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## Article

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# Vine planting rights, farm size and economic performance: Do economies of scale matter in the French viticulture sector? ☆

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## Abstract

This paper assesses the existence of both greater profitability for large-scale farms and economies of scale in the French viticulture sector, thereby confirming or invalidating the argument put forward by the European Commission to justify the abolition of vine planting rights. According to this argument (1) economic efficiency increases with the extension of the vine area in vineyards, and (2) vine planting rights prevent the expansion of farms.

This article discusses the issue of economies of scale in agriculture and focuses on specific matters related to viticulture. The key issue of our demonstration lies in the impossibility of defining economies of scale by comparing the profits of farms producing different types of product at different prices. By using an assessment of these variables through FADN, it proposes and justifies the interest of using a measurement of output which is the net value added per unit of labor.

The report prepared on behalf of the European Parliament is criticized as it demonstrates a positive correlation between size and efficiency, without taking account of the broad farm gate price dispersion for wine. This article demonstrates that in the case of France, over the period 2005–2007, farm size has little impact on performance. The significant differences observed are the result of differences in the selling price of wine.

In summary, the main argument put forward by the European Commission to justify canceling vine planting rights is not adapted to the case of France because it considers wine as a single product sold at a single price.

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*Keywords:* Planting rights; Wine growing farm; Profitability; Economies of scale; Price

## 1. Introduction

The European Commission is pursuing the goal of reforming the Common Agricultural Policy through the adaptation of agriculture and farmers to market signs: the regulations are changing and interventions are gradually being redirected

towards new efficiency goals on the one hand and sustainability on the other (European Commission, 2008). Efforts aimed at increasing efficiency are accompanied by the hope that an improvement in the economic performances of producers will be based on increased farm size as this provides an opportunity to exploit economies of scale. According to some authors, such economies of scale can be achieved in agriculture just as in other industries (Nooteboom, 2006), even if some researchers have long contested their existence (Boussard, 1973).

The last CMO for wine, introduced in 2008, established new legislation ensuring the definitive suppression of vine planting rights. The main justification for this decision was based on the negative impact of the previous legislation on the production

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costs and competitiveness of European viticulture compared to New World wine producers (Montaigne and Coelho, 2006): according to the European Commissioner, M. Dacian Ciolos, “... this analysis demonstrated that vine planting rights lead to an increase in the cost of production and are a barrier to the rationalization of farm holdings, thus decreasing competitiveness”.<sup>1</sup> In the months following this reform, many heated debates were held (Vautrin, 2010; Montaigne et al., 2012) concerning the existence of economies of scale in the viticulture sector and the commission wrote a draft containing new rules for managing production potential through vine planting rights. The current status of the European legislation concerning permission to plant vines is going to change, transforming the planting right regime in a regime based on authorizations (reg. 1308/2013, chapter III).

In the viticulture sector, increased farm size may be the result of two mechanisms: first, the promotion of economic concentration, when the total volume of production is unchangeable, through the elimination of small-scale producers. Such a phenomenon has been observed in many other agricultural segments (Kroll, 1987). While this mechanism worked well in viticulture, some researchers considered it insufficient. The suppression of vine planting rights will have no impact on this speed of change, at least in those zones where farm holdings are highly specialized in viticulture, because the mechanism depends on the life-cycle of farms and of the individual choices between sale of the land and grubbing-up of vines.

Second, the result may be achieved through the growth of certain farm holdings by planting new vines resulting in an increase in the total surface area of the vineyard. We can therefore raise two questions: first, what would be the consequences of increased production on the market in terms of prices and farmers' revenues? while this is an important question, it exceeds the scope of this paper. Second, would large-scale farms, either newly created or recently expanded, be more efficient than the smaller ones?

Our article focuses on the final issue. We intend to determine the existence and extent of economies of scale in the viticulture segment as well as the direct link between the size of farm holdings and their profitability. At present, as a study at European level seems unfeasible due to access constraints to European agricultural data, we will focus here only on the case of France.

In the first section we explain how the paper contributes to the existing literature research about vine planting rights in EU.

In the second section, we will address measurement issues relating to economies of scale in agriculture, and more particularly viticulture. Here, we will introduce an index to identify their existence and extent.

We will then study the variations in this index, illustrating the need to take account of the significant differences in the price of wine.

In the fourth section, we will demonstrate that for each class of prices in the French viticulture sector, variations in profitability as a function of vine surface area do not exist or are simply erratic. Whatever the case, these variations are too weak to increase the capacity of large-scale farm holdings to achieve acceptable revenues and small-scale farm holdings do not reach such revenues.

In the final section of this article, in order to extend our discussion beyond the French case, we will demonstrate that the legislation relating to vine planting rights in the European Union did not prevent the increase in the average size of farm holdings over the past 17 years.

## 2. Literature research about vine planting rights

Economic research literature on planting rights is limited. If we consider it extensively, we find parliamentary reports summarizing expert opinions, taking stock of the legal texts and providing some statistics on land which is not planted in vines in the appellation areas (Vautrin, 2010; Suguenot and Got, 2011). These reports, although expressing clear and fully detailed diagnostic, give no scientific demonstration, even if the stakes are clearly laid. In particular, they argue that (1) significant non-planted areas are available at European level (1.2 million hectares of 1.67 in delimited PDO areas); (2) the planting rights are neither an obstacle to the development of the wine industry, nor a barrier to entry for investors; (3) they provide regulation in the economy without budgetary cost. They also expressed fears of the professionals: (1) an increase in production, (2) relocation of vineyards in particular for the production of wines without geographical indication, (3) the usurpation and abuse of the protected denomination of origin (PDO) reputation by plantations nearby these areas, (4) the industrialization of wine-making and a concomitant decrease in quality. We could add the work of political science focusing on political action and lobbying to challenge the decision of the signing of the new CMO wine in 2008 (Blancaneux, 2014).

The pioneering work of Luigi Galletto, analyzed the planting rights market in a PDO region from two surveys (2004 and 2008). The author has characterized the size of transfers, the role of brokers, delays, zoning restrictions, the size and age of the growers, the quality of wine (PDO), the share of intra and extra-regional transfers, the impact of limiting the transfer price of planting rights, their high variability and the main factors of increasing or decreasing of these prices (Galletto, 2010).

The applied study of Roberta Sardone's team is the most ambitious and most important. In its theoretical part, the study uses the Nerlove's model (Sardone, 2012). This model tests the response, in terms of area planted with vines by producers, to the price indicator to verify the ability of this mechanism to achieve market equilibrium. The introduction highlights the difficulties encountered in seeking to support relevance of these reactions mainly due to the existence of agricultural policies, market uncertainty, low elasticities of supply and demand, price volatility and income. The price indicator is the average export price. This model is applied at a high level of

<sup>1</sup>E-9290/10DE: answer provided by Mr. Cioloş on behalf of the commission (22.12.2010).

aggregation and the simplicity of data are very poorly suited to a highly differentiated qualitatively production, therefore in price.

In its applied part, the study frequently uses the concept of economies of scale but in two different meanings: sometime, they apply the notion to large companies and the ‘downstream’ industry. In that case the definition is related to economies of scope and economies of organization: large size, ability to provide services in different conditions, marketing, international market access, etc. On the other hand, this concept is more typically applied to the size of the vineyards. These double meanings can induce misunderstanding in analyzing the phenomenon.

Deconinck and Swinnen (2014), propose a theoretical model assessing the effect of planting rights on areas planted with vine based on market supply and price of land. This is a classic application of surplus accounts (Welfare effects) to evaluate the economic policy consequences on who are the beneficiaries and the losers (Bourdon, 1982).

“Our theoretical model integrates the markets for wine, land and planting rights. We identify the efficiency and distributional consequences of planting rights and we show how differences between Member States in implementation of planting rights, in particular concerning trade and enforcement of planting rights and the functioning of the reserve system, affect efficiency and welfare.” (Deconinck and Swinnen, 2014, p. 18).

The advantage of this model is to be based on the microeconomics of production. But like any model of this type, we can discuss the assumptions, the assessment of key variables and the lack of application demonstrating its relevance. The important point is price differentiation. The authors have difficulties to deal with differentiated products and different levels of price, by offering as much land markets (thus models) as there are price levels and quality of wines.

“That is, we assume that producers within one region are producing a homogenous product. In reality, of course, the quality and price of wines can vary a lot between different producers. This could be incorporated in the model by assuming that ‘high quality’ producers and ‘low quality’ producers form two separate regions (with or without trade in planting rights between regions, as analyzed later).” (Deconinck and Swinnen, 2014, p. 6).

In that case it should be difficult to aggregate the results for the whole region and every price segment.

### 3. The size of farm holdings: an economic issue

“Economies of scale may be defined initially as those that result when the increased size of a single operating unit producing or distributing a single product reduces the unit cost of production or distribution” (Chandler and Hikino, 1994).<sup>2</sup>

Economies of scale result from the existence of fixed costs or, in other words, the indivisibility of certain production

factors, as well as from learning economies (improved skills) and economies relating to the cost of inputs in relation to changing production techniques (Vettori, 2003).

#### 3.1. Economies of scale in agriculture.

In agriculture, economies of scale are most often linked with mechanization which allows the use of more powerful and high-performance machines. However, the existence of economies of scale in agriculture has been always at the heart of agricultural studies. Some authors have contested their very existence or the extent to which they can be achieved in agriculture (Boussard, 1973, 1987; Marshall et al., 1997; Gleyses, 2007; and initially Marshall, 1890) “*In agriculture and other trades in which a man gains no very great new economies by increasing the scale of his production, it often happens that a business remains of about the same size for many years, if not for many generations*”. (Marshall, 1890, p. 238). Others, without systematically questioning their existence, note their limited importance (Chavas, 2001).

With regard to the debate on the existence and extent of economies of scale, two recent studies in the dairy industry provide ambiguous conclusions: the first (Institut de l’Elevage, 2011) shows economies of scale ranging from €10 to 19 per thousand liters of milk, depending on the type of production system, for an estimated average cost of approximately €500.

If we exclude the cost of labor, these economies of scale exist for a volume of between 200 and 700 thousand liters of milk produced every year. Above this level of production, economies of scale do not exist. The main result shows that individual costs vary considerably from one farm to another, independent of the size of the farm, a fact which can lead to very significant variations in the revenues of family labor.

A second study in the same industry in Canada (Perrier, 2011) reaches similar conclusions: small economies of scale are achieved for between 45 and 120 cows while economies of scale stabilize for larger farms. The author finds a lack of economies of scale if labor constraints are taken into account together with scattered profits: small farm holdings may be considerably more profitable than larger farms.

In the agricultural sector, the question of economies of scale is currently being reviewed, namely by taking account of environmental considerations and by establishing a link between economies of scale and economies of scope and learning. The French study of the dairy industry therefore compares the profits of specialized barns with those of farm holdings engaged on polyculture and cow breeding and suggests that self-supply (consumption of its own grain, pastureland and fodder) and the valorization of by-products (manure) balances any economies of scale achieved in specialized farms.

These studies therefore draw our attention to the specificity of the results according to the nature of the products, which can either be associated with the land (grass, grain) or removed from the land (milk). Furthermore, in all cases, these products or crops are essentially *commodities* with a single market price. The studies also highlight the sensitivity of the outcomes to the estimated remuneration of labor on farms. Thus, the decision

<sup>2</sup>Here highlighted by the authors.

whether or not to consider the hourly remuneration of labor can considerably alter the outcomes.

The only study we found on viticulture and return to scale, thanks to the referees, was realized by [Townsend et al. \(1998\)](#). The study was performed using farm management data from wine farms of the Western Cape. All farmers are members of co-operative wine cellars implying very few, if any, scale economies in processing and marketing. Their method is based on data envelopment analysis. “The results suggest that approximately 50% of wine grape producers in the Western Cape experience constant return to scale (CRS) with approximately 10% and 40% having increasing and decreasing return to scale, respectively.” p. 178. Unfortunately they provide no information on different levels of wine prices.

[Vita and D'Amico \(2013\)](#) compare the economic results of micro and small size quality wine grape farms in Sicily. Average farm profitability expressed as farm net value for each homogeneous area was calculated taking into account production costs and total output.

The study reveals how designation of origin does not always ensure adequate profitability for micro and small vine growers. But in that study, wine-growers sale unprocessed grapes that do not provide any value-added products and local producers do not gain additional remuneration for the intangible components of their PDO grapes. The study does not explore to what extent these results are caused by increasing costs or by an inefficient market structure. The level of prices is not analyzed.

In short our contribution focuses on the assessment of the question of economies of scale in the French viticulture taking into account the wide diversity of the wine prices at the farm level.

### 3.2. Economies of scale in viticulture

It would appear important to examine wine production as previous studies show that the desire for economies of scale seems to be the main justification for changes to the legislation concerning the suppression of vine planting rights. Likewise, this question was also addressed in the goals of the study commissioned by the European Parliament: “The expected advantages of liberalization are related to cost and supply flexibility. It is expected that a cost reduction may be achieved by eliminating the direct and indirect costs of requesting and acquiring planting rights and possibly the economies of scale linked to more suitable sizes of vineyards” ([Sardone, 2012, p. 26](#)).

Economies of scale are defined as the decrease in the average cost of production of ONE product when the quantities (or volumes) of that product increase.

Like most of the European viticulture segments, French viticulture is characterized by a supply of wines demonstrating varying levels of quality, with very different reputations and related to a wide range of Protected Designation of Origin (PDO) or Protected Geographical Indication (PGI) labels. Differences among wines go beyond the distinction between ‘Quality wine’ and ‘Wine other than quality’. This distinction classifies farms according to the type of farming in the surveys and namely the Farm Accountancy Data Network (FADN), a

distinction adopted in the report commissioned by the European Parliament.<sup>3</sup> Furthermore, these wines are generally produced in diverse geographical areas defined by law, often with heterogeneous yield constraints. Finally, wines are sold at very different prices. The price level of wine can range from 1 to 20 and more.

It is therefore clear that the ‘wine’ category does not satisfy the condition of uniqueness of the product necessary to the pursuit of potential economies of scale; the same applies to the two categories of ‘Quality wines’ and ‘Wine other than quality’. This situation is quite specific to viticulture because most agricultural crops are commodities with a standard quality whose price is unique and defined by the market (the exceptions, such as the case of milk used in the production of PDO cheese, are relatively rare and concern low volumes or quantities).

Concerning our problem statement, and considering the difficulty encountered in applying this rationale to each of the 350 French designations of origin, we will adopt a differentiation for the farm holdings according to the average selling price of the wine as a proxy for homogeneous categories of wine.

Our insistence on the heterogeneity of the price of wine is not intended to highlight the existence of differences in revenues based on the price (which would be a quite trivial matter). It endeavors to show the need to take these differences into account when assessing economies of scale and, more generally, the size effect on profitability. From a methodological point of view, it seems impossible to compare the production costs of two farms producing different wines, i.e. different products.<sup>4</sup> The concept of economies of scale can be applied to a single product or to similar products from both farms.

Accordingly, if this precaution were not taken, an evaluation of the size effect on costs or on profitability would not make sense. We will now define the relationship between economies of scale and profitability.

## 4. Materials and methods

The main difficulty in measuring costs in agriculture (the same applies to viticulture) lies in the estimation and measurement of labor costs. Indeed, for the vast majority of farm holdings, the work of the leading farmer (or owner) and possibly of other members of his family accounts for the largest proportion, and often all, of the labor used in

<sup>3</sup>Typical farm “quality wine” is a farm whose more than 2/3 of the total Standard Gross Margin comes from grape vines producing appellation wines (former categories AOC and VDQS in France and VQPRD in European Union). Typical farm “wine other than quality” is a wine estate whose more than 2/3 of the total SGM comes from vineyards as a whole (including table grapes) without the SGM appellation vineyards reaches alone this threshold of 2/3. These categories changed in the new regulation as PDO. The terms and refer to a no longer existing classification as the category v.q.p.r.d. was not confirmed by the reg. 498/2008 and later by the current reg. 1308/2013.

<sup>4</sup>There is no case here of economies of scope as we rank each vineyard according to the average price and quantity of an undifferentiated product.

production. Currently, this family labor is not formally paid, at least not taking into account a relatively fixed rate from one farm holding to another: it is the profit of the farm holding that is used as a means to compensate family labor.

Consequently, one cannot speak of measuring the production costs related to labor involvement. We do not, therefore, include labor in the appraisal of production costs. However, in order not to ignore the importance of this production factor, we sought to establish an economic indicator of differences between farm holdings that takes account of labor productivity but does not involve cost. The ‘net value added per worker’ (i.e.  $nVA$  – average work unit) calculated on the basis of the FADN data satisfies this condition. However, we must also demonstrate that the variations in this indicator are good proof of the existence or absence of economies of scale and their potential magnitude.

Let us consider the following variables:

- nVA: net value added.
- P: wine selling price.
- Q: wine production (volume).
- S: surface area of vineyard.
- Y: yield (wine volume per vineyard unit).
- L: labor quantity.
- C: production costs (without labor) = intermediate consumption + depreciation.

By definition, for a farm producing wine and only one type of wine:

$$nVA = (P * Q) - C$$

$$\text{therefore : } nVA/Q = (P * Q)/Q - C/Q$$

$$\text{so : } (nVA/L) * (L/Q) = P - C/Q$$

$$\text{therefore : } nVA/L = [P - (C/Q)] * Q/L$$

$$\text{so : } nVA/L = [P - (C/Q)] * (S/L) * Y \quad (1)$$

In other words, the net value added per worker ( $nVA/L$ ) is equal to the difference between the selling price and the cost (excluding labor) per unit of production ( $C/Q$ ), multiplied by the yield and the physical productivity of labor ( $S/L$ , i.e. the surface area per worker).

Let us now focus on the variations of net value added per worker in light of changes to the unit cost and physical labor productivity. Together, these elements form the basis for assessing economies of scale if their significance decreases when the size (of the vineyard) increases.

We have already stated the need to make assumptions for a given class of selling prices; therefore  $P$  is a constant that does not depend on the surface area. The same rationale applies to yields since within the same designation of origin, yields (like prices) are equal or similar.<sup>5</sup>

From the point of view of the existence of economies of scale, 4 cases – and only 4 – can arise:

**H1.** unit costs (excluding labor) decrease and physical labor productivity remains unchanged. According to Eq. (1) above, it is clear that our economic indicator (net value added per worker) increases.

**H2.** unit costs remain unchanged and physical productivity of labor increases: our economic indicator increases.

**H3.** unit costs decrease and physical productivity of labor increases: our economic indicator increases.

**H4.** unit costs increase and physical productivity of labor also increases (We can relate to this situation a case where the unit costs decrease while physical labor productivity also decreases although it is a very unlikely event). In this case, reasoning according to production costs alone cannot lead to a decision being taken because the unit price of family labor is unknown by nature and we cannot, therefore, find a balance for these opposite variations. In other words, nothing allows us in this situation to say whether or not economies of scale exist. However, reviewing our indicator (net value added per worker) can help us to make a decision. For example, if the indicator increases at the same time as the size of the vineyard, this can favor the development of economies of scale.

In short, at a given price (and performance) level, the net value added per unit of labor changes to the same extent as the average unit cost, although in opposite directions thus making it a very good indicator of whether or not economies of scale exist. It should also be noted that the study for the European Parliament (Sardone, 2012) adopted exactly the same indicator.

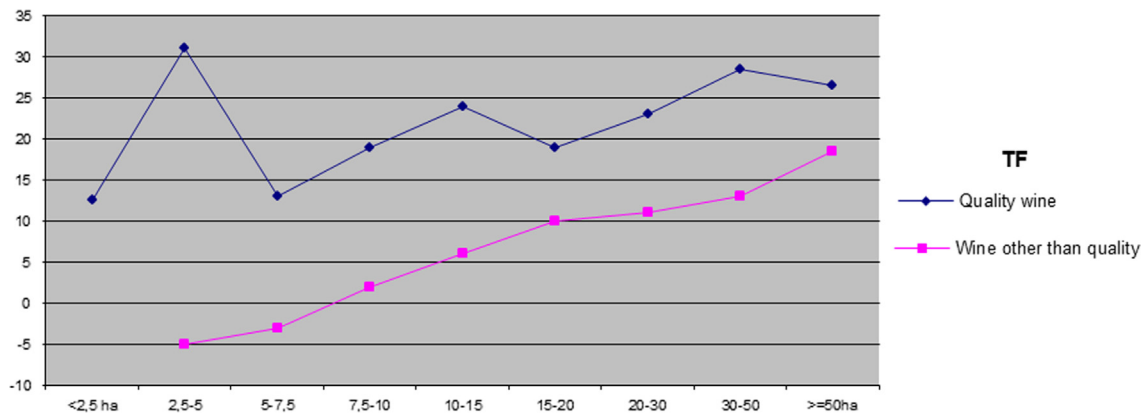
Finally, and most importantly, this indicator (net value added per worker) allows us to measure the effectiveness of economies of scale (when they exist) in substantially improving incomes in large farm holdings, for example by helping them to meet or exceed the minimum socially accepted income. Indeed, the net value added per worker is primarily used to pay family labor (and possibly the salaries of non-family workers). Other uses (payment of interests on loans and land leases per worker) are much smaller and we have no reason to believe they vary a priori with the size of the vineyard since they primarily depend on the financial situation of the farm owner and not on the business operations of the farm holding.

This indicator therefore shows whether it is possible to improve unit labor remuneration in viticulture by increasing farm size. These possible improvements in remuneration result from economies of scale, i.e. a lower unit cost excluding labor and / or improved physical labor productivity, all for a given (non-variable) level of wine selling prices.

Differences in net value added per worker between large and small farms are a good indicator of the adequacy of the EU policy aimed at fostering the growth of farms by eliminating vine planting rights with regard to its goal of improving farm performances and thus obviating the policy of supporting viticulture.

We can now discuss the economic effects of abolishing planting rights.

<sup>5</sup>In French viticulture, there is a notable exception to this rule (for the production of Cognac) which we will address later on.



Graph 1. Farm net value added per average work unit per category of vineyard (k€/awu) - Aquitaine and Languedoc-Roussillon (period 2006–2009). Source: Sardone et al., 2012 – p.77, figure 3.9 (Data source: EU-FADN – DG AGRI)

## 5. Limitations of studies neglecting price heterogeneity

In 2011, a report prepared on behalf of the European Parliament (Sardone, 2012) addressed wine-growing issues. This report focused on the debate concerning the abolition of vine planting rights.

### 5.1. Merging data from two Structurally different regions

One argument developed in this study established a relationship between the profitability (as measured through the Net Value Added per unit of labor) of the farm holdings and the different sizes of the farms<sup>6</sup>. The data considered was provided by FADN for the period 2006–2009. With regard to France, only two regions were considered: Aquitaine and Languedoc-Roussillon (Graph 1). The study distinguishes between farms belonging to the different ‘types of farming’ (TF): ‘grape growing with designation of origin’ and ‘other grape growing’.

This study highlights a strong trend towards increased profitability when the surface area of the vineyard increases. This is true for the case of the ‘other grape growing’ TF and for the ‘grape growing with designation of origin’ TF, despite a slightly reduced significance for the latter.

### 5.2. Some comments about this study explaining the distortion

It should be noted that considering two regions together may influence the results. This is not of consequence for the ‘grape growing other than quality’ TF, only available in Languedoc-Roussillon, but for the ‘grape growing with designation of

origin’ TF where 1/3 of the areas are located in Languedoc-Roussillon and 2/3 are situated in Aquitaine. These two regions are characterized by designations of different origin and therefore by different price levels. This explains why profitability in Languedoc is clearly lower than in Aquitaine. This situation, combined with the presence of larger farms in Languedoc, may affect the interpretations of the observations.

One should also notice the distinction between the influences of the two TFs (‘Quality wine’ and ‘Wine other than quality’) in distinguishing wine selling price levels. However, this distinction is not sufficient. In Languedoc-Roussillon, in the case of the ‘wines with designation of origin’ TF, the coefficient of variation (among the farms) of the selling price is approximately 0.60, which is relatively significant. Moreover, several direct relationships exist between farm size and selling price. For example, for a surface area of vines of more than 50 ha, the average price is around €75/hl in contrast to a price of less than €40/hl for farm sizes between 10 and 15 ha. Establishing a link solely between profitability and the size of the vineyards is relatively restrictive, even if our reasoning goes from one type of farming (TF) to another.

Another interesting point highlighted in this study is that, considering the two regions globally or individually for whatever TF considered, independent of the size category retained, profitability never reaches a high level; in all situations the values are below the average profitability of French agricultural farms (i.e. approximately €31,000 per unit of labor, period 2005–2007).

Accordingly, if the study quoted above were to take into account other winegrowing regions in France and include differences in the wine selling prices, the results and conclusions would be considerably different.

The selling price of the wine varies considerably from one farm to another. These variations are mainly related to the different designations of origin (Delord, 2011). Even limiting the boundaries of our analysis to the regional level, the differences are significant (see Table 1).

Let us now identify some possible variations in profitability for homogeneous groups of wine according to the size of farms in the French viticulture segment.

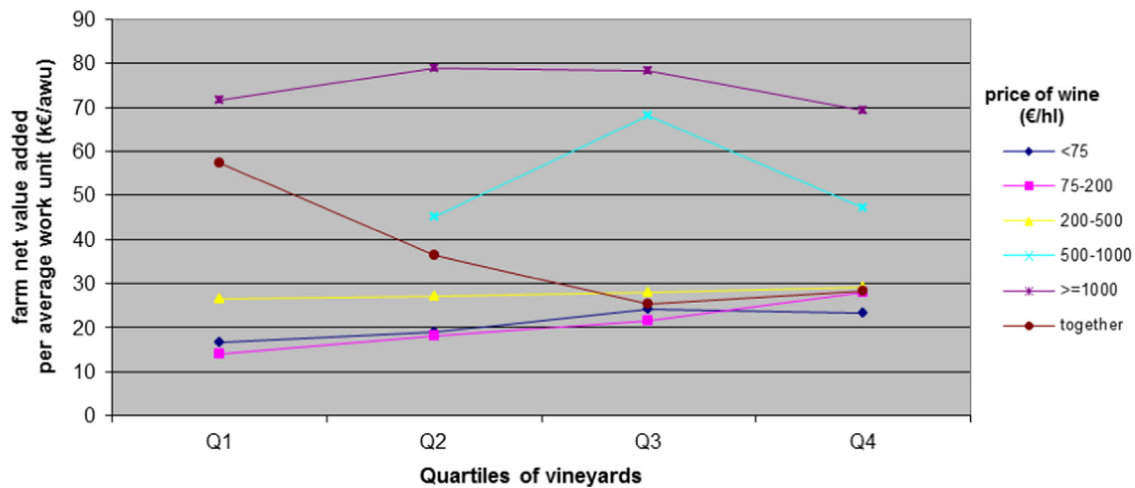
<sup>6</sup>“Currently, the existing economies of scale in viticulture (see §3.2.1; Cembalo et al., 2010) largely dependent on mechanization (Pomarici et al., 2006; Galletto and Barisan, 2007), may, in the event of liberalization, determine a pressure towards expanding vineyards. Such a phenomenon would accentuate the split between capital intensive processes based on large vineyards which may become larger, and small labor-intensive farms. In such a situation, the competitive pressure of larger farms on the smaller units may, in principle, determine the marginalization of the latter. Indeed, with the abolition of planting rights, small labor-intensive processes are exposed to the risks of shrinking.” (Sardone et al., 2012, p. 89–90).

Table 1

Distribution of farms represented according to the selling price of the wine and the location. .

Source: FADN-France, constant sample 2005–2007– authors' computation

wine price (€/hl)	Regions or areas									Total France
	Champagne	Loire valley	Burgundy	Alsace	Poitou-Char.	Aquit.+MidiP	Rhône-Alpes	Langue-doc-R.	Prov.+Corsica	
none sale	0	5	37	745	488	77	91	0	11	1454
> 0–75	0	567	0	0	1859	695	546	8164	1331	13,382
75–200	0	1219	388	122	326	1496	1078	1491	1603	9949
200–500	171	505	1544	548	0	1,386	1212	588	822	7536
500–1,000	2785	65	740	687	0	316	316	0	259	6048
> = 1,000	3649	0	250	0	0	47	47	0	5	4029
Total	6605	2361	2959	2102	2673	4029	3288	10,243	4032	42,398
yield (q/ha)	131	68	76	96	131	63	66	74	60	76



Graph 2. – Profitability by wine price classes and increasing size of the quartiles of vineyard.

Source: FADN-France, constant sample 2005–2007– authors' computation

## 6. Surface area, price and profitability in viticulture

Because of the difficulty encountered in accessing FADN databases for all European countries, we decided to limit our analysis to the case of France. We consider a constant sample for the period from 2005 to 2007: As in fact the FADN survey renews partially the sample each year, we took into account only the 797 typical farms, specialized in viticulture and interviewed each year during the three years period. That sample is representing 42,000 wine-farms. We extrapolated the sample to the whole population of wine-farms in a representative way, using variables as region, typical farm TF, Standard gross margin (SGMs) classes, etc.

### 6.1. Differentiation according to wine selling prices

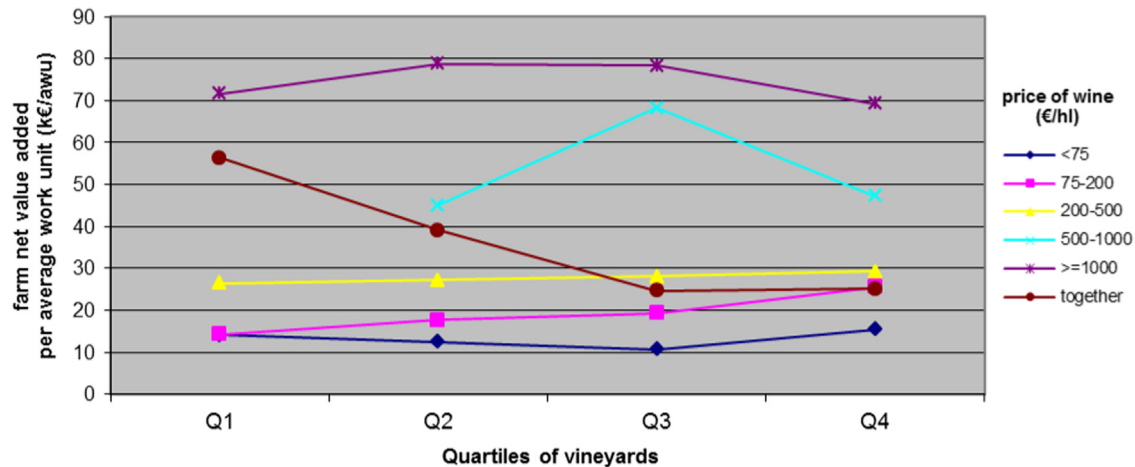
We have already emphasized the need to take account of regional differences in wine production (beyond the traditional distinction between viticulture ‘with’ or ‘without’ designation of origin) and differences in the price ranges for those wines. We will satisfy this obligation by identifying five price levels. Moreover, considering that the distribution of French farms

(viticulture) according to their surface area varies considerably from one price range to another, we chose not to define categories of surface area with fixed boundaries but to use a distribution in percentiles, in this case quartiles (the boundaries are provided in the [Appendix B](#)).

Among the grape farms with a high average selling price (i.e. greater than €500/hl), i.e. accounting for 24% of French specialized grape farms, surface area is not a significant factor in explaining the variation in the profitability of labor (see [Graph 2](#)). For grape farms with a grape price ranging from €200 to €500/hl (i.e. approximately 18% of French farms specialized in grape growing), there is an increasing labor profitability trend which is nevertheless relative, ranging from 10% in the first (< 7.47 ha) and the last quartile (> 20.8 ha).

Whenever the price is lower than €200/hl, the variations in labor profitability are more significant and almost regular: between the first and the fourth quartile, it increases by about 50% for the grape farms selling wines at a price below €75/hl (35% of French farms specialized in viticulture) and it almost doubles for grape farms selling wine at an average price ranging from €75 to €200/hl (24% of French grape farms specialized in viticulture). Likewise, in this case, it is the





Graph 3. - Profitability by wine price classes and increasing size of the quartiles of vineyard, not including Poitou-Charentes.  
 Source: FADN-France, constant sample 2005–2007 – authors' computation

increase in the physical productivity of labor (i.e. the number of hectares of vines per unit of labor) that is the main factor underlying the variations.

## 6.2. Price and yield

The grape farms with a price below €75/hl are quite heterogeneous: a proportion of these farms (i.e. about 1/5) are located in the Poitou-Charentes region where the production of PDO Cognac (distilled from wine) is predominant. By taking account of the special conditions of this production, and in particular the relatively high yields, the profitability of these farms is very high. We do not need to treat farms producing Champagne in the same way (they also have very high yields) as they are sufficiently isolated in the category, representing a price of more than €1000/hl price.

In the Poitou-Charentes region, the wine produced is a raw material for producing PDO brandy Cognac, with very high yields but with very low price, so the whole income still is high. That is the reason we added the result excluding that really atypical vineyard. It modifies significantly the relationship between size and income. It changes the slope of the line. So, if we exclude the grape farms in the Poitou-Charentes region, the profitability of selling at less than €75/hl is significantly lower and, most importantly, fluctuates *erratically* according to the surface area and always remains inferior to half of the minimum wage (see Graph 3).

We should notice that, in the case of grape farms selling wine at low prices (< €75/hl and €75–200/hl), the level of profitability is low. Even in the case of large farms (i.e. farms included in the last quartile, owning more than 26 or 27 ha of vines), the value does not exceed €28,000 per worker; it reaches €23,400 when the selling price is lower than €75/hl; even if we exclude grape farms from the Poitou-Charente region, the maximum values would reach €25,600 and €15,400 respectively (see Graphs 2 and 3).

Among those farms obtaining less than €200/hl, such a level of profitability is not sufficient to pay for labor according to the minimum legal labor rules: the minimum wage (SMIC in

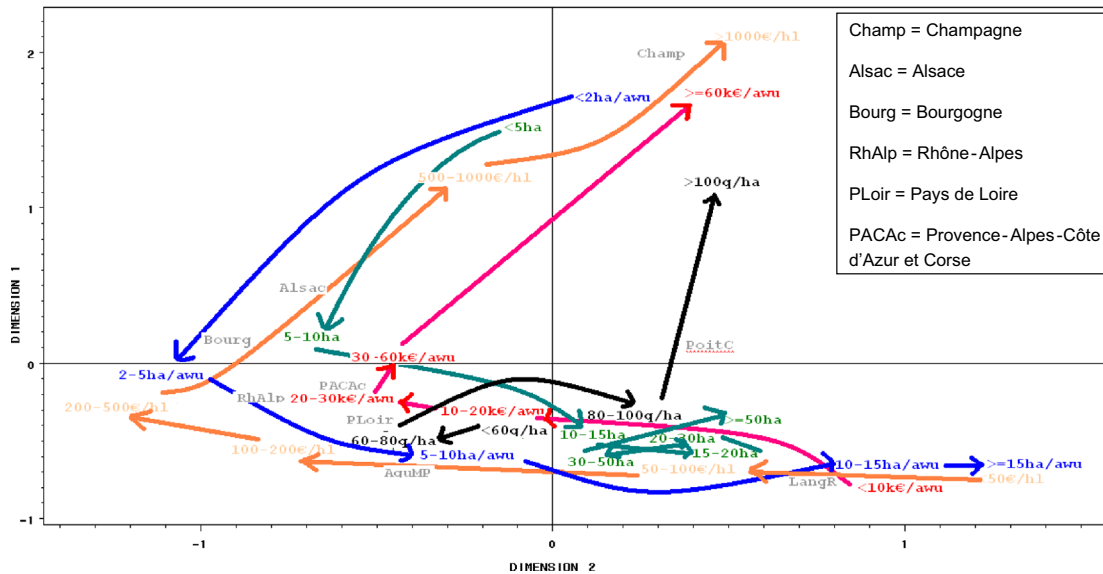
French) is about €20,000/year for this period, when the cost of social protection is included. After incorporating taxes, the payment of interest on debts and land rental (*fermages*), the revenue per unit of labor never reaches the minimum wage level. For prices ranging from €75 to €200/hl, revenue increases considerably (almost doubling) between the first and fourth quartiles; however, if we exclude the Poitou-Charentes region, it remains below the minimum wage.

This minimum income level can only be reached in the case of average selling prices ranging from €200 to €500/hl. Even then, it only slightly exceeds the minimal wage in the same way (i.e. approximately 10 percent), independently of the quartile considered.

## 6.3. A synthetic overview

Multiple Correspondence Analysis (MCA) is a method that allows studying the association between three or more qualitative variables. One can obtain maps where it is possible to visually observe the positioning between the categories of the qualitative variables size of the vineyard, physical productivity (surface per unit of labor), yield (volume of grapes harvested per unit of surface area), average selling price and profitability (net value added per unit of labor). The observations (farms) are not displayed on the map but so are the regions as supplementary variables. These variables were not included *ex-ante* to determine the values of the axis and we therefore simply added these supplementary variables to the axis afterwards. Interpretation of category points is guided by the centroid principle: category coordinates are the weighted average of variable coordinates occurring in that category.

Unlike many other data analysis, this method needs no hypothesis about the links between variables, i.e. it does not use a formalized theoretical model a priori defined; so it is part of the non-parametric methods of data analysis. The axes present in the chart have an algebraic precise definition but their economic interpretation is very complex. The most noteworthy is the proximity (and therefore distance) between points.



Graph 4. - Multiple correspondence analysis. Size of the vineyard: Green. Physical productivity (surface per unit of labor): Blue. Yield (volume of grapes harvested per unit of surface area): Black. Average selling price: Orange. Profitability (net value added per unit of labor): Red. .

Source: FADN-France, constant sample 2005–2007 – authors processing

Our approach also emphasizes the geometrical aspects of multiple correspondence analysis introducing the variable line plot (Hoffman and de Leeuw, 1992). The line plot illustrates the spread of the category points for each variable. A variable discriminates better to the extent that its category points are further apart. The line plot thus shows how well each variable discriminates, as visualized by the sum of the squared distances between the category points for a variable and the origin. Furthermore, the points (categories or classes) of the same variable are naturally ordered (from largest to smallest), which makes possible and interesting to consider the lines, their shape and their orientation. Oriented curves (in color) drawn on the graph aim to facilitate the observation of the factors correlated each other and noteworthy with differences in income. The points of the categories of the other variables which approach a random distribution or more accurately the average distribution observed in the population are placed near the center of the axes.

For example, by paying careful attention to the Graph 4, we can observe in its upper right part the proximity of, a high price of wine (€ 1,000/hl), a high income ( $>=60$  K €/awu), a small area per worker ( $<2$  ha / awu), a small vineyard ( $<5$  ha) and the region Champagne. All these features are well known for that region, its wines and producers.

In the first 2 axes – among 23 possibilities – there is an overall contribution of 24% to total inertia (see Table 2 in the Appendix C). Of the 27 modalities of the variables, 18 have one correlation (squared-cosine) greater than 0.1, of which 12 are greater than 0.2. Graph 4 introduces a ‘scaphoid’ (here a horizontal ‘U shaped’ curve).

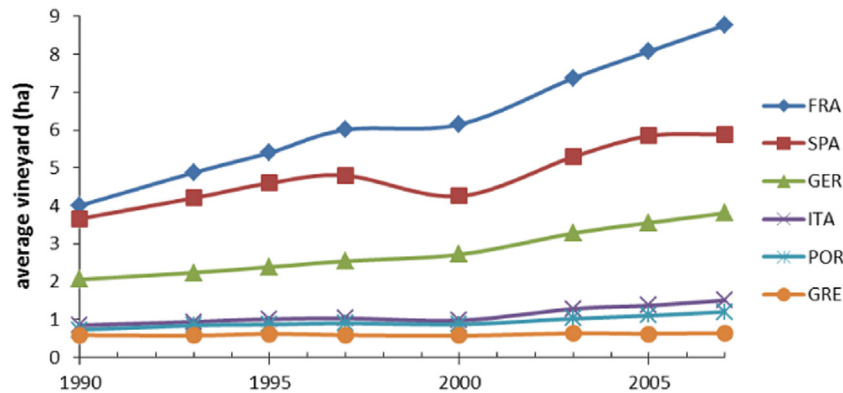
If we consider typology, the modalities of the 5 variables are represented in the scaphoid in a logical order. However, their signification is not the same: profitability (red in the graph) and wine price (orange) go in one direction (‘upstream’), while the representation of the surface areas (green) and physical

productivity (blue, measured as hectares per annual work unit) go in another direction (‘downstream’).

The yield (measured as quintals of grapes per hectare – black), whose modes are put together near the center of gravity, is independent of this order except at the point where the higher yields ( $>100$  q/ha) are located in an area of high profitability and high prices, i.e. close to the Champagne area. We therefore notice the very specific position of Poitou-Charentes in the graph, located between profitability and high yields (Champagne) and the low prices with high physical productivity (surface per labor unit) typical of Languedoc-Roussillon. This representation therefore confirms that it is necessary to study each region individually.

As in the entire TF, physical labor productivity (i.e. the number of hectares per worker) seems to be relatively dependent on farm size. However, in the case of the TF specialized in grape growing, physical productivity does not provide a significant explanation of the differences in productivity and the differences in income; it provides a contrasting explanation to what we would expect. The key factor, which is positively related to profitability and revenues, is the price of wine.

Our results therefore show that the profitability of farms is rarely higher in large-scale farms than in smaller ones. This association is only true when the price of wine is low. In the case of a particular zone (Cognac), the increase in profitability for large farms holds, but when the profitability of small farms is already significant. For the remaining regions of France and for low prices, the increase in profitability is high in terms of relative value but modest in terms of absolute value: the profitability levels reached by large farms are too low to allow the average revenue per unit of labor to reach the minimal legal wage in France. Accordingly, it does not seem feasible for the abolition of vine planting rights in France to impact all the categories of ‘sizes’ and ‘prices’. Consequently, it would not



Graph 5. – Average vineyard surface area by farm cultivating vines (ha). .

Source: Eurostat – authors processing

lead to an improvement in the profitability of farms or, by extension, to an improvement in grape growers' incomes. In short, the wine policy would not be effective.

## 7. Concentration of European wine production

There is another way in which to examine the potential impact of canceling vine planting rights on grape production: we should look at the evolution of the production structures over time. One of the arguments put forward by experts supporting the suppression of vine planting rights states that vine planting rights would 'freeze' the production structures, preventing the expansion of farms in Europe and therefore hindering the improved profitability associated with the expansion of vineyard surface areas.

### 7.1. The progressive growth of Farms

Eurostat data shows that, among the oldest member states of the EU, domestic vineyard surface areas decreased over the past two decades (1990–2007) by factors ranging from 35% in Portugal to between 10% and 20% in Italy and France and a little less than 10% in Greece, Spain and Germany.

At the same time, a considerable number of farms producing grapes disappeared entirely, or at least the farms no longer produce grapes. One of the direct consequences of the decrease in surface areas is that the average size of farms has increased considerably (see Graph 5). In France, Germany, Italy and Spain, the average size of farms in the viticulture segment almost doubled during this period.

### 7.2. On the evolution of regional vineyards

Consequently, while national vineyard surface areas decreased over the past two decades (and the same phenomenon was observed in many regions), we nevertheless note that

in some regions, vineyard surface areas actually increased: +40% in Extremadura, +20% in Burgundy, Alsace and Champagne-Ardenne and +5% in Catalonia, Rioja, Castilla-Leon, Aquitaine, Baden-Württemberg and Friuli-Venezia-Giulia. Finally, we can also note that these 'evolutions' in the vineyards as well as the in every European country do not generally benefit the regions that *a priori* enjoy more favorable conditions for planting and developing vines.

In short, the persistence of a vine planting rights system in Europe appears to be compatible with vigorous growth of farm sizes while also facilitating the transfer of vine surface areas between regions, at least over the past two decades.

## 8. Concluding remarks

This work has established that from a theoretical point of view the net value added per worker is a good estimator for economies of scale. Further, the use of this estimator is quite interesting as it is almost impossible to measure economies of scale directly (i.e. a decrease of average cost when the farm size increases) in agriculture due to the non-fixity of the cost of family labor.

Furthermore, this work demonstrates – at least for the French case – that the performances of farms growing grapes are only slightly influenced by their size. Differences in profitability between farms are based on differences in the selling price of wine. These differences are related to the location and the designation of origin (PDO wines), i.e. influenced by the control of the supply and its potential, the surface areas and the means used to manage vine planting rights in every country, region or PDO.

The levels of profitability reached by large farms do not avoid low incomes, at least if we take account of the legal minimal wage.

We noted that, despite the existence of regulations governing vine planting rights, European farm holdings recently enjoyed a period of considerable growth with regard to average size as well as demonstrating a change in geographic location.

Furthermore, and in order to find a solution to this problem, *ceteris paribus*, it is possible to expect that an increase in vine plantings will lead to market imbalances (*plethora*). This would lead to a negative impact on prices and therefore on the profitability of farms. (Montaigne, 1997). Consequently, further public intervention would be required to regulate the markets and maintain grape growers' income. In times of constraint and even reduction of the EU budget devoted to agriculture, interventions will be limited to what has been accepted by the reform of the Common Agricultural Policy (CAP) and the reform of the wine CMO, so interventions chosen from the menu and this differentially across countries.

Today, the use of distillation is not possible except using the national budget and for localized action; the use of crop insurance cannot operate to cover this systemic risk. Finally, we can think of a wider use of direct aid, for now excluded in France, and the strengthening of marketing aid for exporting in the non-European countries.

Another important point to be stressed is the need to find a balance in the markets, but this debate goes beyond the abolition of regulations governing production and trade. In summary, it would be necessary to take into account the organization of the value chains, the sharing of value-added and the means required to access the land markets.

## Appendix A

### *Sources, methods and definitions*

*FADN*: is an annual European survey focusing on the economic data of farm holdings. Depending on the European Commission, the constraints for accessing the database are significant. In this study, we focus on the French FADN for the period covering 2005–2007. From 2008, access to the database became more complex. In order to improve the reliability of the results, we used average data for the three-year period (2005–2007) concerning the variables related to the farm holdings using a 'constant sample' i.e. using the same farm holdings available across all three years.

*Eurostat*: Eurostat provides results from agricultural censuses and surveys relating to the structures of agricultural farm holdings. Data is available for every country of the EU-28.

*Net Value Added*: it includes 'value added' (sales + stock variations + residual product + subsidies – intermediary consumptions) less depreciation; it is included as a proportion of annual labor. 'Net value added' is a good indicator of labor profitability in agricultural farm holdings.

*SGM (Standard Gross Margin)*: this is a measure of the economic dimension of farm holdings. The regional SGM coefficient of a crop or livestock item is defined as the value of output from one hectare or from one animal less the cost of the variable inputs required to produce that output.

*Types of Farming (TF)*: this characterizes the orientation of production at farm level according to the contribution of each crop or animal to the total SGM of the farm retained. For farms specialized in viticulture, there are 2 main types of farming (TF) in viticulture: 'wines with designation of origin' and 'other wines'.

## Appendix B

### *Definition of quartiles*

#### **For graph 2:**

Division into quartiles according to the number of farms after extrapolation (number of farms represented below) ranked according to the surface planted with vines for each one of the five categories of wine sales.

The upper limits established in hectares of vines for each quartile are defined below:

Wine price (in €/hl)	Upper limit (in ha) of vineyard surface for		
	First quartile	Second quartile	Third quartile
0–75	13.00	17.58	25.69
75–200	9.58	16.77	26.97
200–500	7.47	11.86	20.84
500–1,000	1.90	2.88	7.24
> = 1,000	2.59	4.49	6.62
all farms without price categories	6.94	12.61	21.60

**For graph 3:**

Wine price (in €/hl)	Upper limit (in ha) of vineyard surface for		
	First quartile	Second quartile	Third quartile
0–75	12.61	17.58	25.919
75–200	9.58	16.61	26.61
200–500	7.47	11.86	20.84
500–1,000	1.90	2.88	7.24
> = 1,000	2.59	4.49	6.62
all farms without price categories	6.50	11.86	20.19

**Appendix C. Table 2 – Axis describing the Multiple Correspondence analysis**

The CORRESP Procedure										
Decomposition of < inertia and Khi 2										
Value singul.	Inertia main	Khi 2	Percentage	Percent cumulative	3	6	9	12	15	
					—+—	—+—	—+—	—+—	—+—	—+—
0.82466	0.68006	211326	14.78	14.78	*****					
0.64686	0.41843	130024	9.10	23.88	*****					
0.55573	0.30884	95970	6.71	30.59	*****					
0.53044	0.28137	87434	6.12	36.71	*****					
0.51529	0.26553	82511	5.77	42.48	*****					
0.48963	0.23974	74497	5.21	47.69	*****					
0.47375	0.22444	69743	4.88	52.57	*****					
0.46906	0.22002	68370	4.78	57.36	*****					
0.46327	0.21462	66692	4.67	62.02	*****					
0.44891	0.20152	62620	4.38	66.40	*****					
0.44199	0.19536	60707	4.25	70.65	*****					
0.43855	0.19232	59763	4.18	74.83	*****					
0.41126	0.16914	52558	3.68	78.51	*****					
0.40127	0.16102	50036	3.50	82.01	*****					
0.38569	0.14876	46225	3.23	85.24	*****					
0.37896	0.14361	44625	3.12	88.36	*****					
0.35417	0.12544	38978	2.73	91.09	*****					
0.33889	0.11485	35688	2.50	93.59	*****					
0.31778	0.10099	31381	2.20	95.78	*****					
0.27492	0.07558	23487	1.64	97.43	****					
0.24776	0.06138	19074	1.33	98.76	**					
0.20453	0.04183	12999	0.91	99.67	**					
0.12314	0.01516	4712	0.33	100.00	*					
Total	4.60000	1429423	100.00							

Source: FADN-France, constant sample 2005–2007 – authors' computation.

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