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## Quality and export performance: Evidence from cheese industry

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# Quality and export performance: Evidence from cheese industry

## Abstract

The paper questions the impact of quality label on firm export competitiveness in the cheese and cream industry. We use firm level data from the French custom and an original dataset of firms and products concerned by protected designations of origin (PDO). Our econometric estimations shows that PDO labelling impacts both the extensive margin (the number of destinations) and the intensive margin of trade (the value of trade), and increases the average export unit value. The role of label in export performance varies with the market of destination and is more important when exporting to EU countries.

**Keywords:** Quality label, PDO, trade margin

**JEL:** F10, F14

## 1. Introduction

Quality labels are developed at the European level through a European Union (EU) quality policy. This policy aims at fitting consumer concerns about the attributes of food products, such as quality and geographical characteristics. It is also expected to sustain competitiveness within the agri-food chains.

In this paper we investigate the role of Protected Designations of Origin (PDO) on French export performance in the cheese industry. Using firm level data and an exhaustive dataset of the firms and products concerned by PDO in the cheese industry we show through an empirical analysis that labelling in the cheese industry has a positive impact on exporting firms both at the extensive (number of export destinations) and at the intensive margin (value exported).

Our approach is linked to recent developments in firm-based trade theory (Melitz, 2003). The main predictions of this literature have been confirmed for the food industry. For example, it has been shown that the larger the productive food firms, the more likely they are to export more, and serve distant markets (Chevassus-Lozza, Gaigné and LeMener, 2013; Gullstrand, 2011; Latouche and Chevassus-Lozza, 2012; Vancauteran, 2013a), confirming a self-selection mechanism where only the most productive firms can recover the sunk costs for serving foreign markets and become exporters.

There has been much interest recently in the introduction of vertical quality differentiation in firm-based trade theory to explain certain regularities found in international trade data (Hallak and Sivadasan, 2013). For example, Kugler and Verhoogen (2012) allow for vertical differentiation in product quality to explain why larger plants tend to specialise in higher quality products and pay higher input prices. In one variant of their extended Melitz's (2003) model, they consider plant productivity and input quality to be complements in

generating output quality, while in a second variant the technology for product quality is given by a Leontief production function, making the level of input quality proportional to a sunk investment in quality. They found evidence that larger, more productive Columbian plants operating in industries in which there is more scope for vertical quality differentiation (proxied by research and development (R&D) and advertising intensity), tend to specialise in higher quality products and pay more for their inputs. Crozet, Head and Mayer (2012) argue that firms that export to a larger number of destinations tend to price their goods more dearly. Their empirical analysis is based on the Champagne industry because it is one for which a direct measure of product quality exists. More generally, a small firm can still export provided that the level of product quality is high enough. This is the so-called Alchian effect that makes trade costs relatively less important for high-quality (higher priced) products than for lower quality ones. Exporting firms sell higher quality products than non-exporters of the same size, a result reminiscent of Falvey's (1979) policy-induced quality upgrading effects. Curzi and Olper (2012) confirm this finding by using an alternative approach to study the relationship between product quality and food export performance across destinations from a panel of Italian food firms. Product quality is proxied by investment intensity, R&D expenditure, product and process innovations, as well as quality standard certifications (the ISO 9000 certification). They show that more efficient firms sell higher-quality goods at higher prices and serve more distant markets, confirming the relationship between productivity, product quality, and export performance.

The effect of tariffs and distance on quality has been also the object of several studies recently. Amiti and Khandelwal (2013) argue that tariff reductions induce quality upgrading for firms that are near the 'world technology frontier' because quality upgrading can be seen as a means to escape more intense competition.<sup>1</sup> Having a public standard defining the vertical level of quality entails that some firms are forced to use a higher level of quality than they would like and that the reverse is true for other more productive firms. Since more productive firms cannot deflect competition by increasing quality beyond the standard, they use their productivity advantage to gain market share. Empirical evidence from Olper, Pacca and Curzi (2014) confirms the strong relationship between market penetration and productivity growth.

However, this literature considers that firms supply a single variety. Yet, world trade is strongly dominated by multi-product firms. Recently, Mayer, Melitz, Ottaviano (2014) have studied the role of market size and distances to trading partners on a firm's exported product range and its exported product mix across market destinations. The firms' product mix choice is driven by price competition across markets as the authors consider only horizontal differentiation. Price competition causes a rationalization of production in response to tougher product competition because firms drop their less profitable products and concentrate on their most successful products. However, large multi-product firms are able to manage price competition by adjusting the quality of their products. Our data reveals that the exporters supply multiple products with different price and quality settings. Indeed, some of multi-product exporters provide both labelled products and non labelled products. Labelling also enables firms to manage the cannibalization effect and, in turn, reduces intra-firm competition.

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<sup>1</sup> From the importing firms' perspective, a higher specific tariff tends to reduce the relative price of high quality products vis-à-vis lower quality products subject to the same unit tax. Distance has similar effects in inducing reductions in the volume of trade and in skewing the composition of trade toward higher quality products. Curzi and Olper (2012) report supportive evidence from Italian firms.

In the next section, we describe data that we use. In Section 3, we provide and analyze the results of our different estimations.

## **2. Data and empirical facts**

### **2.1. Data**

We aim at evaluating the effect of PDO labelling on export performance. To do so, we use French firm-level data from the French custom. This database provides for each firm its exports in value and quantity by product (defined at the NC8 level) and destination. We restrict the sample to the firms exporting cheese or cream (products that belong to the HS4 categories 0405 or 0406) in order to have a homogenous sample of firms in terms of products. We end up with a dataset of 638 exporting firm within the cheese and cream industry.

Among this exporting firms, we identify the firms authorized to handle PDO labelled products using the exhaustive list of firms of the French national institute responsible for these official designations (INAO- Institut National de l'Origine et de la Qualité) for 2012. This year, 34 firms among the 638 exporting firms are concerned with PDO labelling products. The list of products covered by PDO labelling is also given by the INAO. In the cheese and cream industry, 21 products, defined at the NC8 level of the classification of goods of the EU statistics, benefit from a PDO label.

As PDO labelling concerns specific products, we make the correspondence between the two INAO databases and firm-product pairs identified in the customs dataset. Two points should be highlighted here. First, PDO authorized firms are multi-products firms: they do not only export labelled products and they may also export non-labelled products. Second, each labelled product has not an exclusive NC8 code. In the empirical analysis, we assume that all the products belonging to a NC8 category of good concerned by a PDO and exported by an authorized firm, are labelled. Because of this approximation, the effects of labels may be under-estimated in our analysis.

### **2.2. Descriptive statistics**

The combination of French Customs and INAO datasets allow us to distinguish PDO authorized firms from non authorized firms. Furthermore, within authorized firms, we can identify which NC8 category of product is labelled. Thus, each pair "firm-NC8" may be classified into three types: non authorized firms, authorized firms but non labelled product and authorized firms and labelled products. Table 1 gives the number of firms of our dataset according to this classification and to the number of products exported. Among the 638 firms of our sample, as said above, 34 are authorized and 604 are not authorized to handle PDO products. Among the 34 authorized firms, 33 also export products without label. The distribution of firms according to the number of products show us that most of the firms are multi-products. Half of non-authorized firms and the third of authorized firms even export more than 9 products within the cheese industry.

**Table 1: Number of firms according to the number of products exported**

	1	2 to 5	6 to 9	>9	Total
no PDO	80	123	76	325	604
PDO Authorized, product without label	0	13	9	11	33
PDO Authorized product labelled	1	13	9	11	34

*Sources: Author's calculation using French Custom and INAO datasets*

Table 2 illustrates the share of labelled product in authorized firms' exports. PDO products represent 29% of the products exported, and 21% of the export in value. However, these shares vary according to the total number of products exported by the firm. The larger the firm, the lower the share of labelled products in export (both in terms of number and export value). The last column of table 2 presents the average share of destination countries where firms export both labelled and non-labelled products. It shows that the export destinations for a given firm do not exactly coincide for labelled and non labelled products. There only exist 31.1% of the destinations that are the same for labelled and non labelled products sold by the firms that export few products (between 2 and 5 products).

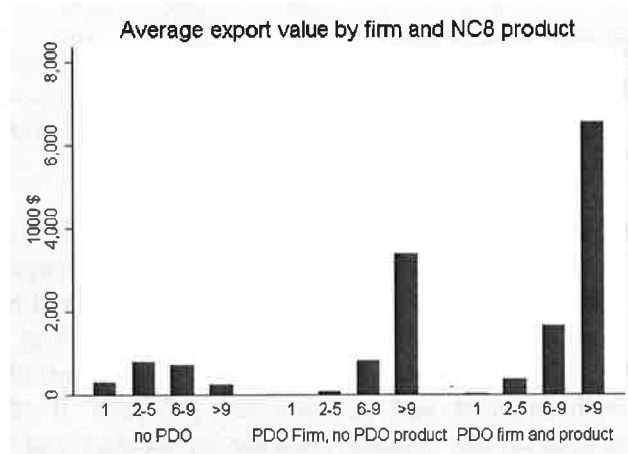
**Table 2: Share of labelled products in authorized firms products and trade**

# HS8 per firm	% HS8 with label	% labelled exports	% common destinations
[2-5]	43%	64%	31,1%
[6-9]	19%	66%	56,8%
≥10	13%	18%	49,8%
total	29%	21%	48%

*Sources: Author's calculation using French Custom and INAO datasets*

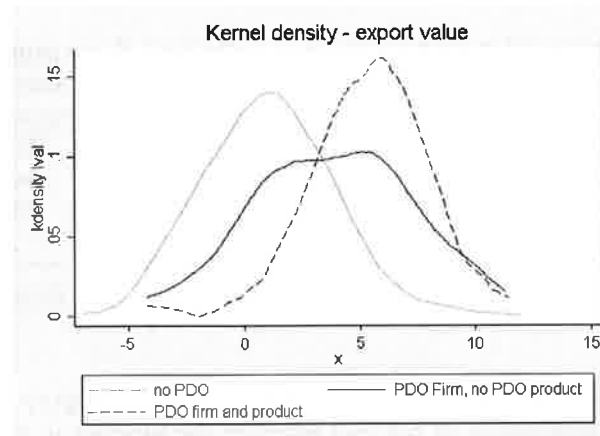
We compare the mean export value by firm and NC8 category of products, depending on whether the firm is authorized or not and whether the product is labelled. Figure 1 shows that the value exported is higher for PDO firms as compared for non-authorized firms, whether or not the product is labelled, except for firms exporting a small number of products. This observation is confirmed by the figure 2, which displays the kernel density of the export value by firm and NC8. More authorized firms with labelled products export high values than non authorized firms.

**Figure 1: Export value by firm and NC8 category of good**



*Sources: Author's calculation using French Custom and INAO datasets*

**Figure 2: Export value by firm and NC8 products kernel density**

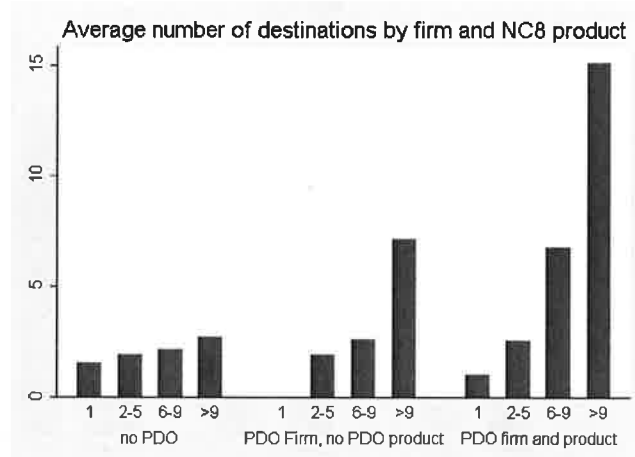


*Sources: Author's calculation using French Custom and INAO datasets*

In figure 3, we assess the extensive margin of trade by computing the average number of destination countries by firm and NC8 category of product. The number of destinations is always higher for PDO authorized firms. This result is more salient for firms that export more than 9 products. Furthermore, authorized firms export labelled products to a higher number of destinations as compared to other products.

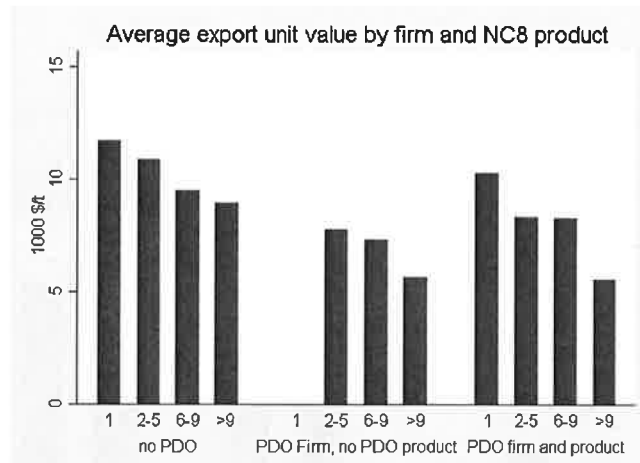
Contrary to export values or number of destinations, the unit value does not differ a lot according to the type of firms and product (figure 4). Trade unit values of non-authorized firms are higher in average than those of authorized firms. Within PDO firms, PDO products are exported at a higher price than non labelled products, in average, except in firms with a large number of products.

**Figure 3: Number of destination by firm and NC8 category of good**



*Sources: Author's calculation using French Custom and INAO datasets*

**Figure 4: Average unit value by firm and NC8 category of good**

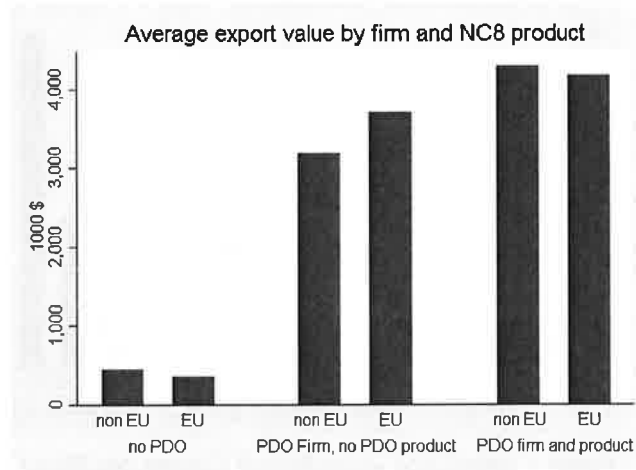


*Sources: Author's calculation using French Custom and INAO datasets*

Finally, as quality labels as PDO are developed and recognized at the European level, we investigate the trade performance of labelled firms and products according to the market of destination. Figure 5 and 6 displays the average export value and number of destination for European and non European countries. The previous result holds when distinguishing EU and non-EU destinations: PDO authorized firms export more in value than non-authorized firms. Within authorized firms, labelled products exhibit higher export value, however, the difference between European and non European destination is low. In terms of number of destinations, we observe similar results. It is worth noting that PDO authorized firms export to a larger number of European countries than non European countries, and that it is the opposite for non authorized firms (Figure 5).

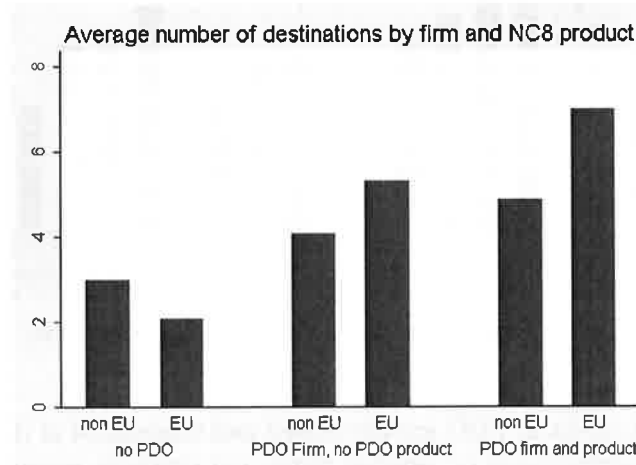


**Figure 4: Export value by firm and NC8 category of good, according to the destination market**



*Sources: Author's calculation using French Custom and INAO datasets*

**Figure 5: Number of destination by firm and NC8 category of good, according to the destination market**



*Sources: Author's calculation using French Custom and INAO datasets*

Descriptive statistics suggest a role of PDO labelling in firms export performance in the cheese and cream industry. This impact appears both at the extensive margin and at the intensive margin (i.e. the value exported). Moreover, we observe these differences in trade margin both within and between firms. An authorized firm export more and to more destination than non authorized firms especially to EU markets and the value exported by an authorized firm is higher for its labelled products than for its non-labelled products.

### 3. Empirics

#### 3.1. Empirical strategy

Our objective is to examine whether PDO labelling entails better performance for French exporters in the cheese industry. To do so, we estimate the impact of benefiting from a label on the probability of export to a given destination (the extensive margin of trade), the value of export (the intensive margin of trade) and the export unit value.

The effect of PDO on trade is estimated using a dummy  $PDO_{fk}$  equal to 1 if the firm  $f$  benefits from PDO labelling for the category of good  $k$  (defined at the NC8 level) and zero otherwise. The three models have the same explanatory variables. In the equation of extensive export margin, the dependent variable  $I$  is binary, equal to 1 for observations with positive export flows for the firm  $f$ , the good  $k$  and the country of destination  $j$ , and to zero otherwise. In the second and the third models, the dependent variables are respectively the value of trade  $X_{fjk}$  and the trade unit value  $uv_{fjk}$ :

$$\begin{cases} I(X_{fjk} > 0) \\ X_{fjk} \\ uv_{fjk} \end{cases} = \beta_0 + \beta_1 PDO_{fkt} + \Gamma Y_{kj} + \Theta Z_f + \varepsilon_{fjk} \quad (1)$$

$Y_{kj}$  and  $Z_f$  are the full sets of NC8-destination and, respectively, firm-specific fixed effects,  $\Gamma$  and  $\Theta$  are the associated vectors of parameters. In a first step, we estimate the effect of PDO on export regardless of the destination country. In a second step, we distinguish the impact of labelling according to the importer, assuming that the impact of PDO may be different within the European Union, as this label is defined at the community level.

We restrict the sample of estimation to PDO authorized and exporting firms (34 firms). Our specification allows us to compare trade of labelled product and non-labelled products for a given category of good and destination, for firms that are authorized to sell PDO products.

#### 3.2. Results : impacts of PDO labelling on export performance

Table 3 presents the results of the estimation of equation (1). Columns 1 and 2 display the results on the probability of export. The positive and significant coefficient of the dummy PDO indicates that benefiting from a PDO label increases the probability of export, for a given category of good (defined at the NC8 level) and destination. This impact of PDO on the extensive margin is higher when exporting to European countries.

In columns 3 and 4, we assess the impact of PDO labelling on the value of export (the intensive margin). We obtain a positive and significant coefficient: PDO labelling has a positive impact on export value of authorized firms for a given destination and category of good. Using the variable PDO crossed with an EU dummy shows that this effect vary with the destination market (the two coefficients are statistically different) and is higher for EU destinations. European consumers may be more aware of products differentiation through PDO and consequently value the labelling at a larger extent than non European consumers.

Finally, column 5 presents the coefficient of the equation on trade unit value. We find that trade unit values are higher for labelled products than for non labelled products, once we control for firm, destination and NC8-good characteristics. When we distinguish the impact of

PDO labelling on trade unit value according to the market of destination, we find that the “upgrading effect” of PDO only exists on the European market (column 6). On non European markets, there is no difference in terms of trade unit values between labelled and non labelled products, which confirms our previous result on a differential behaviour of European consumers.

**Table 3: Role of label on the export performance**

	Decision to export (Probit)		Export value (OLS)		Unit value (OLS)	
PDO	0.60***		1.13***		0.09**	
PDO x EU		0.85***		1.30***		0.09*
PDO x non-EU		0.40***		0.85**		0.09
Adj. or pseudo R <sup>2</sup>	0.33	0.34	0.38	0.38	0.62	0.61
Number of obs	30550	30550	2021	2021	2021	2021

Standard errors in parentheses. \* p < 0:10, \*\* p < 0:05, \*\*\* p < 0:01.

Firms, destination and good fixed effects included (probit)

Firms fixed effects and destination-good fixed effects included (OLS)

Analysing the impact of PDO labels on the number of exports destinations for a given good and firm is another way to assess the extensive margin of trade. Table 4 shows the result of the estimation on the number of export destinations. We still use firms and NC8 good-destination fixed effects and continue to work on the sample of PDO authorized firms. It appears in column 1 that authorized firms export PDO labelled product to a larger number of destinations than non labelled products. This positive effect of labelling on the number of destination is only significant for non-EU destination (column 3). The fact that the coefficient of the PDO dummy is not significant can be explained by the fact that almost all the firms of our sample export to all the countries of the European Union, the product being labelled or not.

**Table 4: Role of label on the number of destinations of firms**

	# of destinations	# of EU destinations	# of non-EU destinations
PDO	0.21***	0.33	0.63***
Adj. R <sup>2</sup>	0.26	0.45	0.32
Number of obs	325	189	226
Number of firms	34	28	29

Standard errors in parentheses. \* p < 0:10, \*\* p < 0:05, \*\*\* p < 0:01.

Firms fixed effects and destination-good fixed effects included

### 3.3. Results: spill-over effect of PDO on the other products of the firm

Benefiting from PDO for a given product may impact the other products within the same authorized firm. In the latest part of the empirics we test this driving force of PDO labelled products on the non-labelled ones at the firm level. We first explain non labelled product's unit value by the unit value of labelled product of the same firm and destination. Regression (table 5, column 1) shows that the unit prices of non-labelled products are positively impacted by the prices of PDO products at the firm level. However, this spill-over effect of label is only observed on non European markets (column 7).

We also assess the impact of the share of labeled products in the firm's export on the unit value of non labeled exports (columns 2 and 3). It appears that non labeled products tend to have lower unit values when labeled products represent a high share of the exports of the firm within the NC8 category of product to the given destination.

**Table 5: Determinants of unit value of no labelled product  $k$  of authorized firm  $f$  for destination  $j$**

	All dest.			EU dest			Non-EU dest		
	UV	UV	UV	UV	UV	UV	UV	UV	UV
Label Av. Price	0.34***			0.24			0.37***		
Share of label exports		-0.08			-0.07			0.09	
(Share of label exports) <sup>2</sup>		-0.01**			-0.01*			0.01	
Val. of label exported			0.03			0.06*			0.04
(Val. of label exported) <sup>2</sup>			-0.004			-0.01*			-0.002
R <sup>2</sup>	0.90	0.90	0.90	0.89	0.89	0.89	0.95	0.94	0.94
Number of obs	1134	1134	1134	638	638	638	496	496	496
Number of firms	33	33	33	25	25	25	28	28	28

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Firms fixed effects and destination-good fixed effects included

## 4. Discussion

The results confirm the export competitiveness role of PDO labelling in the French cheese industry. Benefiting from label allows firms to reach new markets (in particular outside of the EU), to export more in value terms and to export at higher prices (in European market only). Further investigations are needed. The evaluation of the extensive margin has to be extended to non exporting countries (our current estimation is restricted to firms who export at least once). The comparison of PDO authorized firms with similar non authorized firms using data on firms' characteristics may enrich our analysis by understanding the determinants and the impact of PDO labelling at the firm level. The difference of impact we observed in European and non European countries has to be developed, distinguishing European countries where PDO label are numerous (as Italy) from others.

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