

**Firm age and the probability of product innovation.  
Do CEO tenure and product tenure matter?**

**Marco Cucculelli**

Department of Economics and Social Science  
Università Politecnica delle Marche  
Piazzale Martelli, 8 – 60100 Ancona – Italy - Ph. +39-071-2207162  
Email: m.cucculelli@univpm.it

Paper submitted to the special track:

**“Firm age and Performance”**

**Keywords:** product innovation, firm age, CEO tenure, CEO change,

# **Firm age and the probability of product innovation.**

## **Do CEO tenure and product tenure matter?**

### ***Aim of the paper***

Looking at the probability of introducing innovations according to age is likely to shed light on the dynamics of industries. Industries' technologies and products evolve according to the innovations introduced by entrants, surviving and incumbents.

Following an established line of empirical research, Huergo & Jaumandreu (2004) show that the probability of innovation changes along the firm life, and that young firms are prone to innovate, whereas the oldest ones propend to innovate less than entrants: a downward-sloping line connects the probability of innovation to firm age.

However, they also show that this pattern fits only to firms which have entered the market within 15-20 years (entrants), and for firms older than 35-40 years (mature incumbents). For a large number of firms aged 20 to 40, the probability of innovation (i.e. the introduction of new products) follows a different pattern, which does not reconcile with the expected negative association between age and innovation. Besides, the Authors do not associate this evidence with any specific variable affecting the probability of innovation over time, except for a generic selection effect which may interest exiting firms. Therefore, an explanation for the observed innovative behaviour of this group of firms is still missing.

This paper aims to fill this gap by presenting empirical evidence on how the CEO turnover and CEO tenure change the probability of innovation of incumbent firms over time.

We model the changing profile of the innovation – age relationship by controlling for three different types of “age”: firm age, product age and CEO tenure (“entrepreneurial” age). These three different – and overlapping – types of age have different impacts on the probability of innovation. In the resource-based theory approach, firm age affects the company ability to develop and accumulate resources and competences, thus providing the basis for the generation of new waves of products. Similarly, the age of the last product introduced, i.e. its “tenure”, helps to explain the probability of introduction of a new product conditional on the existing product portfolio characteristics (for example, its newness, its fit with the market or with available technology etc). Finally, the “tenure” of the CEO, i.e. the age of the company from an entrepreneurial point of view, summarizes the impact of the renewal ability of the new CEO on the innovative performance of the company.

### ***Background***

The traditional perspective on firm growth treats each firm as producing a single product and run by a single entrepreneur (Kirchoff, 1994; Goldberg, 2009). This approach, which can be traced back to dominant theories of the firm (the neoclassical

economic theory, the transaction cost theory, and the behavioural theory of the firm, Stam, 2007) – has a major drawback as it does not consider how different types of ages affect the age-innovation relationship. Additionally, micro-level empirical studies on firm performance fail to consider the multi-product nature of the growth process, as they typically postulate a perfect overlap between the product, the firm and the entrepreneur.<sup>1</sup>

Despite its extensive use in the theoretical and empirical literature, the single-product approach to firm growth has two major drawbacks. On the one hand, it neglects the dynamic structure of the process of product innovation. Over time, firms create additional innovations and focus on generating a continuous stream of products as the way to achieve growth: “the process of innovation and entrepreneurship are one and the same only when the process is carried out by a small firm early in its life” (Kirchoff, 1994; page 62). On the other hand, it fails to take into account the changing nature of the entrepreneurial orientation of the company over time, which acts as a moderator of the ability of the firm to introduce products. For example, most businesses in developed and emerging economies tend to be family-owned throughout their entire lifetime, often extending across generations. The family underpinning influences their ability to make decisions and the tendency to make important changes, thus affecting their entrepreneurial behaviour. Therefore, the CEO change and the CEO tenure are crucial variables to understand if and how a new product can be developed and introduced, thus making the (family) governance of the company a crucial variable to explain the probability of innovation.

## ***Methodology***

The paper uses the empirical approach developed by Huergo & Jaumandreu (2004). It links the probability of product introduction to age, and estimates (cross section/over time) the following probability model (Huergo & Jaumandreu (2004):

$$P(y_{it} = 1|x, \tau) = E(y_{it} = 1|x, \tau) = x_{it}\beta + \mathcal{G}(\tau_{it}) \quad (1)$$

where  $y$  is a 1/0 variable indicating product innovation,  $x$  is a vector of control variables,  $\tau_{it}$  is the age(s) of the firm/CEO tenure and  $\mathcal{G}$  is an unknown function linking probability to firm age. We use different types of age in the estimates, and control for product tenure to take into account the impact of product portfolio strategy on product innovation. Following Huergo & Jaumandreu (2004),  $\beta$  can be estimated using nonparametric estimates (using the kernel regression Nadaraya-Watson estimator) of conditional expectation functions of (1) and, then, used to recover the unknown  $\mathcal{G}$ .

---

<sup>1</sup> A notable exception to this pattern is the recent work by Bernard, Redding and Schott (2010) and Goldberg et al (2009), suggesting that product mix changes represent a potentially important channel through which firms grow by moving resources from less to more efficient uses within firms.

## **Data**

Our analysis exploits a unique dataset that collects information on a sample of 3,452 Italian manufacturing firms. The dataset has been first set up in 2005 and then updated regularly through triennial surveys. The dataset, which contains disaggregated information at the firm level, has been built by matching two complementary sources: i) a cross-sectional survey dataset, collected directly from the companies using questionnaire-based phone interviews, and ii) an accounting dataset that consists of the company accounts of interviewed firms from 2000 to 2012 (AIDA - Bureau van Dijk).<sup>2</sup>

Information covered by the survey allows knowing the i) firm's age, ii) the number of products in portfolio, the year in which each product has been introduced and its code of classification (Ateco2007), iii) the year in which CEO has changed and the nature of CEO (family or external). These information permits to describe the temporal profile of the innovation activity as related to firm age, product tenure and CEO tenure.

## **Preliminary results and conclusions**

The paper contributes to the literature on the dynamics of the probability of product innovation by age in incumbent firms. After confirming the existence of a general negative relationship between innovation and age, as in Huergo and Jauamndreu (2004), the paper shows that the upward trend in probability observed in firms aged 20 to 40 is explained by variables related to the CEO tenure and CEO change, when the age of the product is controlled for. In particular, the empirical findings provide evidence on the importance of governance variables, i.e. the change of the CEO, in explaining the innovative behaviour on incumbents, as dependent on the renewal ability of new-appointed CEOs.

## **References**

- Bernard A., Redding S., Schott, P. (2010). Multiple-Product Firms and Product Switching. *American Economic Review*, 100(1): 70–97.
- Cucculelli M., Ermini B, (2012) New product introduction and product tenure: What effects on firm growth?, *Research Policy*, 41, 808– 821

---

<sup>2</sup> The AIDA - Bureau van Dijk DATABASE is an authoritative and reliable source of information on Italian companies. Information is drawn from official data recorded at the Italian Registry of Companies and from financial statements filed at the Italian Chambers of Commerce. Companies furnish data on a compulsory basis. The information provided includes company profiles and summary financial statements (balance sheet, profit and loss accounts, and ratios). Each company's financial statement is updated annually. Additional information on the AIDA Bureau van Dijk database can be retrieved on <http://www.bvdinfo.com>.

Goldberg P.K., Khandelwal A., Pavcnik N., Topalova P. (2009). Multi-product firms and product turnover in the developing world: Evidence from India. NBER working paper no. 14127, *National Bureau of Economic Research*.

Huergo E., Jaumandreu J., (2004), How does probability of innovation change with firm age? *Small Business Economics*, 22, 193-207

Kirchoff B.A., (1994), *Entrepreneurship and Dynamic Capitalism: The Economics of Business Firm Formation and Growth*, Praeger Publishers, Westport CT, USA.

Stam E. (2007) Why butterflies don't leave: location behaviour of entrepreneurial firms. *Economic Geography*, 83 (1), 27-50.