Gomez-Mejia, L.R., Nunez-Nickel, M., & Gutierrez, I. (2001). The role of family ties in agency contracts. *Academy of Management Journal*, *44*, 81-95.

Hamilton, J. (1989). A new approach to the analysis of time series and the business cycle. *Econometrica*, *57*, 357-384.

Karniouchina, E. V., Carson, S. J., Short, J. C. & Ketchen, D. J. (2013). Extending the firm vs. industry debate: Does industry life cycle stage matter?. *Strategic Management Journal*, *34*, 1010–1018.

Kellermanns, F. W. & Eddleston, K. A. (2006). Corporate entrepreneurship in family firms: A family perspective. *Entrepreneurship Theory and Practice*, *30*, 809–830.

Kim. C. (1994). Dynamic linear models with Markov switching. *Journal of Econometrics*, *60*, 1-22.

Klepper, S. (1996). Exit, growth, and innovation over the product life cycle. *American Economic Review*, *86*, 562-583.

Kotlar, J., De Massis, A., Fang, H. & Frattini, F. (2014). Strategic reference points in family firms. *Small Business Economics*, *43*, 597-619.

Kuratko, D. F., & Audretsch, D. B. (2009). Strategic entrepreneurship: Exploring different perspectives of an emerging concept. *Entrepreneurship Theory and Practice*, *33*, 1–17.

Kuratko, D. F., Hornsby, J. S. & Hayton, J. (2015). Corporate entrepreneurship: The innovative challenge for a new global economic reality. *Small Business Economics*, *45*, 245-253.

Miller, D. (1983). The correlates of entrepreneurship in three types of firms. *Management Science*, *29*, 770–791.

Miller, D. & Le Breton-Miller, I. (2005). *Managing for the long run: Lessons in competitive advantage from great family businesses*. Boston: Harvard Business School Press.

Miller, D., Steier, L., & Le Breton-Miller, I. (2003). Lost in time: Intergenerational succession, change and failure in family business. *Journal of Business Venturing*, *18*, 513–531.

Morris, M. H., Kuratko, D. F. & Covin, J. G. (2011). *Corporate entrepreneurship and innovation* (3rd ed.). USA: Cengage/Southwestern.

Patel, P.C. & Chrisman, J.J. (2014). Risk abatement as a strategy for R&D investments in family firms. *Strategic Management Journal*, *35*, 617-627.

Salvato, C. (2004). Predictors of entrepreneurship in family firms. *Journal of Private Equity*, *7*, 68–76.

Schumpeter, J.A. (1934). *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle*. Transaction Publishers.

Sharma, P. & Chrisman, J.J. (1999). Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. *Entrepreneurship Theory and Practice*, *23*, 11–27.

Wright, M. & Kellermanns, F.W. (2011). Family firms: A research agenda and publication guide. *Journal of Family Business Strategy*, *2*, 187-198.

Zahra, S. A. (1995). Corporate entrepreneurship and company performance: The case of management leveraged buyouts. *Journal of Business Venturing*, *10*, 225–247.

Zahra, S. A. (1996). Governance, ownership, and corporate entrepreneurship: The moderating impact of industry technological opportunities. *Academy of Management Journal*, *39*, 1713–1735.

Zahra, S. A. (2005). Entrepreneurial risk taking in family firms. *Family Business Review*, *18*, 23–40.

Zahra, S. A., Hayton, J. C. & Salvato, C. (2004). Entrepreneurship in family vs. non-family firms: A resource-based analysis of the effect of organizational culture. *Entrepreneurship Theory and Practice*, *28*, 363–381.

Zahra, S. A., Neubaum, D.O. & Huse, M. (2000). Entrepreneurship in medium-size companies: Exploring the effects of ownership and governance systems. *Journal of Management*, *26*, 947–976.

TABLES AND FIGURES

Figure 1
Evolution of Production Value and Number of Enterprises

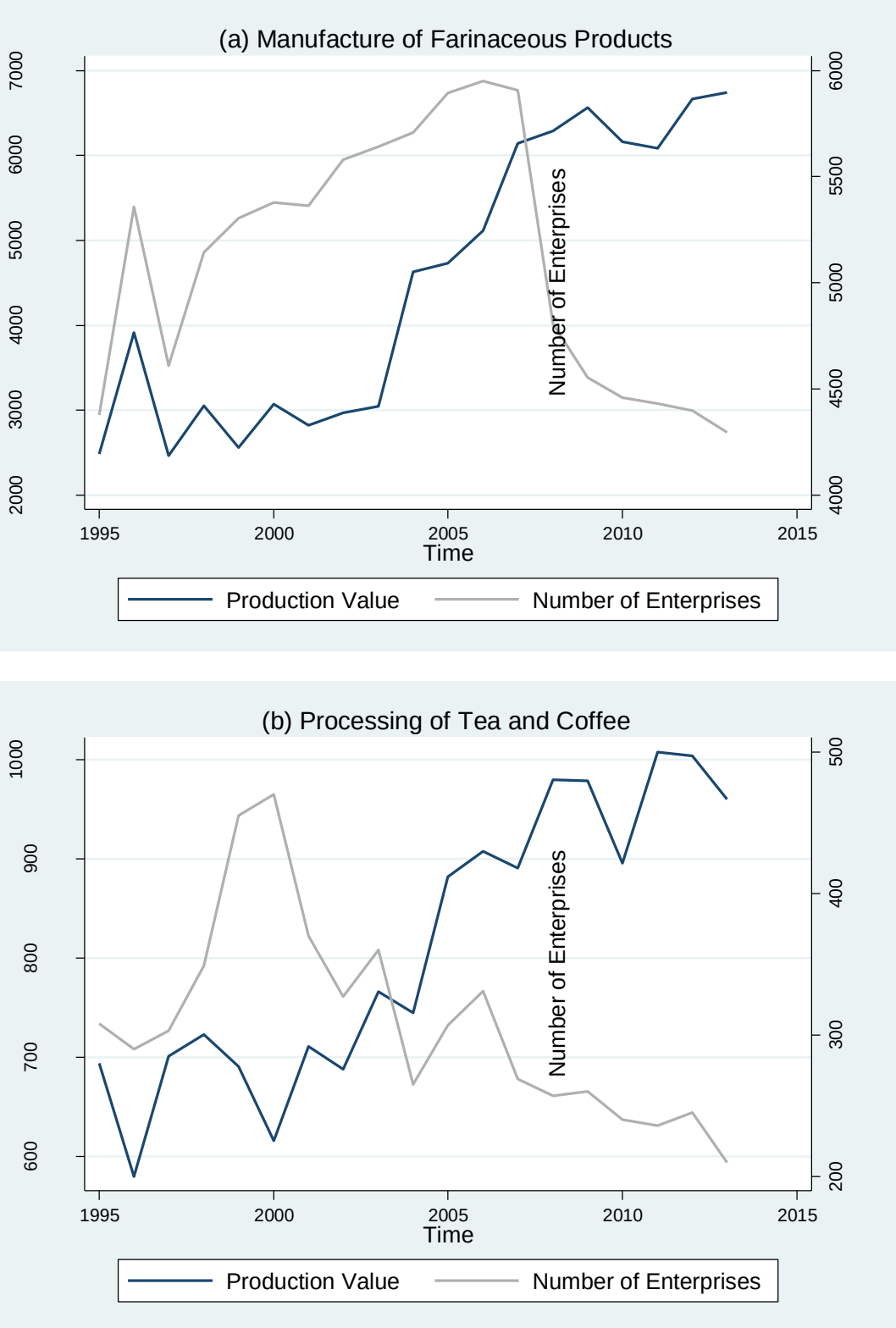

Table 1
Correlation Matrix and Descriptive Statistics

Variable	Mean	Std. Dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Market Product Innovation	0.31	0.46	1.000																
Firm Product innovation	0.49	0.50	0.680	1.000															
Patent Applications	0.13	0.34	0.347	0.355	1.000														
Product Range	0.34	0.47	0.089	0.142	0.066	1.000													
Process Innovation	0.44	0.50	0.170	0.222	0.142	0.064	1.000												
Organiz. Innovation	0.32	0.47	0.207	0.263	0.146	0.021	0.495	1.000											
Family firm	0.70	0.46	-0.017	0.010	-0.015	-0.029	0.025	0.028	1.000										
Growth	0.19	0.39	0.015	0.027	0.025	-0.011	0.000	-0.022	-0.020	1.000									
Maturity years	6.09	4.54	-0.037	-0.041	-0.051	0.052	0.002	-0.002	0.025	-0.684	1.000								
Size	77.12	156.25	0.144	0.159	0.232	-0.052	0.085	0.092	-0.132	0.009	-0.110	1.000							
Firm age	24.06	19.63	0.028	0.033	0.040	-0.005	-0.011	-0.015	0.049	0.006	-0.049	0.161	1.000						
CEO age	52.46	10.16	-0.013	-0.032	-0.008	-0.053	-0.055	-0.051	0.025	-0.015	0.006	0.026	0.169	1.000					
Liquidity ratio	1.38	1.35	-0.012	-0.027	-0.016	-0.025	-0.006	-0.014	-0.020	-0.031	-0.041	0.008	0.130	0.037	1.000				
Diff. ROA	0.01	0.42	0.015	0.018	0.009	-0.002	0.020	0.025	0.002	-0.016	-0.004	-0.018	-0.051	-0.030	0.032	1.000			
Productivity	53.64	30.82	0.063	0.041	0.067	-0.034	0.027	0.007	-0.117	0.014	-0.041	0.162	0.144	0.097	0.172	0.073	1.000		
High tech industry	0.05	0.21	0.068	0.097	0.079	0.048	0.018	-0.006	-0.043	-0.019	-0.018	0.051	0.038	0.009	0.023	0.003	0.072	1.000	
Industry adjustment	0.17	0.37	0.054	0.054	0.021	-0.001	0.003	0.024	-0.016	-0.222	0.082	0.083	0.012	-0.014	0.046	-0.017	-0.087	-0.028	1.000

Notes: All of the variables are defined in Appendix 1.

Table 2
Entrepreneurial Phenomena in Growth vs. Maturity Stages

	Mkt Product Innovation (1)	Firm Product Innovation (2)	Patent Applications (3)	Product Range (4)	Process Innovation (5)	Organiz. Innovation (6)	Mkt Product Innovation (7)	Firm Product Innovation (8)	Patent Applications (9)	Product Range (10)	Process Innovation (11)	Organiz. Innovation (12)
Growth	0.014	0.038**	0.055***	-0.001	0.012	-0.059***						
	[0.016]	[0.017]	[0.015]	[0.017]	[0.017]	[0.020]						
Maturity years							-0.004*	-0.006**	-0.004**	0.008***	0.006**	0.005*
							[0.002]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]
$Size_{20\text{-}50}$	0.043***	0.069***	0.083***	0.006	0.062***	-0.002	0.032*	0.065***	0.080***	0.000	0.065***	-0.023
	[0.015]	[0.016]	[0.014]	[0.016]	[0.016]	[0.020]	[0.017]	[0.019]	[0.016]	[0.019]	[0.019]	[0.024]
$Size_{50\text{-}250}$	0.121***	0.173***	0.187***	-0.084***	0.112***	0.073***	0.114***	0.154***	0.210***	-0.066***	0.124***	0.069**
	[0.018]	[0.019]	[0.017]	[0.019]	[0.020]	[0.024]	[0.021]	[0.023]	[0.020]	[0.023]	[0.024]	[0.029]
$Size_{>250}$	0.226***	0.256***	0.327***	-0.065**	0.133***	0.138***	0.217***	0.252***	0.344***	-0.049	0.164***	0.095**
	[0.028]	[0.030]	[0.026]	[0.030]	[0.031]	[0.035]	[0.034]	[0.036]	[0.031]	[0.036]	[0.037]	[0.042]
Firm age	0.004	0.018*	0.007	0.010	-0.017*	-0.023*	0.011	0.018	0.001	0.017	-0.014	-0.019
	[0.009]	[0.010]	[0.008]	[0.010]	[0.010]	[0.012]	[0.011]	[0.012]	[0.010]	[0.012]	[0.012]	[0.014]
CEO age	-0.005	-0.014**	-0.005	-0.021***	-0.022***	-0.015*	-0.010	-0.022***	-0.005	-0.028***	-0.031***	-0.018*
	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]	[0.008]	[0.007]	[0.008]	[0.006]	[0.008]	[0.008]	[0.010]
Liquidity ratio	-0.013**	-0.022***	-0.015**	-0.011	-0.005	0.004	-0.011	-0.018**	-0.010	-0.010	-0.004	0.007
	[0.006]	[0.007]	[0.006]	[0.007]	[0.007]	[0.009]	[0.007]	[0.008]	[0.007]	[0.008]	[0.008]	[0.011]
Diff. ROA	0.015	0.026	0.024	0.010	0.046**	0.030	0.027	0.031	0.004	0.002	0.025	0.030
	[0.017]	[0.018]	[0.015]	[0.018]	[0.018]	[0.023]	[0.020]	[0.021]	[0.018]	[0.021]	[0.022]	[0.028]
Productivity	0.001***	0.000	0.001***	-0.000	0.000**	-0.000	0.001*	0.000	0.000	-0.000	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
High tech industry	0.124***	0.218***	0.121***	0.139***	0.015	-0.090**	0.149***	0.226***	0.131***	0.153***	0.050	-0.092**
	[0.033]	[0.036]	[0.031]	[0.036]	[0.036]	[0.040]	[0.038]	[0.041]	[0.034]	[0.041]	[0.041]	[0.046]
Industry adjustment							0.064***	0.069***	0.006	0.007	0.004	0.025
							[0.019]	[0.021]	[0.018]	[0.021]	[0.021]	[0.026]
Constant	0.223***	0.417***	0.138***	0.522***	0.536***	0.604***	0.268***	0.490***	0.192***	0.450***	0.503***	0.547***
	[0.035]	[0.038]	[0.033]	[0.038]	[0.039]	[0.047]	[0.046]	[0.050]	[0.043]	[0.050]	[0.051]	[0.062]
Observations	5161	5161	5160	5160	5161	3489	3699	3699	3698	3698	3699	2458
R2	0.03	0.04	0.06	0.01	0.01	0.01	0.03	0.04	0.06	0.01	0.02	0.01

Notes: The table reports estimation results of Equation 1. Three, two and one star (*) indicate, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in brackets. All of the variables are defined in Appendix 1.

Table 3
Entrepreneurial Phenomena in Growth vs. Maturity Stages and Family Control

	Mkt Product Innovation (1)	Firm Product Innovation (2)	Patent Applications (3)	Product Range (4)	Process Innovation (5)	Organiz. Innovation (6)	Mkt Product Innovation (7)	Firm Product Innovation (8)	Patent Applications (9)	Product Range (10)	Process Innovation (11)	Organiz. Innovation (12)
Family firm	0.011	0.040**	0.021	-0.042**	0.048***	0.035	-0.137***	-0.033	0.049	0.077	0.021	0.144**
	[0.016]	[0.017]	[0.015]	[0.017]	[0.017]	[0.022]	[0.049]	[0.053]	[0.045]	[0.053]	[0.053]	[0.064]
Growth	0.009	0.035	0.013	-0.020	-0.001	-0.011						
	[0.029]	[0.031]	[0.027]	[0.031]	[0.031]	[0.038]						
Growth*Family firm	0.009	0.005	0.061*	0.026	0.020	-0.068						
	[0.034]	[0.037]	[0.032]	[0.037]	[0.037]	[0.045]						
Maturity years							-0.017***	-0.012***	-0.002	0.017***	0.004	0.015***
							[0.004]	[0.005]	[0.004]	[0.005]	[0.005]	[0.006]
Maturity years*Family firm							0.017***	0.009*	-0.002	-0.012**	0.003	-0.014**
							[0.005]	[0.006]	[0.005]	[0.006]	[0.006]	[0.007]
$Size_{20-50}$	0.043***	0.070***	0.084***	0.005	0.063***	-0.003	0.031*	0.065***	0.081***	0.000	0.066***	-0.022
	[0.015]	[0.016]	[0.014]	[0.016]	[0.016]	[0.020]	[0.017]	[0.019]	[0.016]	[0.019]	[0.019]	[0.024]
$Size_{50-250}$	0.123***	0.177***	0.192***	-0.087***	0.117***	0.074***	0.114***	0.159***	0.213***	-0.068***	0.128***	0.073**
	[0.018]	[0.019]	[0.017]	[0.019]	[0.020]	[0.024]	[0.022]	[0.023]	[0.020]	[0.023]	[0.024]	[0.029]
$Size_{>250}$	0.230***	0.266***	0.336***	-0.073**	0.145***	0.141***	0.218***	0.262***	0.351***	-0.054	0.173***	0.101**
	[0.028]	[0.031]	[0.026]	[0.031]	[0.031]	[0.035]	[0.034]	[0.037]	[0.031]	[0.037]	[0.037]	[0.042]
Firm age	0.003	0.015	0.005	0.012	-0.019*	-0.022*	0.010	0.016	-0.001	0.019	-0.016	-0.021
	[0.009]	[0.010]	[0.008]	[0.010]	[0.010]	[0.012]	[0.011]	[0.012]	[0.010]	[0.012]	[0.012]	[0.014]
CEO age	-0.005	-0.015**	-0.006	-0.021***	-0.023***	-0.015*	-0.010	-0.023***	-0.006	-0.027***	-0.031***	-0.018*
	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]	[0.008]	[0.007]	[0.008]	[0.006]	[0.008]	[0.008]	[0.010]
Liquidity ratio	-0.013**	-0.022***	-0.015**	-0.011	-0.005	0.005	-0.012	-0.018**	-0.010	-0.010	-0.004	0.008
	[0.006]	[0.007]	[0.006]	[0.007]	[0.007]	[0.009]	[0.007]	[0.008]	[0.007]	[0.008]	[0.008]	[0.011]
Diff. ROA	0.015	0.026	0.025	0.010	0.046**	0.029	0.028	0.031	0.004	0.002	0.025	0.029
	[0.017]	[0.018]	[0.015]	[0.018]	[0.018]	[0.023]	[0.020]	[0.021]	[0.018]	[0.021]	[0.022]	[0.028]
Productivity	0.001***	0.000	0.001***	-0.000*	0.001**	-0.000	0.001*	0.000	0.000*	-0.000	0.001*	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
High tech industry	0.124***	0.219***	0.121***	0.137***	0.016	-0.088**	0.144***	0.227***	0.135***	0.154***	0.053	-0.084*
	[0.033]	[0.036]	[0.031]	[0.036]	[0.036]	[0.040]	[0.038]	[0.041]	[0.035]	[0.041]	[0.041]	[0.046]
Industry adjustment							0.065***	0.070***	0.006	0.005	0.005	0.026
							[0.019]	[0.021]	[0.018]	[0.021]	[0.021]	[0.026]
Constant	0.219***	0.391***	0.129***	0.550***	0.503***	0.574***	0.371***	0.519***	0.160***	0.392***	0.489***	0.440***
	[0.037]	[0.040]	[0.034]	[0.040]	[0.040]	[0.049]	[0.058]	[0.063]	[0.054]	[0.063]	[0.064]	[0.078]
Observations	5157	5157	5156	5156	5157	3485	3697	3697	3696	3696	3697	2456
R^2	0.03	0.04	0.06	0.01	0.02	0.01	0.04	0.05	0.06	0.02	0.02	0.01

Notes: The table reports estimation results of Equation 2. Three, two and one star (*) indicate, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in brackets. All of the variables are defined in Appendix 1.

Appendix

Appendix 1: Variable Definitions

Variable	Definition
Entrepreneurship measures:	
Market Product Innovation	A dummy variable equal to one if the firm introduced either a new good or a significantly improved product onto the market before its competitors, and zero otherwise. "*On average in the last three years (2007-2009), did the firm carry out any market innovation (i.e. the introduction of a good which is either new or significantly improved with respect to its fundamental characteristics; the innovation should be new to the market)? (i) Yes; (ii) No.*" source: EU-EFIGE survey.
Firm Product Innovation	A dummy variable equal to one if the firm introduced either a new good or a significantly improved product that was already available in the market from its competitors, and zero otherwise. "*On average in the last three years (2007-2009), did the firm carry out any product innovation (i.e. the introduction of a good which is either new or significantly improved with respect to its fundamental characteristics; the innovation should be new to your firm)? (i) Yes; (ii) No.*" source: EU-EFIGE survey.
Patent Applications	A dummy variable equal to one if the firm either applied for a patent, registered an industrial design, registered a trademark or claimed copyright, and zero otherwise. "*On average in the last three years (2007-2009), did the firm…? (i) Apply for a patent; (ii) Register an industrial design; (iii) Register a trademark; (iv) Claim copyright.*" source: EU-EFIGE survey.
Product Range	A dummy variable equal to one if the firm changed its product range, and zero otherwise. "*Referring to the last year, the product range offered by your firm has: (i) Been widened; (ii) Remained the same; (iii) Been reduced.*" source: EU-EFGE survey.
Process Innovation	A dummy variable equal to one if the firm adopted either a new or a significantly improved production technology, and zero otherwise. "*On average in the last three years (2007-2009), did the firm carry out any process innovation (i.e. the adoption of a production technology which is either new or significantly improved; the innovation should be new to your firm; your firm has not necessarily to be the first to introduce this process)? (i) Yes; (ii) No.*" source: EU-EFIGE survey.
Organizational Innovation	A dummy variable equal to one if the firm introduced new organizational method in its business practice, workplace organization or external relations, and zero otherwise. "*On average in the last three years (2007-2009), did the firm carry out any organizational innovation (i.e. the adoption of a new organizational method in your enterprise's business practice, workplace organization or external relations that has not been previously used by your firm)? (i) Yes; (ii) No.*" source: EU-EFIGE survey.
Independent variables:	
Family firm	A dummy variable equal to one if the firm is family owned, and zero otherwise. "*Is your firm directly or indirectly controlled by an individual or a family-owned entity? (I) Yes; (ii) No.*" source: EU-EFIGE survey.
Growth	A dummy variable equal to one if in 2007 the industry is in the growth stage, and zero otherwise. source: Authors' elaborations on EUROSTAT data.
Maturity years	Number of years from the end of the industry growth phase and the beginning of either the maturity or the decline stages (computed in 2007 for those companies operating in mature industries). source: Authors' elaborations on EUROSTAT data.

Control variables:	
Size	Number of employees. source: BvD-AMADEUS.
Firm age	Number of years from the firm inception. source: EU-EFIGE survey.
CEO age	CEO age. source: EU-EFIGE survey.
Liquidity ratio	A continuous variable computed as current assets over current liabilities. source: BvD-AMADEUS.
Diff. ROA	A continuous variable computed as the difference between the firm return on asset and the median return on asset of its industry (at the size class and regional level). source: BvD-AMADEUS.
Productivity	A continuous variable equal to value added over number of employees. source: BvD-AMADEUS.
High tech industry	A dummy variable equal to one if the firm operates in a high-tech industry, and zero otherwise. source: BvD-AMADEUS.
Industry adjustment	A dummy variable equal to one if the variation in the number of active enterprises in the industry sector where the frim operates (between 2007 and the first year of the maturity stage) belongs to the first quartile of the distribution, and zero otherwise. source: EUROSTAT.

Notes: Balance sheet data refer to 2007.

Appendix 2: Industry Life Cycle Stages: Hamilton's Latent State Regime Switching Method

Following Hamilton's (1989) model, we assume that an industry belongs to one of the three latent regimes (growth, maturity, or decline) at any time t. The nonstationary time series that characterizes the industry, $\{y_t\}$, is the growth rate of the industry at time t, calculated by first differencing the logarithm of industry sales. Based on previous results (Hamilton, 1989; Lahiri and Wang, 1994), a first order autoregressive process for each regime $S(t) \in \{1,2,3\}$ can be specified as follows:

$$y_t = \mu_{S(t)} + \phi y_{t-1} + \varepsilon_t \qquad \text{(A1)}$$

with $\varepsilon_t \sim N(0, \sigma^2)$ and μ_1, μ_2, and μ_3, being the industry growth rates in the three life cycle stages.

The dynamic of y_t can be easily obtained once we define the probabilities of changes between regimes. In particular, the specification proposed by Hamilton (1989) is a Markovian process of the following form:

$$\Pr(S_t = j \mid S_{t-1} = i, S_{t-2} = k, \ldots, \psi_t) = \Pr(S_t = j \mid S_{t-1} = i) = \rho_{ij} \qquad \text{(A2)}$$

where ψ_t represents all the past values of y_t prior to time t and ρ_{11}, ρ_{12}, ρ_{21}, ρ_{22}, ρ_{31}, ρ_{32} are the transitional probabilities associated with regime switches.

Based on the distributional assumptions, the conditional probability is:

$$f(y_t|S_t = i, \psi_t) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{(y_t - \mu_i - \phi y_{t-1})^2}{2\sigma^2}\right] \qquad \text{(A3)}$$

Then, the joint probability of y_t and S_t is given by the product of conditional and marginal probabilities, that is for the first regime:

$$f(y_t, S_t = 1|\psi_t) = f(y_t, S_t = 1, \psi_t)\Pr(S_t = 1|\psi_t) \qquad \text{(A4)}$$

The conditional density for an observation at time t is the summation of these joint probability terms over all possible values of S_t:

$$f(y_t|\psi_t) = \sum_{j=1}^{3} f(y_t, S_t = j|\,\psi_t) \quad \text{(A5)}$$

The parameters of Equation (A5) are estimated with a maximum likelihood procedure. The probabilities of being in a certain state given the data observed up to that point in time are instead obtained as a byproduct of an algorithm similar to the Kalman filtering procedure (Karniouchina et al., 2013). In order to reduce the influence of outliers and prevent them from affecting industry stages shifts, we also adopt a full sample smoother to calculate the probability of being in state j (Kim, 1994; Karniouchina et al., 2013)[11]. These smoothed probabilities are then used to classify industries into one of the three distinct states. In particular, we calculated these smoothed probabilities for each state/year combination and assigned the industry in that particular year to the industry stage with the highest probability. We then repeat the procedure for each country considered in the analysis.

[11] Estimation was carried out using the MS_Regress package for MATLAB (Perlin, 2014).

Appendix 3: Additional Figures and Tables

Table A3.1: Entrepreneurship Measures Classification

Entrepreneurship Measures	Entrepreneurship Classification following *Morris et al. (2001)*	Expected Risk Intensity
Market Product Innovation	Corporate Venturing	High Risk
Firm Product Innovation	Corporate Venturing	High Risk
Patent Applications	Corporate Venturing	Moderate Risk
Product Range	Strategic Entrepreneurship	Moderate Risk
Process Innovation	Strategic Entrepreneurship	Low Risk
Organizational Innovation	Strategic Entrepreneurship	Low Risk

Table A3.2: Descriptive Statistics over the Industry Life Cycle

Variable	GROWTH		MATURITY		Obs.	t-statistic
	Mean	St. Dev.	Mean	St. Dev.		
A) Firm-specific characteristics:						
ROA	0.073	0.091	0.069	0.092	1617	0.004
Size	75.83	165.17	78.23	170.63	1410	-2.40**
Productivity	45.66	23.33	51.83	27.41	1164	-6.17***
B) Industry-specific characteristics:						
Number of enterprises	4728.08	7165.37	4648.49	7460.71	129	79.59***
Δ(Number of enterprises)	0.011	0.094	-0.072	0.240	129	0.083***

Notes: The descriptive statistics reported in section A (Firm-specific characteristics) have been performed on a subsample of companies with complete information for the period 2001-2009 who experienced both growth (before) and maturity (after) phases during 1995-2013. The univariate tests reported in section B (Industry-specific characteristics) are performed at the industry level on a subsample of sectors that experienced both growth (before) and maturity (after) phases during 1995-2013. All balance-sheet indicators are recoded at the 1^{st} and 99^{th} percentiles because of outliers.

Table A3.3: Summary Statistics for Family and Non-Family Firms

Panel A: Full sample

Variable	Family firms			Non-family firms			t-statistic
	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.	
A) Balance Sheet Data:							
ROA	0.074	0.094	4877	0.077	0.111	2179	-0.003
Size	50.28	69.08	4570	74.88	94.42	1838	-24.60***
Productivity	50.38	27.38	3841	57.53	33.14	1604	-7.15***
B) Entrepreneurship Measures:							
Market Product Innovation	0.303	0.460	6907	0.309	0.462	2672	-0.006
Firm Product Innovation	0.488	0.500	6907	0.470	0.500	2679	0.018
Patent Applications	0.231	0.421	6906	0.231	0.422	2679	0.000
Product Range	0.342	0.474	6906	0.385	0.487	2679	-0.043***
Process Innovation	0.444	0.497	6907	0.423	0.494	2679	0.021*
Organizational Innovation	0.497	0.500	4522	0.456	0.498	1666	0.041***

Panel B: Companies operating in growing industry sectors

Variable	Family firms			Non-family firms			t-statistic
	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.	
A) Balance Sheet Data:							
ROA	0.073	0.093	959	0.073	0.112	472	0.000
Size	51.62	73.23	908	76.32	93.59	405	-24.70***
Productivity	51.81	29.08	759	57.71	31.82	340	-5.90***
B) Entrepreneurship Measures:							
Market Product Innovation	0.304	0.460	1262	0.319	0.466	562	0.015
Firm Product Innovation	0.494	0.500	1262	0.496	0.500	562	-0.002
Patent Applications	0.270	0.444	1262	0.242	0.429	562	0.028
Product Range	0.357	0.479	1262	0.370	0.483	562	0.013
Process Innovation	0.432	0.496	1262	0.421	0.494	562	0.011
Organizational Innovation	0.454	0.498	839	0.443	0.497	361	0.011

Panel C: Companies operating in mature industry sectors

Variable	Family firms			Non-family firms			t-statistic
	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.	
A) Balance Sheet Data:							
ROA	0.074	0.095	3918	0.078	0.111	1707	-0.004
Size	49.95	68.02	3662	74.47	94.68	1433	-24.52***
Productivity	50.03	26.94	3082	57.48	33.49	1264	-7.45***
B) Entrepreneurship Measures:							
Market Product Innovation	0.303	0.459	5645	0.307	0.461	2117	-0.004
Firm Product Innovation	0.487	0.500	5645	0.463	0.499	2117	0.024*
Patent Applications	0.222	0.416	5645	0.228	0.420	2117	-0.006
Product Range	0.339	0.473	5644	0.389	0.488	2117	-0.050***
Process Innovation	0.447	0.497	5645	0.424	0.494	2117	0.023*
Organizational Innovation	0.507	0.500	3683	0.460	0.499	1305	0.047***

Notes: The descriptive statistics reported in this table refer to 2007. All balance-sheet indicators are recoded at the 1st and 99th percentiles because of outliers.