Firm Survival & Quality Labels in the Food Industry

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Our results confirm existing findings on firm survival determinants literature. We also shed light on the effect of public intervention into that industry. More precisely, our focus on public quality labelling in the French cheese industry shows that quality label reduces the risk of exiting for firms and more particulary for small firms. In other words, public intervention in this industry is well designed to increase the competitiveness of small firms enabling the coexistence on the market of both small and large firrms.

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Preliminary version - Please do not quote

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1 Introduction

The quality of food products is becoming an important issue for public authorities. Consumers care about some quality attributes of products and are willing to pay for them. Consumers increasingly value the quality and the geographical characteristics of agricultural products (Marette (2005)). However some of these characteristics are unobservable to them. Then the quality of such products, called credence goods, cannot be recognized as such by consumers. In this situation, producers may not have the incentive to produce high quality products (Akerlof (1970)). Public intervention, though, may enhance social welfare by providing public labels that certifies the quality of the product (Auriol and Schilizzi (2003)). Some countries have adopted this kind of regulation for many years. For instance, the AOC (Appellation d'Origine Contrôlée) regulation in France and the DOC (Denominazione di Origine Controllata) in Italy have been respectively created in 1935 and in 1963. In line with the successive reforms of the Common Agricultural Policy that tends to eliminate price support and use non distortional measures that are decoupled from production in the European Union, the European Commission (EC) has also developed an EU quality policy. Its objective is to valorize and protect agricultural and food products through the diversification of agricultural production in order to 'achieve a better balance between supply and demand on the markets' (Commission (1996)). High quality reputation is expected to sustain competitiveness and profitability of the agricultural sector. Different quality labels have been introduced from 1992 (Regulation Regulation (EEC) No 2081/92) for geographical indications mainly: protected designations of origin (PDO) and protected geographical indications (PGI).

Our goal is to assess the ability of such public policy for quality to sustain the competitiveness of firms involved in such a policy and determine which firms have benefited from it. The PDO label certifies both a higher product quality and its geographical origin. Its quality is inherent to a limited geographical area characterized by geological, agronomic, climatic and historical factors. It also depends on specific manufacturing process and human factors requirements. The number of PDO certified products has continuously increased. PDO labels mainly applies for wine, cheese, fruit and vegetable, butter and oil and meat. From the theoretical literature on PGI, we know that this kind of public label is an efficient tool to provide quality (Moschini et al. (2008)). However, firm profitability depends on market structure (Hayes et al. (2004)), supply control conditions (Marette and Crespi (2003),Lence et al. (2007)) and the importance of cost generated by the PDO technical requirements (Bouamra-Mechemache and Chaaban, 2008). Moreover, it has been empirically shown in the case of the a specific cheese industry (brie) that firms that engage in PDO were mostly small size firms (Bouamra-Mechemache and Chaaban, 2009). We analyze how PDO-

like label can contribute to the success of firms that voluntary enter into such a quality certification scheme.

To accomplish this, we provide an empirical analysis of the French AOC label, which is older than its EU equivalent PDO. In 2008, the AOC labelled products included 48 dairy products and 39 other foodstuffs in addition to the 472 wine appellation. The performance of dairy firms is measured through their life duration on the market or "survival". It is one of the most widely used empirical measure of performance. Firm survival has been shown to be strongly related to other performance measures as profitability and growth and gives a better understanding on industrial strategies (cf. Dunne et al. (1988)). It is used to analyze how AOC quality label has contributed to the development of dairy firms and to the current structure of the dairy industry.

We use two data sets that cover the period 1990-2006 and provide information on the characteristics of firms and products in the dairy sector. The first one is the annual firm survey that cover firm-level data while the second one is an exhaustive survey of all dairy plant that provides information on individual production at a detailed level of product category. Such information which is quite difficult to obtain at the individual level enable us to distinguish among PDO and non PDO plants. We will use it for first time to assess the impact of AOC on firm performance. Because cheese represents all but one dairy products under PDO, we focus on PDO cheese and analyze the role of AOC on the dynamics of the French cheese sector.

The remainder of this article is organized as follows. The next section review the determinants of firm survival. Section 3 provides an overview of the data set and discusses its strengths and weaknesses for measuring firm survival rate. It examines entry and exit rates of cheese firms and present the methodology used to estimate survival rate. Section 4 provides the main estimation findings. The final section discusses conclusions and implications for future research.

2 Determinants of Firm Survival

The relation between performance and survival has been empirically shown. Measure of performance through total factor productivity affects survival (Bellone et al. (2006)). Lower performance is observed some years before their failure (Kiyota and Takizawa (2006)). Different factors may explain survival. Actually, various "stylized facts" have been drawn from the empirical literature on firm survival, entry and exit. These facts apply in many countries and for many industrial sectors (Geroski (1995) and Caves (1998)). Both industry and firm characteristics influences firms' duration length. Substantial rates of entry and exit is recurrently found in a number of countries. In this section, the main findings are summarized. We use these findings to formulates our hypotheses on the determinants of cheese

firm dynamics.

Table 1 summarizes the determinant of survival. The age of firms is an important feature of firm survival. New firms face high risk of failure during the first years of their existence (liability of newness). Their capacity to survive depends on their ability to gather market information and to modify their strategy to the post-entry environment. Firm mortality then declines over time. The oldest firms may suffer from erosion of technology and products (liability of obsolescence) over time so that their failure rate may be high (liability of aging). However, they may also benefit from strong trademarks that help them increase their longevity. Firm size is also a major determinant of survival (liability of smallness). This factor is relevant both for new and older firms but its impact is stronger on the dynamics of new firm. According to Aldrich and Auster (1986), different factors may explain this fact. First, small-sized firms may have more difficulty to raise capital. Second, tax law can be more detrimental compared to larger firms. Third, public regulation affects more smaller firms. In addition, large firms may be favored in the competition on the labor market. Considering that the failure rate is increasing with the size of irretrievable outlay needed to move from minimal or fringe entry to optimal-scale operation, the size of irretrievable outlays also acts of the survival of firms. It results that small firms may have a higher failure rate as they will find it more difficult to reach the minimum efficiency size at which they will be able to operate. Another explanation of the size impact on survival is related to the costs of labor and capital. If they are high, this could be detrimental to new/small firms that will have more difficulty to develop their activities and favor older/larger firms. In addition to age and size, the structure of the firm may also affect firms' dynamic. As shown by Disney et al. (2003), when an establishment is part of a group, it increases its survival rate relative to a single establishment. This result supports the idea that establishments that are part of a group can learn from other establishments of the group and get better market information compared to single establishments.

The dynamics of firms also depend on the characteristics of the industry under consideration. Comparison between different industries in different countries reveals common industry determinants for survival patterns. Both entry and concentration depend on the sunkness of incumbents' commitment and more generally on trade barriers, which has an incidence on survival length. Trade barriers in an industry can arise from high minimum efficiency scale (MES), capital intensity, advanced technology or product differentiation and innovation. On the one hand, a high MES implies relative large amount of resources that are needed to attain the MES. If firms cannot achieve this level of resources, they may not be able to survive on the market. On the other hand, firms that have entered the market will be less sensitive to exit when they have incurred large sunked resources. A high level of innovative activity in an industry may make entry more risky and

Table 1: Determinants of firm survival

Determinant	Impact on survival
Firm characteristics	
Liability of newness	-
Liability of aging	+/-
Liability of obsolescence	-
Liability of smallness	-
Capital and labor cost	-/+
Establishment part of a group	+
Productivity	+
Industry characteristics	
Barrier to entry	-(+)
Innovativeness	-(+)
Early stage in life cycle	-(+)
Agglomeration and technological spillover	+

increase failure risk (Jensen et al. (2008)). However the inverse could be also true if there is a a self selection process of firms before entry decision. Moreover, it may exist some knowledge spillovers for firms that are close to innovative firms. This agglomeration or regional advantages may compensate negative effects of higher costs and competition from other firms located in the the same area. Falck (2007) and Fritsch et al. (2006) empirically show the importance of these regional effect on survival. The distribution of innovations between new and incumbent firms changes over the industry life cycle. This changes affects the probability of survival for firms (Agarwal and Gort (2002)). Lower survival rate occurs at the early phase of life cycle when innovation is high and entry risky while higher survival occurs in the later phase when the market is mature and competitiveness increased as innovation and technical change rate are limited. When the phase of obsolescence of initial endowments is reached, the failure rate increases again.

Our analysis focus on a specific industry, the French cheese industry. We will analyze the impact on firm dynamics of the most relevant factors identified above, age, size, and single establishment. In this specific industry, we will study the impact of some form of innovation through public labelling (AOC. When adopted by firms, AOC may incur higher costs linked to quality requirement and certification costs on the one hand but they can benefit from the higher quality signaled to consumers and increase their competitiveness on the other hand. We asses the impact on AOC label on survival on the relative importance of these factors.

3 Empirical Methodology

We use firm and plant surveys covering the period 1990-2006 provided by the French Administrative Direction of Statistics (INSEE). The first main set information reports economic and administrative information at the firm level (EAE) while the second set is reporting production, activities and more detailed information on the industrial process at the plant level for dairy firms (EAL).[1] The latter set is available only for firms with more than 20 employees, while the first set is exhaustive at the France level. In Table 2, we define several variables of prime interest for the analysis performed here.

Table 2: Variable description

Variable name	**Unit**	**Description**
Year	$[1990 - 2006]$	current year
Survival	#	survival of the firm (in years)
Employee	#	Nb of employe in the firm
Size	dummy	$= 1$ if Employee ≥ 20, 0 otherwise
Age	dummy	$= 1$ if firm created before 1984
Type	dummy	$= 1$ if single plant, 0 if multiple
AOC	dummy	$= 1$ if Firm producing AOC Cheese

The survival analysis is performed on the 1048 firms observed during the period 1990-2006, for which we were able to identify if the firm was producing cheese with AOC label or not. Table 3 reports the main statistics on the variable created and useful for the survival analyses presented in Figures 1 and 2.

Table 3: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Survival	9.852	5.343	1	17	1048
Size	0.341	0.474	0	1	1048
Age	0.49	0.5	0	1	1048
Type	0.685	0.465	0	1	1048
AOC	0.509	0.5	0	1	1048

We are able to compute the time spells corresponding to the survival of the surveyed firms using the previously described data sets. By construction these time spells are evaluated as intervals measured in years over the period 1990-2006. Indeed, our data indicate that a firm was present in the sample

[1] EAE stands for *Enquête Annuelle d'Entreprise* while EAL is the *Enquête Annuelle Laitière*, both provided by INSEE (Institut National de la Statistique et des Études Économiques.)

during a given year. But, when a firm disappeared in the following year, the exact time (day or week) the exit has occurred is not known. In this case the transition times are said to be grouped and discrete-time hazard models are used to deal with such data. Thus the minimum value of the time spell is one year, and its maximum value is 17.

By the definition of the period covered by the surveys (1990-2006), three different time spells can be observed:

1. complete time spell when a firm enters the sample before 1990, and exits before 2006,
2. right-censored time spell when a firm enters after 1990, and is still alive in 2006, and
3. left-truncated time spell when a firm entered before 1990, and exits before 2006 or is still alive in 2006.

We can identify this latter type of time spell because the surveys indicate if a firm was active or not before 1990. But, unfortunately, for most of the firms that were active before this year, we do not know when they have been created.

The starting point of modelling the survival of firms using the previously defined time spells, is then to define the discrete-time hazard function as the probability of exit at discrete time t_j, $j = 0, 1, 2, \ldots, k$, given survival at time t_j, i.e.

$$\lambda_j = Pr\left[T = t_j | T \geq t_j\right] \tag{1}$$

The discrete-time survivor function, i.e. the probability that duration before exit equals or exceeds t, can then be obtained recursively from the hazard function (1) as

$$\begin{aligned} S(t) &= Pr\left[T \geq t\right] \\ &= \prod_{j|t_j \leq t} Pr\left[T > t_j | T > t_{j-1}\right] \\ &= \prod_{j|t_j \leq t} (1 - \lambda_j) \end{aligned} \tag{2}$$

Given the definition of the discrete-time hazard function in (1), a natural estimator of this function is

$$\widehat{\lambda}_j = \frac{d_j}{n_j} \tag{3}$$

where d_j is the number of non censored time spells ending at time t_j, and n_j is the number of firms at risk at time t_j. More precisely, when time spells can only be right censored, the number of firms at risk at time t_j equals the number of firms that were alive at time t_{j-1} minus the number of firms that exit at this time, their time spells being censored or not. Left truncation refers to firms which do not come under observation until they are at risk. By the time you begin observation of such firms, they have already survived for some time, and you observe them only because they did not exit during that time. Thus, when such firms become at risk, n_j is simply increased by adding their number to reflect this fact.

The Kaplan-Meier estimator or product limit estimator of the survivor function defined in 2 is then defined as

$$\begin{aligned} \widehat{S}(t) &= \prod_{j|t_j \leq t} \left(1 - \widehat{\lambda}_j\right) \\ &= \prod_{j|t_j \leq t} \frac{n_j - d_j}{n_j} \end{aligned} \tag{4}$$

This a decreasing step function with jump at each discrete time t_j. The Kaplan and Meier (1958) estimator can be shown to be the nonparametric maximum likelihood estimator of the survivor function.

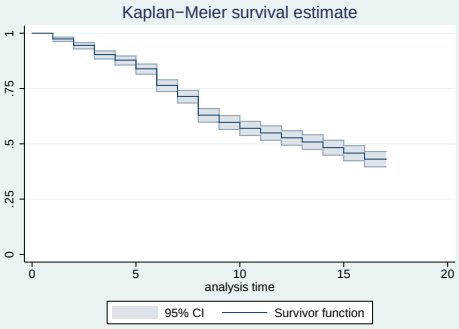
4 Results

In Figure 1, we report different estimated survivor curves and their respective 95% confidence intervals. These estimated survivor allows to investigate the influence of three of the variables identified in the literature as having an impact on firm survival (see section). For instance, Figure 1b shows the estimated survivor curves of firms whose size, measured as the total number of employees, is bigger than 20 or smaller, respectively. It is notable that the survivor curve of larger firms is less steep compared to the survivor curve of small firms. This means that larger firms are faced with a lower probability of exit especially at later ages where confidence intervals around the estimated curves do not cross. We obtain more clear-cut results when considering the impact of the type of the firm (single or multiple plants, see Figure 1c) and age (Figure 1d). Single firms (resp. "older" firms) are faced with a larger probability to exit when compared to firms with multiple plants (resp. "younger"). The two survivor curves diverge rapidly and stay distinct whatever the time spell when considering the type of firm effect (Figure 1c). We observe the same pattern for the age effect for the small values of the time spell, but the two curves exhibit the same shape for large values of the time spell (Figure 1d).

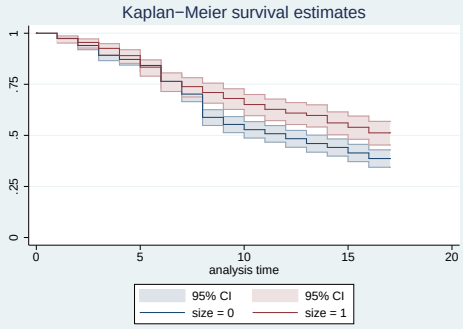
Statistical tests can be used to substantiate the validity of the previ-

Figure 1: Kaplan-Meier survival analysis

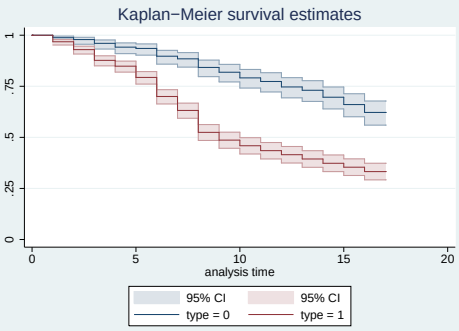
(a) all sample



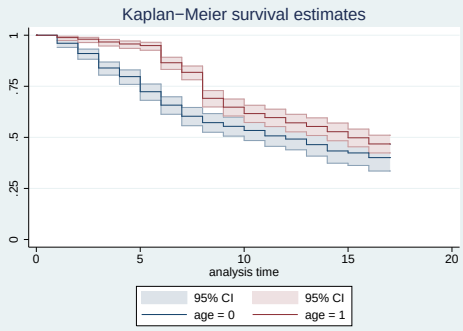
(b) by size (employees)



(c) by type (single *vs* multiple plants)



(d) by age

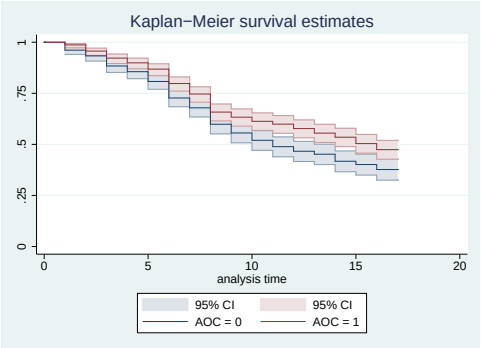


ously observed differences of the survivor curves. We use the family of tests proposed by Harrington and Fleming (1982). These tests are designed to test the null hypothesis that two survivor curves that have been estimated by the Kaplan-Meier estimator are equal to each other. The particular version we apply is the log-rank test which is more sensitive to later differences between survivor curves. The test outcomes (values of the statistics and their p-values) are given in Table 4. They show that the aforementioned differences between the survivor curves are not only visually apparent but also statistically significant. Thus size, the fact to have multiple plants, and aging are important factors that lower the risk of exit at any time. These results are consistent with the main findings of the literature on firm survival discussed in section .

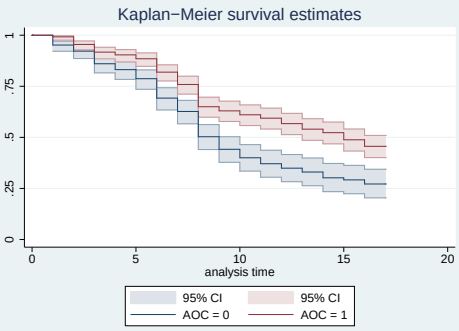
One feature of the French cheese industry is the existence of public labelling policy through AOC. We use the same methodology to asses the impact of AOC on firms survival. Figure 2a reports the estimated survivor curves for two cohorts of firms, producing or not AOC labelled cheese. The two curves display slightly diverging patterns, AOC firms having a lower

Figure 2: AOC effect and firm survival

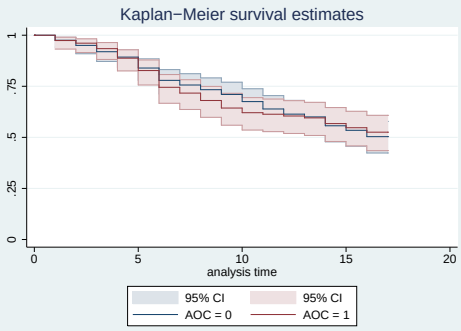
(a) all firms



(b) small firms



(c) large firms



probability of exit than non AOC firms. The log-rank test (Table 4) confirms that this difference is significant. A closer investigation of this effect is provided in Figures 2c and 2b where we distinguish firms according to their size.[2] We find a large and statistically significant effect of AOC labelling when considering small firms while this effect does not show up for large firms (see Table 4).

To sum up, on one side our results confirm existing findings on firm survival determinants. On the other side, we contribute to this literature and shed light on the effect of public intervention into an industry. More precisely, we focus on public quality labelling in the French cheese industry and show that quality label reduces the risk of exiting for firms and more particulary for small firms. In other words, public intervention in this industry is well designed to increase the competitiveness of small firms enabling the coexistence on the market of both small and large firms.

[2]We cross the AOC factor with other factors (age, type), without finding any significant effect.

Table 4: Log-rank tests

Variable	**log-rank statistics**	**p-value**
Size	11.28	0.0008
Type	85.31	0.0000
Age	20.70	0.0000
AOC	10.42	0.0012
AOC- small firms	26.05	0.0000
AOC- large firms	0.00	0.9869

5 Concluding remarks

(T.B.C.)

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