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# Evaluation of the economic impact of geographical indications : three case studies

Aliou Baguissa Diallo

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Clermont-Auvergne

Par

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Sous la direction de :

Philippe JEANNEAUX et Catherine ARAUJO-BONJEAN

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EVALUATION OF THE ECONOMIC IMPACT OF GEOGRAPHICAL INDICATIONS : THREE CASE  
STUDIES

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*A ma mère Ramatoulaye Diallo*

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## Résumé

Les conditions de production et l'origine des produits sont des éléments de plus en plus déterminants dans l'acte de consommation, pareil au prix. Cette demande pour des produits de qualité représente une opportunité économique pour les agriculteurs, notamment localisés en zones difficiles.

Afin de satisfaire la demande des consommateurs en matière d'information sur l'origine des produits, de nombreux pays ont institutionnalisé l'indication de l'origine du produit comme un outil de politique publique (Appellation d'Origine Contrôlée/Protégée, Indication Géographique Protégée, etc.). Cependant, l'effet de ces politiques de certification de l'origine des produits sur le bien-être des producteurs n'a été que peu évalué à ce jour.

Dans cette thèse nous évaluons l'impact économique des politiques de qualité liées à l'origine en mobilisant des méthodes d'évaluation que nous adaptons à la spécificité de ces politiques de certification, notamment la dimension spatiale. Dans un premier temps, nous analysons l'effet de l'adoption de l'AOP sur le prix du lait ainsi que sur les coûts de production des producteurs de lait AOP en Franche-Comté en exploitant la discontinuité à la frontière (*Geographic Regression Discontinuity*). Dans un second temps, nous utilisons les méthodes d'appariement statistique pour analyser les hétérogénéités régionales en Auvergne, Rhône-Alpes et Franche-Comté avant de nous intéresser à l'effet à l'échelle nationale. Enfin, nous évaluons l'effet de l'adoption d'une IGP sur les prix payés aux producteurs de Café de Colombie à l'aide des méthodes comparatives (*Synthetic control methods*). Globalement, les résultats montrent un effet positif de l'adoption de l'IG sur la performance économique, cependant, cet effet est hétérogène entre les filières et les régions d'origine des produits.



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## Abstract

The conditions of production and the origin of products are more and more key determinant elements in consumption decision, at least as similar to price. This demand for quality products represents an economic opportunity for farmers, especially in difficult areas.

In order to satisfy consumer demand for information on the origin of products, many countries have institutionalized the indication of the origin of the product as a public policy tool (Protected Designation of Origin, Protected Geographical Indication, etc.). However, the impact of these product origin certification policies on the welfare of producers has been little evaluated to date.

In this thesis, we evaluate the economic impact of quality policies linked to the origin by mobilizing evaluation methods that we adapt to the specificity of these certification policies, in particular, the spatial dimension. First, we analyze the effect of PDO adoption on the price of milk and on the production costs of PDO milk producers in Franche-Comté using a Geographic Regression Discontinuity (GRD) design. Secondly, we use propensity matching methods to analyze regional heterogeneity in the Auvergne, Rhône-Alpes, and Franche-Comté regions before focusing on the effect of the PDO at the national level. Finally, we evaluate the effect of the adoption of a PGI on the prices paid to Colombian coffee producers using the Synthetic Control Methods. Overall, we find that PDO/PGI adoption is associated with a positive effect on farmers' economic performance, however, this effect is not homogeneously distributed.





# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Context and issues . . . . .	1
1.2	Previous evaluation of GIs policy . . . . .	4
1.3	Issues . . . . .	8
1.4	Areas of study . . . . .	11
1.4.1	Dairy sector in France . . . . .	11
1.4.2	Café de Colombia . . . . .	13
1.5	Contribution of the thesis . . . . .	16
<b>2</b>	<b>Evaluation of the economic impact of PDO policy at the demarcated area level: Geographic Regression Discontinuity Evidence from the case study of Comté</b>	<b>19</b>
2.1	Introduction . . . . .	20
2.2	Description of the supply chain . . . . .	21
2.3	Evaluation framework . . . . .	24
2.4	Data and descriptive analysis . . . . .	26
2.5	Econometric results . . . . .	32
2.6	Conclusion . . . . .	41
<b>3</b>	<b>Evaluation of the economic impact of PDO policy at regional and national level: Evidence from France dairy sector</b>	<b>43</b>
3.1	Introduction . . . . .	44
3.2	Conceptual framework and estimation method . . . . .	46

---

3.3	Data and descriptive analysis . . . . .	50
3.4	Results . . . . .	55
3.4.1	Methodological results . . . . .	55
3.4.2	Empirical results . . . . .	60
3.4.3	Average Effect . . . . .	61
3.4.4	Heterogeneous effect . . . . .	62
3.5	Conclusion . . . . .	68
<b>4</b>	<b>Evaluation of the economic impact of PGI policy at international level: The case study of “Café de Colombia”</b>	<b>71</b>
4.1	Introduction . . . . .	72
4.2	Café de Colombia . . . . .	74
4.3	Evaluation framework . . . . .	81
4.4	Data source . . . . .	82
4.5	Empirical analysis . . . . .	83
4.6	Discussion and conclusion . . . . .	91
<b>5</b>	<b>Conclusion</b>	<b>93</b>
5.1	Summary . . . . .	93
5.2	Lessons Learned . . . . .	95
5.3	Limitations and Directions for Future Research . . . . .	97
	<b>Appendix</b>	<b>99</b>

# List of Figures

1.1	Dynamic of the price of Comté, Cantal and generic milk at farm gate . . . . .	9
1.2	Labeling policies for animal products . . . . .	12
1.3	World coffee production . . . . .	14
1.4	Top 7 coffee producers' countries in the world . . . . .	15
1.5	PDO-PGI schemes vs regions in France . . . . .	18
2.1	PDO production area . . . . .	23
2.2	Distribution of sample across the common border . . . . .	28
2.3	Distance to PDO boundary in Kilometers . . . . .	31
2.4	Graphical depiction of price discontinuity at PDO boundary . . . . .	33
3.1	PDO boundaries in selected regions of origin . . . . .	63
3.2	Differential impact of PDO on price at farm gate . . . . .	65
3.3	Differential impact of PDO on added-value . . . . .	66
4.1	The defined area of production . . . . .	77
4.2	Price in Colombia and in Brazilian naturals producers countries . . . . .	84
4.3	Price in Colombia and in Robustas producers countries . . . . .	85
4.4	Price in Colombia and in other Milds producers countries . . . . .	86
4.5	Price paid to growers in Colombia and Synthetic Colombia . . . . .	88
4.6	Production and price paid to coffee growers in Colombia . . . . .	89
4.7	Placebo test (reassignment of treatment to control countries) . . . . .	90
1	Graphical depiction of price discontinuity at PDO boundary . . . . .	101



# List of Tables

1.1	Number of PDO and PGI by product in France in 2014 . . . . .	13
2.1	Eligibility to PDO area vs PDO adoption . . . . .	27
2.2	Definition of variables and summary statistics . . . . .	29
2.3	Distribution of sample by altitude . . . . .	30
2.4	Mean comparisons by PDO status . . . . .	32
2.5	Estimates of the PDO effect on milk price at farm gate . . . . .	35
2.6	Estimates of the PDO border effect on quantity sold . . . . .	37
2.7	Estimates of the PDO border effect on production costs . . . . .	39
2.8	Estimates of the PDO border effect on financial charges . . . . .	40
3.1	Definition of variables and summary statistics . . . . .	52
3.2	Difference in characteristics of PDO and PDO farms . . . . .	54
3.3	Distribution of price and added-value by regions . . . . .	54
3.4	Sample sizes for subclasses with the propensity score between $\alpha$ and $1 - \alpha$ . . . . .	57
3.5	Logit estimates of the propensity to adopt PDO strategy . . . . .	58
3.6	Distribution of sample by altitude . . . . .	59
3.7	Distribution of sample by proportion of farm located to less-favoured area . . . . .	59
3.8	Distribution of sample by region of origin . . . . .	59
3.9	Optimal number of blocks . . . . .	60
3.10	Average treatment effects (ATT) of PDO price at farm gate (in euro per litre) . . . . .	61
3.11	Average treatment effects (ATT) of PDO adoption on added-value . . . . .	62
3.12	Differential impact of PDO on price at farm gate by region of origin . . . . .	64

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3.13	Differential impact of PDO on added-value by region of origin . . . . .	66
4.1	Different protection of café de Colombia . . . . .	76
4.2	Coffee producers countries by type of coffee between 1995-2010 (Price) . . . . .	83
4.3	Country Weights in the Synthetic Colombia . . . . .	87
4.4	Coffee price predictors means . . . . .	87
1	Distribution of Census and FADN dataset by OTEX . . . . .	100
2	Distribution of Census dataset by size . . . . .	100
3	Distribution of EU's PDO and PGI across countries . . . . .	104
4	PDO-PGI scheme by product in Italy . . . . .	105
5	PDO-PGI scheme by product in France . . . . .	106
6	PDO-PGI scheme by product in Spain . . . . .	107
7	PDO-PGI scheme by product in Greece . . . . .	108
8	PDO-PGI scheme by product in Slovenia . . . . .	109
9	PDO-PGI scheme by product in Croatia . . . . .	110
10	PDO-PGI scheme by product in Cyprus . . . . .	111
11	PDO-PGI scheme by product in China . . . . .	112
12	PDO-PGI scheme by product in Thailand . . . . .	113
13	PDO-PGI scheme by product in Andorra . . . . .	114
14	PDO-PGI scheme by product in Colombia . . . . .	115
15	PDO-PGI scheme by product in India . . . . .	116
16	PDO-PGI scheme by product in Turkey . . . . .	117
17	PDO-PGI scheme by product in Vietnam . . . . .	118

# Introduction

## 1.1 Context and issues

The number of geographical indications (GIs) is currently estimated to be more than 10,000, with a potential trade value of more than 50 US billion ([Giovannucci et al., 2009](#)). GIs have seen heterogeneous development across regions. The European Union has the most developed GIs system in the world. At the community level, European Union (EU) has progressively abandon its quota and direct price support policy, and changed to promoting a quality policy, which is mainly based on the indication of the origin of products. In particular, two instruments have been developed, these are Protected Designation of Origin (PDO) and Protection of Geographical Indication (PGI). Both PDO and PGI refer to the name of a region, a specific place or in exceptional cases, a country, and are used to describe an agricultural product or a foodstuff originating in that region, specific place or country. However, unlike PGI, PDO requires that all stages of production take place in the demarcated area, thus it is narrower.

Specifically, PDO implies that:

- The quality or characteristics of the product are essentially or exclusively due to a particular geographical environment with its inherent natural and human factors; and
- The production, processing and preparation of the product take place in the defined geographical area.

More flexible, PGI implies that:

- The product possesses a specific quality, reputation or other characteristics attributable to that geographical origin; and



- 
- The production and/or processing and/or preparation of the product take place in the defined geographical area.

Thus, the difference between PDO and PGI is that, in the case of PDO, all production stages must take place in the defined area (from production of raw material to final product), whereas for PGI, the raw material can originate from another area<sup>1</sup>. By December 1996, there were only 326 products protected as PDO or PGI against 1 239 products in January 2015 (EU Door). Although about 90% of GIs come from the 30 countries of the Organisation for Economic Co-operation and Development (OECD), GIs are now increasingly perceived as an opportunity in many developing countries that have unique physical and cultural attributes that can be translated into product differentiation. So, development practitioners have been promoting the implementation of GIs in developing countries. For instance, the Food and Agriculture Organization (FAO) of the United Nations is implementing a quality and origin program to support the development of GIs in developing countries. Similarly, the French Development Agency (AFD) has recently funded a project of implementation of GI in Guinea (Coffee Ziama) and Cameroon (Honey of Oku and Penja Pepper). The development of PDO and PGI stems from both consumer and producer concerns.

Since the signing of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 1994, a long-standing struggle on Geographical Indications (GIs) between the European Union (EU) and the United States (US) has been intensifying. GIs are “indications which identify a good as originating in the territory of a member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin” Article 22:1<sup>2</sup>. Bordeaux wine, Darjeeling tea, Comté or Parmigiano-Reggiano cheeses are well-known examples of GIs.

Differences in the form and substance of GIs have been the subject of political and economic conflicts for many years between the two protagonists. Other countries around the world have aligned themselves with either the EU or the US. The two groups of countries hold strongly divergent views on what place GIs should have in the protection of intellectual property rights.

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1. EU regulations also protect traditional knowledge and methods of production through Traditional Specialties Guaranteed (TSG). However, TSG does not refer to the origin of the product.

2. But prior to the TRIPS agreement on GIs, many other international conventions existed such as the Paris convention for the protection of industrial property (1883), the Madrid Agreement (1891) and the Lisbon Agreement for the Protection of Appellation of Origin and their International Registration (1958); the Stresa convention for the use of Appellations d'Origine and Denominations for cheeses (1951); the International agreement on olive oil and table olives, Genève (1956).

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To some countries, GIs facilitate consumers' choice by conveying accurate information about the product origin and other attributes, whereas for other countries GIs are an unnecessary and undesirable form of protection for producers in a particular region against competition from new entrants ([Josling, 2006](#)).

The controversy is about the optimal level of GI protection: how to find the optimal balance between consumers' needs for information on product quality/origin and producer gains in designing GIs ([Fink and Maskus, 2006](#)). While geographical indications may provide an indication of the quality of the product, they may also in certain circumstances lead to exclusions and/or undeserved rents to producers ([Mérel and Sexton, 2011](#); [Menapace and Moschini, 2012](#)). As highlighted by [Josling \(2006\)](#), whether a GI is deserved is strictly an empirical question. For each application, public authorities should check that the presupposed link between the product and its geographical origin exist. If this correlation exists, the government should protect the product by local law and if not the application should be stillborn.

While these controversies have led to the recognition of intellectual property status for GIs, they have, however, hidden the analysis of the potential economic effects of GIs, which remain little known to date. Four arguments are often advanced in the literature to justify the protection of GIs ([Sylvander et al., 2006](#)). The first argument is the potential ability of GIs to convey accurate information to consumers and to protect producers against unfair competition. The GI certification is a third-party certification, which is also public. This makes it possible to send a signal of credible quality to the consumer. Furthermore, certification is a single logo on the product, which removes the need of the consumer to read all the ingredients of the product. This briefness of the information facilitates the choice of the consumer and limits the search costs. For producers, protection reduces fraud and prevents against usurpation of their product in two ways. On the one hand, protection excludes producers who do not benefit from the location in the production area from participating in the production. On the other hand, producers who are located in the production area but do not comply with the code of practices are also excluded of the production of the certified good. In the absence of protection, unscrupulous producers would be tempted to behave like a free-rider: enjoying the reputation of the product by selling a lower quality product at a high price without incurring costs. As a result, the benefits to producers are to protect the reputation of the product,

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but also to limit the dissipation of their income. The second argument refers to the potential ability of GIs of controlling supply in agricultural market. Indeed, GIs are based on quality differentiation and not on cost-reduction strategy. As a result, yield are expected to be lower in GIs production compare to standard agriculture. Moreover, many GIs supply chains argue that producing quality requires some supply control (Lucatelli, 2000). The third argument is related to the potential of GIs to sustain territorial, local, region and rural development. And the fourth argument advanced in the literature is the potential of GIs to preserve biodiversity and traditional knowledge.

## 1.2 Previous evaluation of GIs policy

All the work in this field seeks to answer the following question: “Are Geographical Indication (GI) certifications good or bad for consumers, producers and total welfare?”.

Theoretical studies have thoroughly analysed the welfare-enhancing effect of PDO/PGI certification (Lence et al., 2007; Menapace and Moschini, 2012; Mérel and Sexton, 2011; Moschini et al., 2008; Zago and Pick, 2004). They have analysed the relevance of PDO/PGI certification to address market failures and distortions which stem from the asymmetric information on product’s quality between producers and consumers (Akerloff, 1970). Roughly speaking, theoretical works compare the gains from better quality signaling to the cost of collective certification; and converge to a *conditional* welfare-enhancing effect of PDO certification. That is, PDO/PGI certification enhances welfare only if certain conditions are met, otherwise the certification could be welfare-reducing. Zago and Pick (2004) showed that PDO regulation can be welfare-reducing if the quality difference is low and certification costs high. Moschini et al. (2008) showed that PDO certification benefits producers only if production of high quality products draws on scarce factors that they own. In short, theoretically, PDO certification could have a welfare-enhancing effect or welfare-reducing effect (Bonroy and Constantatos, 2015), hence the need for empirical works.

Empirical studies have mainly focused on the demand side, and have evaluated consumers’ willingness to pay (WTP) for PDO/PGI products (Bonnet and Simioni, 2001; Darby et al., 2008; Grunert, 2005; Hassan and Monier-Dilhan, 2002; Hu et al., 2012; Menapace et al., 2011;

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Onozaka and Mcfadden, 2011; van der Lans et al., 2001; Van Ittersum et al., 2007)<sup>3</sup>. Deselnicu et al. (2013) meta-analysed the literature on consumers valuation of GIs and found that the highest percentage premium is obtained by GI products with short supply chains, and by relatively poorly valued products such as agricultural commodities. They also found that GIs which adopt stricter regulations (PDO) yield larger premiums than less regulated ones (PGI)<sup>4</sup>. However, work on consumers' WTP ignore production costs, even though evidence of significant PDO certification costs have been found in the literature (Bouamra-Mechemache and Chaaban, 2010; Arfini et al., 2006; Colinet et al., 2006). Therefore, the consumer WTP studies are likely to overestimate the actual benefits of PDO.

On the supply side, few studies have attempted to assess the effectiveness of PDO/PGI schemes in increasing the income of farmers using qualitative approaches (Economics, 2008; Paus and Rviron, 2010; Williams et al., 2009) or quantitative comparison methods (Barjolle et al., 2007; Barjolle and Thevenod-Mottet, 2004; De Roest and Menghi, 2000; Desbois and Néfussi, 2007). However, these studies are limited in their selection of methods because of their use of descriptive analysis. Barjolle et al. (2009) identified two main approaches used in the evaluation of GIs policy: *i*) subjective or qualitative approaches, and *ii*) objective or quantitative approaches.

The subjective approaches are based on direct interviews with stakeholders and expert point of views. For instance, Paus and Rviron (2010) interviewed about thirty experts with good knowledge of agricultural policy in Switzerland, the products being evaluated (the Rye Bread of Valais and its four main competitors in Switzerland), and their respective modes of production. Using a Likert scale, which is a graduated scale allowing interviewees to indicate their degree of agreement with respect to different statements, they find that PDO products are better than similar non-PDO products with respect to value added, price premium, and access to market<sup>5</sup>. Also, Economics (2008) used the responses of producers and expert evaluations and a wide set of subjective methods to assess the effectiveness of PDO/PGI schemes in relation to their objectives. In the United Kingdom, Williams et al. (2009) conducted 25 interviews: 10 interviews of stakeholders for each case study (Jersey Royal Potato and Welsh Lamb) and

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3. Notable exceptions are Bouamra-Mechemache and Chaaban (2010), Bontemps et al. (2012)

4. In the specific context of France, some empirical work shows that PDOs label is less valued than the brand for the case of Camembert (Bonnet and Simioni, 2001; Hassan and Monier-Dilhan, 2002)

5. The main interest of the Likert scale method is to quantify the attitudes and to emphasize consensus and divergences within groups

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five retailers, who were questioned about both products. They find that the PDO Jersey Royal Potato was consistently linked to price premium, but the PGI Welsh Lamb was not.

Although, subjective approaches provide useful insights to the researcher on the type of impact to assess, they are not sufficient to rigorously evaluate the impact of PDO/PGI schemes. The subjective approach is potentially subject to a subjective bias, that is, the perception or point of view of stakeholders may differ from the story told by data. Moreover, subjective approaches do not allow quantification of the scale of the impact (i.e. magnitude of the effect). Subjective approaches should, therefore, serve as a preliminary stage, aiming to guide researchers in identifying the type of impact to assess later using objective approaches (De Janvry et al., 2010).

The second approach used by the existing case studies is “quantitative” or “objective”. Objective approaches rely on hard data, either collected by researchers by a field survey for instance, or provided by a secondary official source such as the national office of statistics. Objective approaches can be divided into synchronic and diachronic comparison methods. Synchronic comparison consists of comparing the economic performance of a PDO product or supply chain to a similar non-PDO product or supply chain. Conversely, diachronic comparisons focus on the same product or supply chain, and compare the economic performance before and after the PDO initiative. Put succinctly, the synchronic method compares the “with” and “without” PDO situation; the diachronic method compares the situation before and after the PDO initiative.

Chatellier and Delattre (2003) compare the income per work unit of PDO supply chains in the northern Alps of France to the national average, and find that PDO supply chains have better performances despite low subsidies. This performance could be partially explained by higher milk selling prices as shown by Hauwuy et al. (2006). According to the authors, the PDO milk price from the northern Alps region of France is 50% higher than the average national price. Furthermore, Desbois and Néfussi (2007) find that the PDO milk price is sufficiently high to cover extra costs, when comparing the PDO milk price at the farm gate to the national average. Instead of comparing PDO performance to the national average, some studies compare PDO to an industrial supply chain (De Roest and Menghi, 2000; Dupont, 2004; Paus, 2003), and find similar results. For instance, Dupont (2004) compares the economic performance of

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PDO Comté to Emmentaler and finds various positive effects in favour of PDO Comté, including price premium and high income. [De Roest and Menghi \(2000\)](#) applied a similar method to highlight the benefits of PDO with respect to rural employment. The authors compare PDO Parmigiano-Reggiano cheese to the industrial milk supply chain in Italy: the PDO product generates higher rural employment levels thanks to its labour-intensive practices. [Paus \(2003\)](#) using the same method, analyses the performance of Raclette cheese in Switzerland compared to the consumer milk: she found that the PDO Raclette supply chain helps to preserve both land and local knowledge, as well as maintaining regional specificity. [Barjolle et al. \(2007\)](#) compare the price of PDO milk to standard milk for various PDO cheeses from France (Cantal, Comté) and Switzerland (Gruyère, Emmentaler). They find a substantial difference in price in the case of Comté and Swiss Gruyère: the price of PDO milk is 15 to 25% higher than generic milk. However, they fail to find any price premium in the case of PDO Cantal. Moreover, the price of PDO milk can even be lower than standard milk, as in the case of PDO Emmentaler in Switzerland.

Some studies compare the economic performance of the supply chain before and after the introduction of PDO/PGI schemes. Using the diachronic method, [Barjolle and Thevenod-Mottet \(2004\)](#) analyse the effect of the recognition of PDO status to Abondance cheese on the quantity produced, delocalisation of firms, and concentration. They find that the total volume produced of Abondance has increased by more than 50% in six years. They also find that PDOs do not escape the concentration trend prevailing in the agri-food sector in France, since six companies produced about 60% of the total volume of the PDO Abondance. The small number of studies using diachronic comparison is explained by the lack of prior PDO data in Europe, where most of PDO/PGI schemes are well-established and old.

A final kind of study combines the subjective and objective approaches ([Arfini et al., 2009](#); [Carbone et al., 2014](#); [Galli et al., 2011](#)). For instance, [Galli et al. \(2011\)](#) compare the performance of eleven Italian PDO cheeses, using a pair-wise comparison on a set of indicators grouped into five PDO scheme objectives (bargaining power, information, market performance, differentiation, rural development). They use a weight to reflect the preference of policy makers for each objective, and ranked PDOs according to an average score of performances. They find that small PDOs, with a strong tradition of high quality cheese, from the Piedmont region in

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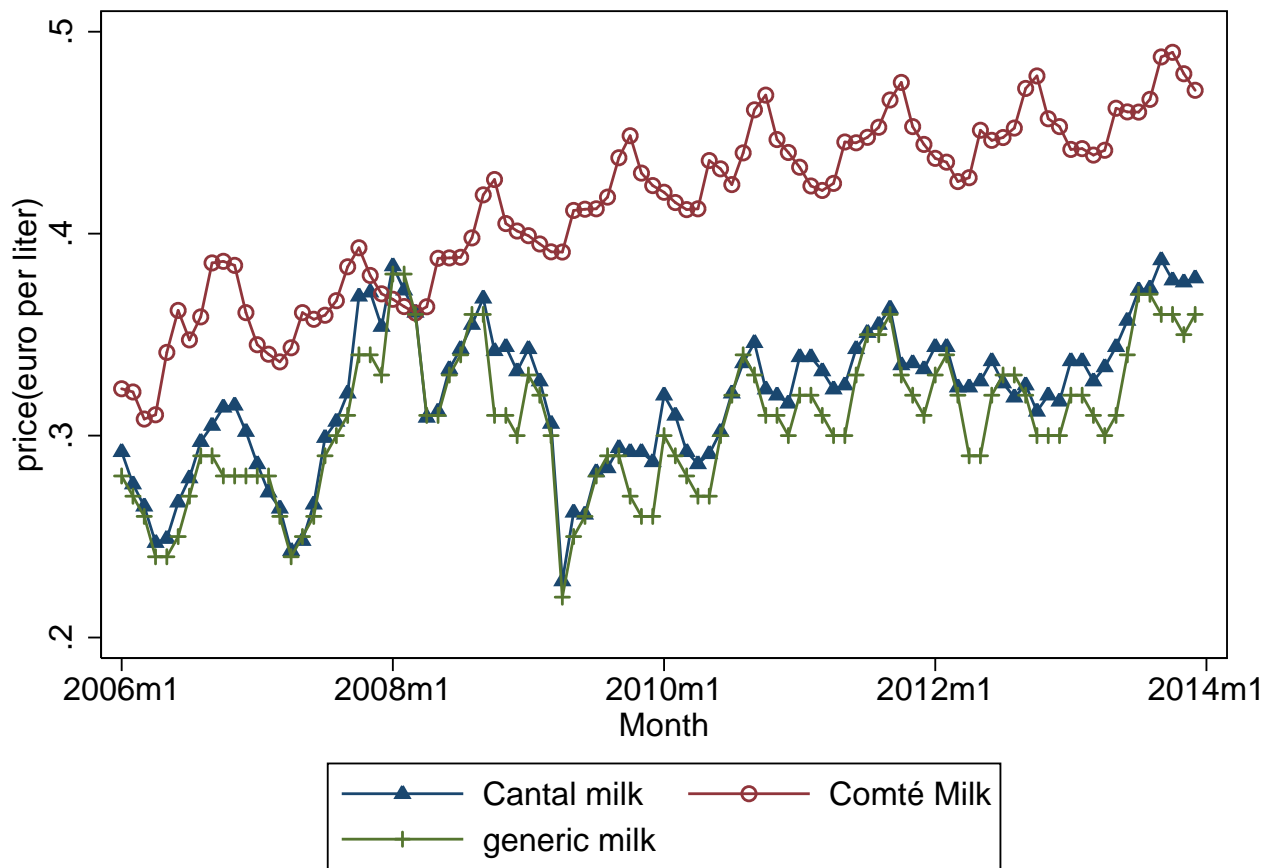
northern Italy were the top ranked. [Carbone et al. \(2014\)](#) apply the same method to Italian cheese and olive oil sectors, and find similar regional heterogeneity. These studies also provide useful insights on the internal coherence of the PDO policy. However, although the pair-wise comparison relies on official data sources, weights used to obtain average score are subjectively set by researchers.

### 1.3 Issues

In the context of the standardization of agricultural products and the emergence of health crises, consumers are increasingly interested in the quality of the products they purchase. They attach importance to the history behind products, their conditions of production and traceability, at least as much as to price. The quest for genuine products is generating a growing demand for agricultural products with an identifiable geographical origin. The consumers' incentives to pay a higher price for GI products are linked to the quest for quality for health issues but also to support local producers. It would therefore be expected that these higher prices will benefit producers. However, in the case of some GIs, there is no difference in price between the GI and its nearest substitute. For instance, the farm gate price of milk in the PDO Comté supply chain is 30% higher than generic milk over several decades now, whereas there is no significant difference between the price of milk used in Cantal manufacturing and generic milk, although both Cantal and Comté are GIs ([fig. 2.2](#)). Similar examples also exist in developing countries. For instance, despite a successful increase in sales volumes, the introduction of the Mexican Tequila GI has largely failed to benefit the local community and environment. Influential actors have manipulated production standards in ways that contradict the theoretical concept of a GI and negatively affect the overall quality of tequila ([Bowen, 2010](#)). In contrast, empirical evidence of the household welfare enhancing effect of GI adoption has been found in the case of Basmati GI ([Jena and Grote, 2012](#)).

Naturally, various questions arise from [fig. 2.2](#): Why the price of milk in the two GI supply chains (i.e. Comté and Cantal) is so different, given that both supply chains produce the same product (i.e. milk) and benefit from the same protection? Can we claim a causal link between the adoption of GI and the difference observed in price in favor of PDO Comté through a simple comparison? What types of bias are associated with a naive comparison?

Figure 1.1: Dynamic of the price of Comté, Cantal and generic milk at farm gate



Source: Author using SSP-Agreste monthly data



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The lack of significant difference between the Cantal milk price and generic milk, despite the PDO, implies that more research is desirable to understand the mechanisms through which PDO policy improves welfare. This also shows that the effect of PDOs on economic performance is not automatic, but rather conditional on other factors that deserve to be explored. In other words, it is a question of going beyond an analysis of the PDOs as a simple tool of legal protection. The final goal is to understand what is done with the Comté but not with the Cantal, and what could explain this divergence of trajectory.

Although focusing on a case study provides useful insights on specific mechanisms, their external validity is limited. That is, findings cannot be generalized to the target population. In our example, the finding for the PDO Comté cannot be generalized to all the milk producers in France. Yet, policy makers are likely to be more interested about what happens at regional or national level instead of a specific case study.

Although a relationship undoubtedly exists between economic performance and PDO adoption, the cause-and-effect evidence is very scant. Most previous studies used comparative methods to evaluate the effect of Geographical Indications (GIs). They compare GI product/supply chain with similar non-GI product or industrial supply chain (i.e. synchronic comparison) or they compare the economic outcome of a supply chain before and after GI adoption (i.e. diachronic comparison).

Two types of bias are associated with the synchronic comparison method. The first bias is linked to the limited number of cases (unit of analysis). Indeed, because synchronic comparison is based on limited cases, there is a risk that researchers pick up case studies subjectively in a way to validate or (reject) a given hypothesis. [Galtung \(1967\)](#) warns against “traditional quotation/illustration methodology, where cases are picked that in accordance with the hypothesis, and hypotheses are rejected if one deviant case is found”. The second bias is linked to the difficulty of controlling for different factors (e.g. public support, geographical location) that may influence the performance. The difference observed between GI and non-GI units may come from these factors instead of from the GI *per se*. Therefore, a careful evaluation of GI policy requires controlling for covariates in order to maximise comparability and reduce the risk of confounding the effect of GI with other factors.

Although diachronic comparison reduces this bias, by focusing on the same unit at different

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times, it is not sufficient because the same unit is not really the same at different times (Lijphart, 1971).

## 1.4 Areas of study

This thesis primary focus is on first stage actors in the dairy sector in France (i.e milk producers) and coffee growers in Colombia.

### 1.4.1 Dairy sector in France

France has the oldest and most well-developed system of GI protection in the world. Historically, early in 1905, France passed the first law on the “Appellation d’Origine Controlée (AOC)”, which demarcated production areas (Trubek and Bowen, 2008). However, the concept of AOC as defined by the 1905 law did not link products quality to its origin’s characteristics such as soil attributes or climatic conditions. In May 1919, the AOC were redefined to include the concept of “uniqueness” and “quality”<sup>6</sup>. In 1935, a national body called *Institut National des Appellations d’Origine* (INAO) were created to handle the French policy of quality and origin<sup>7</sup>.

The PDO strategy has been developed in France, mainly, in wine and dairy sectors. Among animal products, PDOs are highly correlated with milk and dairy products (fig. 1.2). Currently, dairy PDOs include 45 cheeses, 3 butters and 2 creams while the PGIs include 6 cheeses and one cream (table 1.1). In 2013, PDO cheeses represented 15.2% of matured cheeses, 1.6 billion euros of turnover, that is to say 25% of “cheese” turnover of the dairy industry, other than fresh and melted cheeses. The PDO cheeses are also characterized by the use of raw milk as raw materials (3/4 of processed milk is raw milk).

Since 2000, the production of PDO cheeses in France is stable at around 190, 000 tons with a turnover approximately estimated at 1.4 billion euros (INAO and CNAOL, 2014). In 2013, about 20 000 dairy farmers were engaged in PDO strategy.

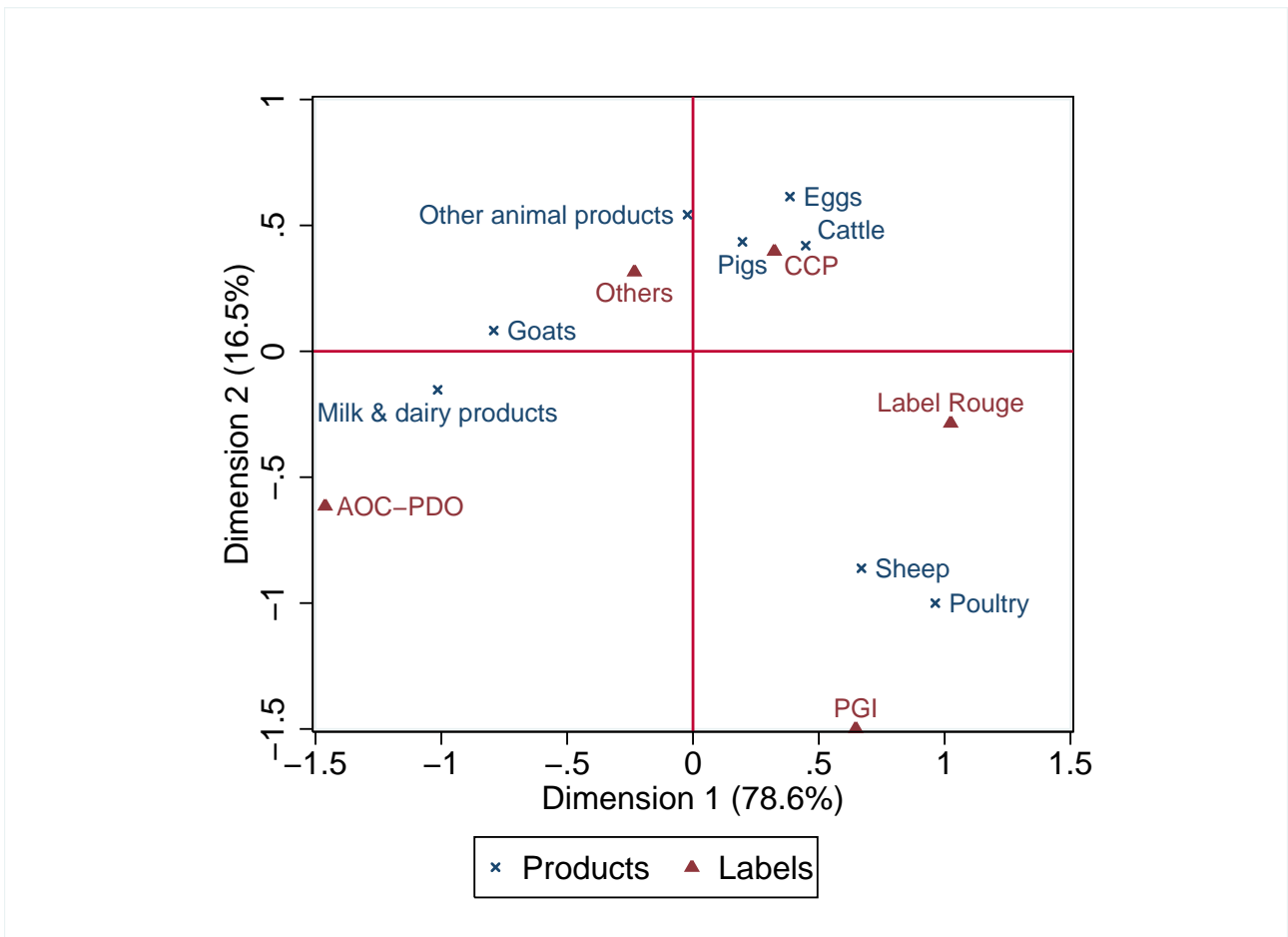
According to milk type, cheeses can be categorized into three groups:

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6. Law of 6 May 1919, as Amended, on the Protection of Appellation of Origin, *Journal Officiel de la République Française*, 08 May 1919

7. Legislation Decree of 30 July 1935, as Amended, on the protection of the Wine Market and the Economic Regime Governing Alcohol, *Journal Officiel de la République Française*, 31 July 1935.

Figure 1.2: Labeling policies for animal products



Source: Author using 2010 agricultural census

Table 1.1: Number of PDO and PGI by product in France in 2014

Product	PDO/AOC	PGI
Cheeses	45	6
Butters	3	
Creams	2	1

*Source: INAO (2014)*

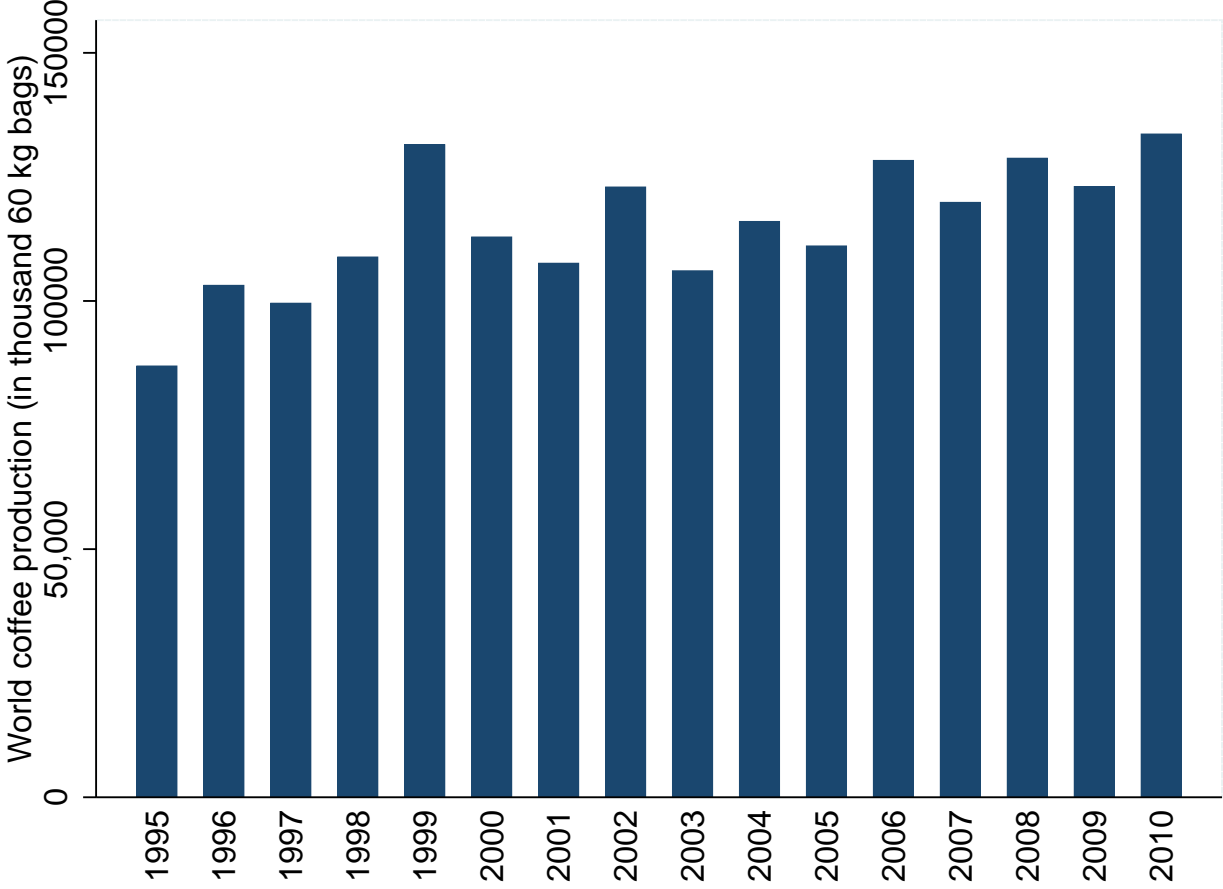
- Cow’s milk: In 2013, PDO cheeses from cows milk represent 86% of PDO cheese sales and 28 out of 45 PDO cheeses are produced using cow’s milk.
- Sheep’s milk: This category represented 11% of total volume of PDO cheeses sales in 2013, only 3 PDO cheeses are produced using sheep’s milk and.
- Goat’s milk: This category represented 3% of total volumes of PDO cheeses sales in 2013, only 14 PDO cheeses are produced from goat’s milk.

The production technology is another source of PDO cheese diversity. In term of production technology, we can distinguish four categories of cheese: soft cheeses (e.g.: Mont d’Or, Camembert de Normandie, Brie de Meaux etc.); veined cheeses (e.g.: Bleu d’Auvergne, Fourme d’Ambert, Bleu des Causses etc.); hard pressed cheeses (e.g.: Comté, Beaufort, etc.) and pressed uncooked cheeses (Cantal, Saint-Nectaire, Morbier etc.). In addition, historical local practices, which differentiated PDO cheeses further, ensured they had a strong local character and uniqueness. The diversity of PDO cheeses comes from the differences of their regions of origin (mountain vs plain area), including geographical and climatic conditions, and cultural differences.

### 1.4.2 Café de Colombia

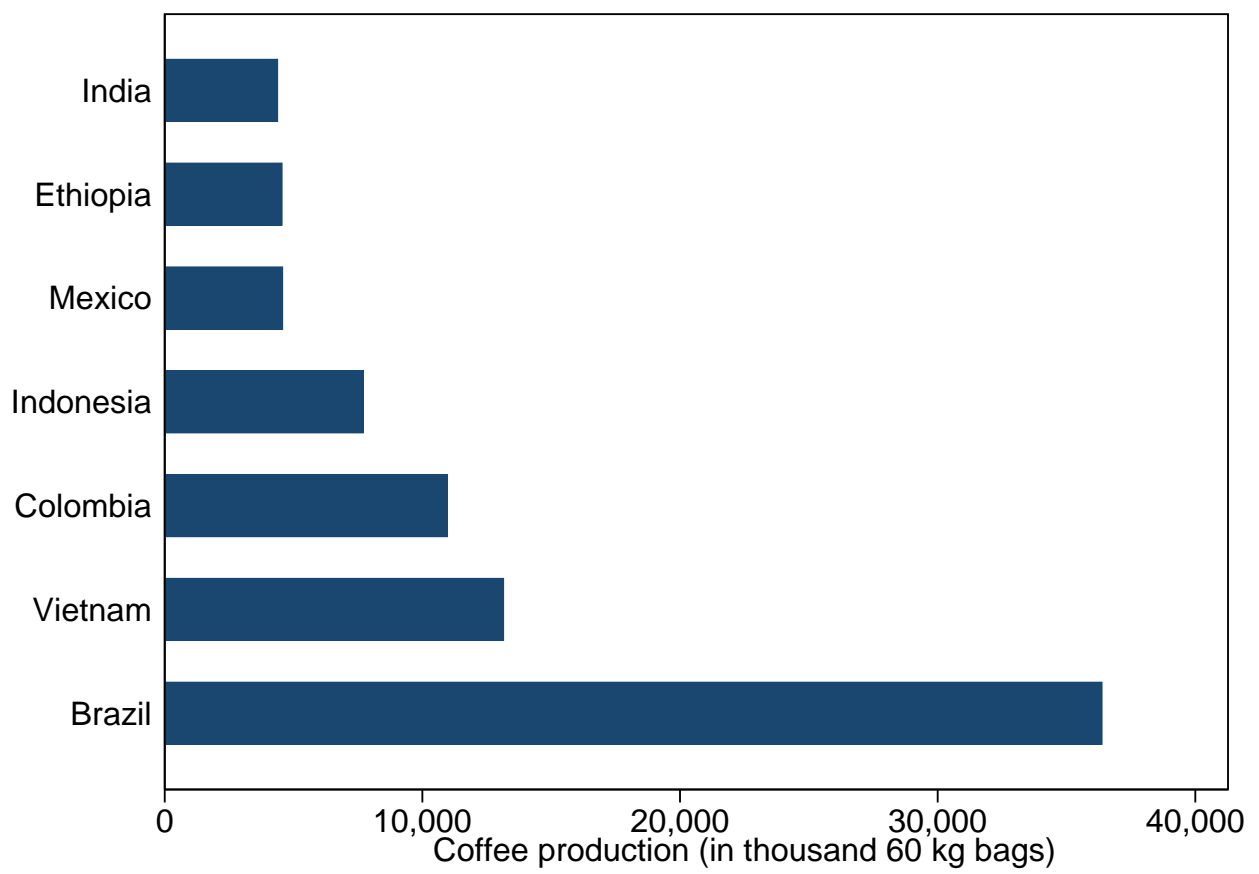
The “Café de Colombia” is the first non-EU product to have benefited from the EU’s PGI protection in 2007. Although PGI “Café de Colombia” differs from French well-established PDO in term of regulation (PGI less restrictive than PDO), farmers from the two countries face similar concentrations of downstream actors beyond the farm gate. The coffee market is also characterized by high concentration of production. World coffee production increased by more than 50% between 1995 and 2010, from 87 million 60 kg bags to 134 million bags (fig. 1.3). The top seven coffee producers represent 79% of the world production and the three largest producers-Brazil, Vietnam and Colombia, produce 60% of world coffee (fig. 1.4)

Figure 1.3: World coffee production



Source: Author using ICO data

Figure 1.4: Top 7 coffee producers' countries in the world



*Source:* Author using ICO data

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## 1.5 Contribution of the thesis

This thesis aims to evaluate the impact of PDOs on the performance of farm, the thesis uses methods that allow overcoming the bias that we have just highlighted. The present thesis contributes and completes existing studies in three ways.

Firstly, we use a geographic regression discontinuity design to evaluate the effect of PDO, with a primary focus on Comté milk producers. This chapter contributes to existing literature on GIs both in term of methodology and empirical findings. Methodologically, we use for the first time in this literature the geographical delimitation of GIs and geo-referenced data of farms location to infer a causal effect. As discussed in the previous section, a simple comparison of PDO and non-PDO supply chain outcomes does not accurately identify the causal effect. The difference observed may come from systematic difference in observables (e.g. plain vs mountains locations) and/or unobservable characteristics (e.g. motivation, social capital). The geographic regression discontinuity (GRD) controls for difference in observable and unobservable characteristics, by comparing farms located on either side of the geographic boundary of the GI. The geographic delimitation is assumed to be exogenous to farmers because eligibility to the GI defined area is mainly based on the climatic conditions (e.g. soil quality), which are exogenous. Moreover, the boundary of GIs follows the local government boundaries (i.e. communes). This method also have the advantage of relying on an element which is common to all GIs, that is, the delimitation of a geographic area. It can be applied to evaluate the effect of all GIs, at least at farm level. This allows comparison of the result from various studies, since using the same method across GIs neutralizes the variability of findings linked to methodological choices. Empirically, we apply the GRD method to identify the effect of PDO on farm gate milk price in Comté. This allows us to answer the question of whether the gap between Comté milk price and generic milk, depicted on fig. 2.2, is associated with PDO adoption. Additional qualitative analysis has given an understanding of what is going on in Comté, but not in Cantal. The main finding is that the legal protection PDO is not sufficient condition to improve economic performance, additional mechanisms are required. We have also contributed empirically by evaluating the effect of PDO on production and financial costs. Previous studies mainly focus their analysis on price. However, numerous studies have outlined the potential cost disadvantages of PDO producers, therefore, ignoring these costs may result in a skewed actual benefit of

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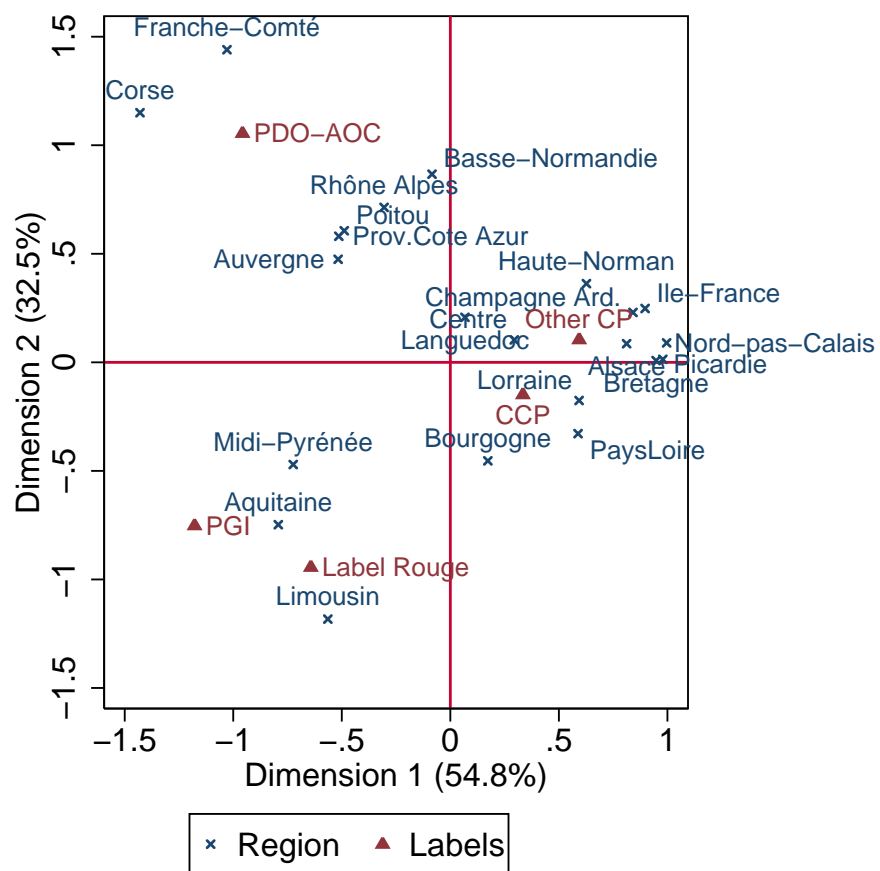
GIs. But at the same time we can argue that producers may behave strategically by including in the code of practices only practices anchored in their habits, which do not involve extra costs. Therefore, whether the adoption of PDO leads to extra costs or windfall effect is specific to the context of the analysis.

Although focusing on a specific case study like Comté provides useful insights, policymakers may instead be interested in the effect at large scale level (e.g. regional or national). In the second chapter, we first evaluate the effect of PDO on price and added-value at the national level using block/stratification estimator. The estimator involves three main steps: i) modeling the participation decision of farmers in PDO through an estimation of propensity score; ii) splitting the estimated score into homogenous blocks, that is, with no significant difference in propensity score on average; iii) Estimating the effect by block and weighting block effect to obtain average effect. Because the development of PDO in France is highly correlated to regional specifics (fig. 1.5), we also assessed some regional heterogeneity. Empirically, we found that PDO is associated with a significant increase in both price and added-value. However, these average results hide a lot of heterogeneity between different regions of origin. In particular, we find that PDO policy is effective in increasing price and added-value in the regions of Franche-Comté and Rhône-Alpes, but not in Auvergne.

The last empirical chapter uses a comparative case studies method to evaluate the effect of PGI adoption on the price paid to coffee growers in Colombia. Methodologically, comparative method and statistical methods differ in the number of observations. Comparative method is suitable when the number of treated unit is limited, between one and three. In our case, Colombia is compared to other producing coffee countries. But unlike previous case studies on GIs, which use diachronic or synchronic comparative methods, we use the synthetic comparative method recently developed by [Abadie \(2003\)](#); [Abadie et al. \(2015\)](#). The synthetic control combines the diachronic and synchronic comparison to overcome the methodological limitations of using them separately. Empirically, we found that PGI policy increases the price paid to growers by more than 30%, and we draw lessons for other countries for successful certification in developing countries, as well as the challenges in the implementation of this place of origin policy.



Figure 1.5: PDO-PGI schemes vs regions in France



Source: Author using 2010 agricultural census

# Evaluation of the economic impact of PDO policy at the demarcated area level: Geographic Regression Discontinuity Evidence from the case study of Comté

We use a geographic regression discontinuity (GRD) design and a georeferenced database to evaluate the economic impact of Protected Designation of Origin (PDO) policy on dairy farmers in Franche-Comté region (France). We find a sharp and significant conditional price change of about 25% and 31% between farms immediately located on either side of common PDO border. However, we find no change in quantities of milk delivered, implying that PDO mainly increases the revenue of dairy farms through price premium. We also find that farms located on either side of PDO border have similar production costs, reflecting a “deadweight effect”, that is, the code of practices mainly includes production practices that are anchored in habits.

*Keywords:* PDO, GRD design, geo-referenced data, dairy sector, farm performance.

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## 2.1 Introduction

Over the last three decades, Geographical indications (GIs) have emerged as a collective Intellectual Property Rights (IPR) in both developed and developing countries. The number of GIs is estimated to more than 10 000 in the world with a trade value of more than 50 billion US dollar ([Giovannucci et al., 2009](#)). Well-known examples of GIs include Darjeeling tea, Bordeaux wine, Parmigiano-Reggiano and Comté cheese. The World Trade Organizations Agreement on Trade-Related Aspects of IPR defines GIs as “indications which identify a good as originating in the territory of a Member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin” Article 22:1.

The legal aspects of GIs have been widely documented in the literature ([Josling, 2006](#); [Evans and Blakeney, 2006](#); [Barham, 2003](#); [Yeung and Kerr, 2008](#); [Fink and Maskus, 2006](#)). However, less attention have been paid to the economic impact of GIs. Theoretically, GIs can enhance welfare by conveying accurate information to consumers and limiting free-rider behavior among producers([Lence et al., 2007](#); [Menapace and Moschini, 2012](#); [Moschini et al., 2008](#); [Zago and Pick, 2004](#)). But, GIs can also be source of undeserved rents for producers ([Mérel and Sexton, 2011](#))<sup>1</sup>. The few empirical existing studies mainly focus on consumers willingness to pay for GIs product ([Bonnet and Simioni, 2001](#); [Ali and Nauges, 2007](#); [Costanigro et al., 2010](#); [Darby et al., 2008](#)), while works on supply side are scarce and mainly descriptive<sup>2</sup>. Moreover, these previous studies use different methods; therefore limiting the comparability of results across studies.

This paper evaluates the impact of GIs on revenues and cost of farmers, with a primary focus on dairy milk producers in the Franche-Comté region (France). We contribute to the literature on the evaluation of the economic impacts of GIs in three ways. Firstly, we propose an original method for the evaluation of GI impacts: Geographically Regression Discontinuity (GRD) design. This method can be applied to all GI evaluations since it relies on the only thing common to all GIs, namely the delimitation of the geographical area of production. Having a transposable evaluation method contributes to a better understanding of GIs and knowledge, insofar as it makes it possible to neutralize the variability of the results between

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1. see [Bonroy and Constantatos \(2015\)](#) for a broad review of theoretical works

2. see [Deselnicu et al. \(2013\)](#) for a meta-analysis of studies on consumers' willingness to pay for GI products

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studies linked to methodological choice. Therefore, this method may serve as a framework for future assessments of GIs in both developed and developing countries. Secondly, we introduce geolocalized data sufficiently detailed (longitude and latitude), making it possible to locate each farm and to calculate the boundary of the defined geographical area of production. Thirdly, the advantage of our evaluation design is that the GRD is intuitive. The method compares the economic performances of farms located just across the common border, i.e. for which the conditions of production are identical. Then, the method facilitates the dissemination of results to professionals and policy makers.

The rest of the paper is organized as follow. Section 2.2 briefly describes Comté supply chain. Section 2.3 presents the design of our evaluation. Section 2.4 describes the data used in the analysis. Section 2.5 presents empirical findings and section 2.6 presents conclusions.

## 2.2 Description of the supply chain

GIs knew a different development according the regions. European Union has the most developed GIs system in the world, namely Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI). PDO and PGI have been widely adopted EU member countries as public policy in the last three decades. According to the main government body in charge of quality schemes in France-Intituit National des Appellations d'Origine (INAO)-Comté is the largest French dairy PDO cheese. Since 1990, the Comté production significantly increased by more than 15 000 tons. The PDO Comté supply chain has been developed on a specific technical and social division of labor (Perrier-Cornet, 1986). The dairy farmers, organized in collective cheese-making units, control the process from milk to fresh cheese (i.e. non-mature cheese) but do not have access to the market. In contrast, cheese maturers have the quasi-exclusive access to the market without being involved in the first stage process. The prohibition of mature cheese production at the farm level established the role of the cheese-makers and their specific know-how. This labor division is still very present along the PDO Comté supply chain. This labor division and specialization along the supply chain contributed to the development of traditional know-how, recognized and protected today by the appellation of origin.

Three important stages lead to the construction of PDO Comté (Perrier-Cornet, 1990): (i) the territorial exclusivity was the first step, (ii) the collective definition of the code of practices

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and (iii) the management of the supply.

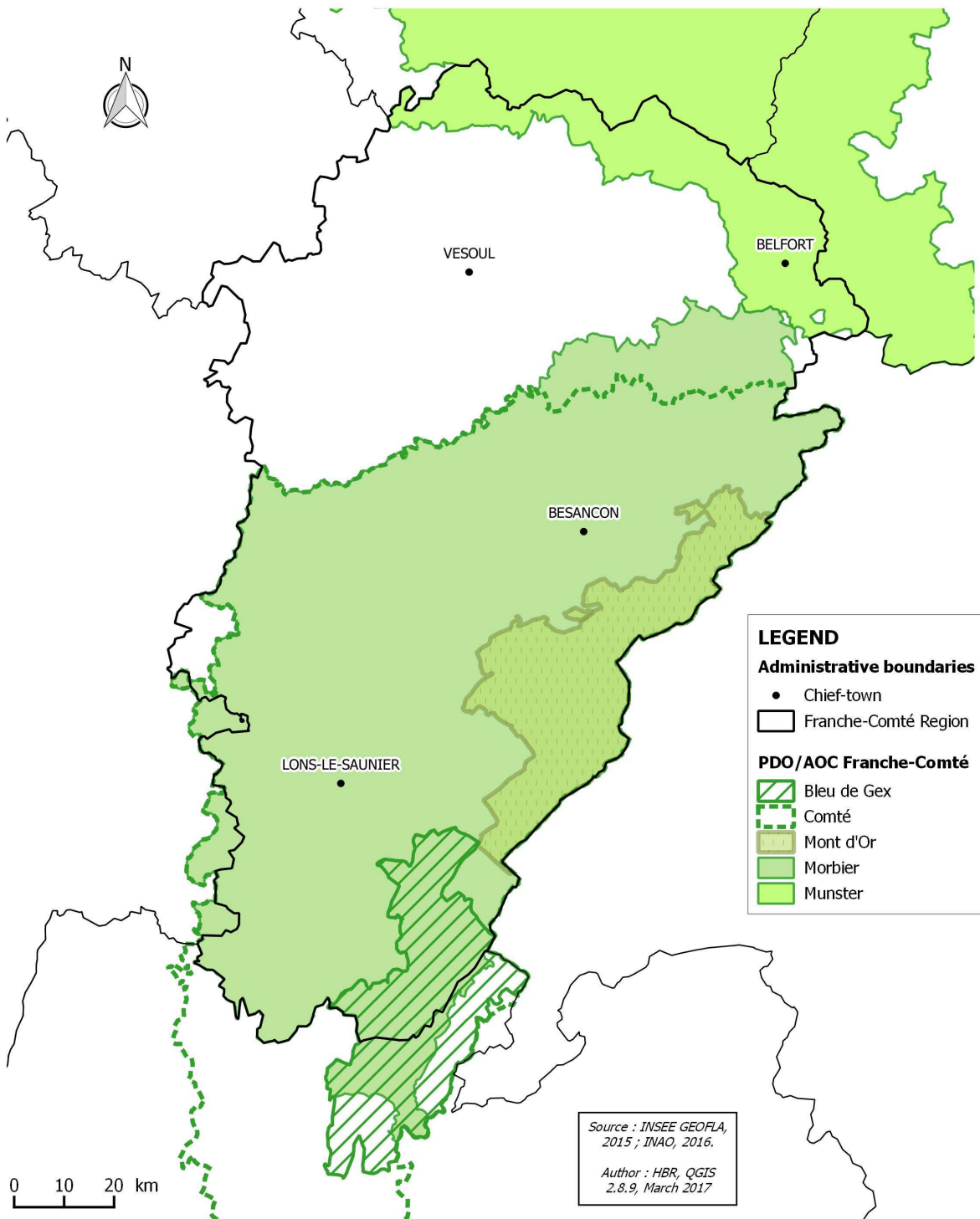
The protection of Comté cheese starts with a ruling of the Magistrates Court of Dijon in 1952. The production area was restricted in 1998 in order to better match with the effective production territory. This restriction also aimed to prevent from the recent development of Comté production in the departement of Haute-Saône, which borders the historical production area of Doubs and Jura (fig. 4.1).

The second step consisted in collectively setting the production rules. The quality requirements were collectively set by the stakeholders involved in the Comté cheese production. The code of practices progressively exclude intensive agricultural practices. This led to specifications of animal feeding (e.g. corn silage prohibition, GMOs' prohibition or cows' grazing mandatory), local breeds (mandatory use of Montbéliard or Simmental breed), and of a set of supply control mechanisms (e.g. milking robot prohibition, land load limitation ratio of one hectare fodder per milking cow, maximum milk-land productivity ratio of 4 600 liter milk per hectare). Raw milk, feed based on grass and hay are crucial requirements that were highlighted in numerous research studies (Barjolle et al., 1998). Similar requirements were set for the downstream actors. This precise definition of the code of practices strengthens the link between the product and the *terroir* and helps reaching high gustatory quality for Comté cheese. Moreover, the code of practices promotes small-scale local dairy units and forces large industrial groups involved in the supply chain to respect such requirements at dairy stage and thus, face similar production costs.

Finally, a third phase sought to control the cheese supply. The interprofessional Comté organization controls today its supply through a mechanism of “campaign planning” which defines the volume of production every year to avoid cheese shortage, overproduction and price volatility.

On the one hand, one might think that the implementation of the CoP increases the production costs. On the other hand, one might think that dairy producers would only incorporate into the CoP practices already rooted in their production habits, particularly in mountain areas. This would give rise to windfall effects: the specifications of the CoP would only legally establish these practices in the mode of production. Moreover, the spirit of the PDO is based

Figure 2.1: PDO production area



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on the valuation of local resources (i.e. grass) which limit the dependence of the farmers on the inputs. Such practices may not result in additional production costs.

Evaluating the impacts of the CoP will require designing a framework which allows to compare similar farms in terms of natural conditions of production but which differ only on the adoption of the CoP by some and the non-adoption for others. Thus, it is necessary to compare PDO and non-PDO farms both located in mountain areas. Indeed, PDO farms face structurally different production conditions than those located in plain areas.

## 2.3 Evaluation framework

To evaluate the causal effect of PDO adoption on revenue (price and quantities) and production costs, we use a semi-logarithmic specification following (Gopinath et al., 2011):

$$\ln Y_i = \alpha_0 + \alpha_1 PDO_i + \alpha_2 D_i + \alpha_3 PDO_i \times D_i + \alpha_4 X_i + \epsilon_i \quad (2.1)$$

Where  $Y_i$  represents dependent variables,  $PDO_i$  is a dummy causal variable equal to one for farms located in the demarcated geographical area and 0 otherwise,  $D_i$  is the distance in kilometers of farm  $i$  from the boundary of demarcated area. The boundary is normalized to zero such that farm  $i$  has positive distance if located inside the demarcated area and a negative distance if located outside the demarcated area.  $X_i$  represents covariates and  $\epsilon_i$  is the error term. The advantage of a semi-logarithmic specification is that it allows to interpret our parameter of interest  $\alpha_1$  as a percentage of impact of the PDO adoption on the outcome  $Y_i$ .

The validity of this model relies on the continuity of unobserved characteristics  $\epsilon_i$  (?). That is, PDO and non-PDO farms located at the boundary of the PDO area have similar unobservable characteristics. Because  $\epsilon_i$  is not observable, we cannot directly test whether it is continuous at the boundary. However, we can assess the reliability of the identification assumption by testing whether the observable characteristics  $X_i$  are continuous at the boundary. If observable characteristics are continuous, there is no reason that unobservable characteristics would not be so. In other words, if the observable characteristics  $X_i$  do not change discontinuously, we can feel confident that the unobservable characteristics also do not change discontinuously at the PDO boundary.

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This framework is a direct application of Regression Discontinuity (RD) methods, where the distance to the boundary is the treatment-determining variable. The RD methods are increasingly popular in economics<sup>3</sup>. Recent examples of GRD in developed countries include [Keele and Titiunik \(2014\)](#), and for example in developing countries see [Aker et al. \(2014\)](#).

In this paper, we use a Geographically Regression Discontinuity (GRD) design. The cutoff is the boundary which is normalized to zero and the the distance to the boundary is the treatment-determining variable, hence the name of geographically regression discontinuity.

Intuitively, the assignment variable determines the individual’s eligibility for treatment (assignment). In our case, the distance to the border is the treatment-determinant variable (positive or negative). It tells us whether the farm is in the PDO area (positive distance to the border) or not in PDO area (negative distance to the border). All farms located within the area can potentially benefit from treatment, while farms outside the PDO cannot. Farms located in the PDO area may choose, however, not to adopt the PDO.

If all farms within the PDO area have effectively adopted the PDO, then the distance to the border defines deterministically the adoption of the PDO. In other words, if we know the location of farm (i.e.the distance), we know precisely whether the farm receive the treatment (adoption of the PDO) or not (not adoption of the PDO). This configuration is refereed to as a “sharp RDD” in the literature ([Imbens and Lemieux, 2008](#)).

Conversely, if some farms located in the PDO eligibility area have not adopted it, then this is a “fuzzy RDD” model: the location does not give a deterministic indication of the PDO adoption. In this case, the PDO variable that corresponds to the endogenous choice of the farmer to adopt or not the PDO must be instrumented by an exogenous variable: eligibility for PDO which depends strictly on conditions exogenous to the farmer such as administrative borders of the communes, pedo-climatic conditions ([Angrist and Imbens, 1995](#)).

The distribution of the farms in our sample will then determine whether we should use a sharp or a fuzzy RDD.

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3. For a practical to the RD method see [Imbens and Lemieux \(2008\)](#). See also the special issue of the Journal of Econometrics of February 2008 and the edited volume ‘Regression Discontinuity Designs: Theory and Applications’ (*Advances in Econometrics*, vol. 38) available on the following website: <https://sites.google.com/site/aie38rdd/>



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## 2.4 Data and descriptive analysis

We use three databases to evaluate the impact of PDO adoption on farmers economic outcomes (i.e. price, quantities, production costs and financial charges).

The first database is an annual survey called Farm Accounting Data Network (FADN). The survey is conducted by the Service of Statistics and Prospective of the French Ministry of Agriculture, Food Processing and Forests (hereafter, MAAF). The FADN survey includes farms of medium and large size. That is, farms with a gross production higher than 25,000 euros. The FADN compiles farm-specific and accounting data. Specifically, the FADN survey provides the four outcome variables used in regressions (price, quantities, production costs and financial charges). However, this survey does not include information on treatment variable, that is, it does not distinguish between PDO and non-PDO farms.

Conversely, the second database, which is the 2010 French Agricultural Census, includes information on whether farms have adopted PDO. The Agricultural census also includes information on socio-demographic characteristics (e.g. age, gender etc.) and agricultural activities (e.g. size, diversification, altitude etc.). However, the census does not include economic variables. Therefore, we have to combine the two databases : the FADN survey and the census. The census is conducted every ten years and the latest available census is 2010, justifying why we focus on this year.

The third database includes a list of *communes* which are eligible to participate in the production of the GI product. It also includes variables on longitude and latitude, which allows to compute the boundary of PDO area and the distance of each farm to the common boundary. This database is provided by “Intituit National des Appellations d’Origine (INAO)”, which is the main government body in charge of quality schemes in France. Because of the statistics secret covering farm-level data, a specific procedure was required to access to the two first databases.

The definition of variables used in the present study and summary statistics are reported in table 2.2. The total number of observations is 121, with 80 PDO farms and 41 non-PDO farms. The majority of farmers are men (93%), with an average age of 46 years old. About 38% of sample farms have adopted direct marketing strategy, while less than 10% of the sample farms are engaged in diversification activities (e.g. agri-tourim, accommodation, etc.). The sample

average size of farms measured as Utilized Agricultural Area (UAA) is 117 hectares, with an average right to produce of 285 thousand liters per year. On average, farms are located at 24 km from the PDO production area boundary, on both sides of the common border.

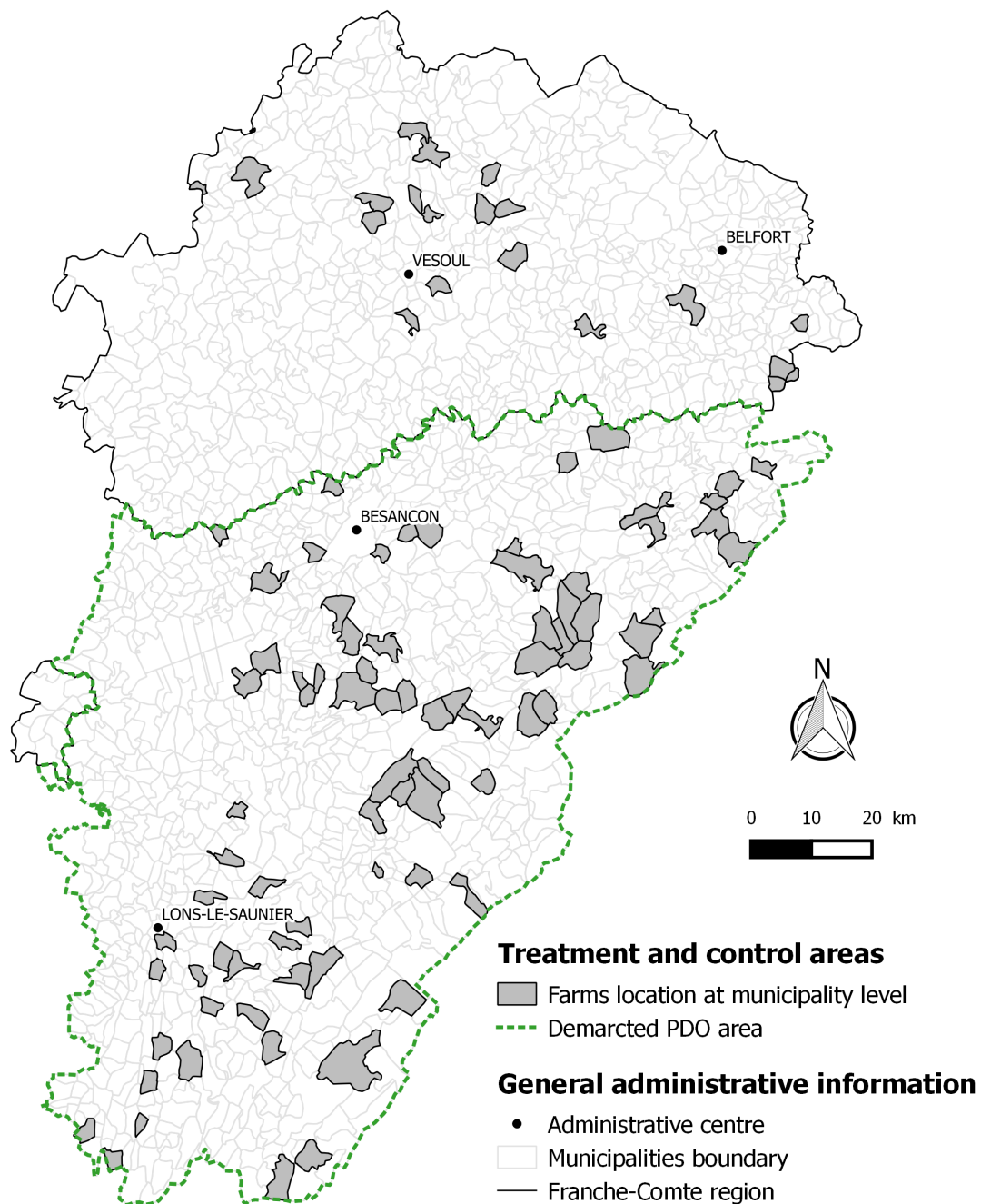
The location of farms is plotted on fig. 2.2. The maximum location of farms outside the PDO area is 50 km, while the maximum location of farms inside the PDO area is almost 100 km from the boundary, which is normalized to zero<sup>4</sup>. As shown in table 2.1, farms outside the PDO area have not adopted the PDO as expected. And only 2 farms out of 82 inside the eligible PDO area have not adopted the PDO. Therefore, we use a “sharp” regression model in the empirical section.

Table 2.1: Eligibility to PDO area vs PDO adoption

	PDO adoption			
	Yes	No	Total	
PDO area	Yes	80	2	82
	No	0	39	39
Total	80	41	121	

4. The farms are geo-referenced at the *commune* level . Therefore, two farms located in the same *commune*, will have the same distance to the border.

Figure 2.2: Distribution of sample across the common border



Source: INSEE, GEOFLA  
2015; FADN 2010  
Author: HBR, QGIS 2.6.1,  
March 2017

Table 2.2: Definition of variables and summary statistics

Variable	Description	Mean	Std.Dev.
Price	Price of milk at the farm gate in euros per liter	0.403	0.058
Quantity	Quantity of milk sold in thousand liters	30.205	18.317
Revenues	Revenues from milk activities (only) in thousands euros	12.240	7.741
Cost	Cost of production in thousand euros	157.278	107.493
Financial charges	Interests and financial charges in thousand euros	4.533	4.761
PDO	1 if farm is granted with “geographical indication”, 0 otherwise	0.661	0.475
Distance	Distance from the boundary of GI area in km	23.633	43.878
Age	Age of farm head in number of years	46.297	8.658
Gender	1 if farm head is a man, 0 otherwise	0.925	0.263
Milk quota	Quantity of milk that farm is allowed to produce in thousand liters	285.175	162.622
Diversification	1 if there is a diversification activities on the farm, 0 otherwise	0.082	0.276
Direct marketing	1 if farm sells directly to consumers, 0 otherwise	0.173	0.380
Size	Utilized agricultural area in ha	116.828	68.333
Livestock	Livestock unit cattle	96.540	56.586

The distribution of the sample by the altitude suggests a positive correlation between altitude and PDO adoption (Table 2.3). Specifically, 45% of PDO farms are located between 300 and 600 meters and 50% are located at more than 600 meters. Whilst only 4% of non-PDO farms are located at more than 600 meters. This analysis implies that PDO have been mainly adopted in mountain areas where the conditions of production are deemed difficult. This is also consistent with the objective of the European Commission (EC) to develop GI in less-favored and/or remote areas (EC reg. n° 2081/92 and n° 510/2006). Thus, a suitable evaluation design should take into account this difference in location in order to identify a causal effect of PDO.

Table 2.3: Distribution of sample by altitude

Altitude	PDO farms		non-PDO farms	
	Frequency	Percentage	Frequency	Percentage
Lower than 300 m	4	5%	14	34.15%
Between 300-600 m	36	45%	25	60.98%
Higher than 600 m	40	50%	2	4.88%
Total	80		41	

As mentioned above, to assert the reliability of the identification assumption, we test whether the observable characteristics of farms changed discontinuously using a mean difference test. Specifically, we test the null hypothesis of no difference in observable characteristics of PDO and non-PDO farms. The results are reported in table 2.4. We cannot reject the null hypothesis of no difference for all characteristics, at the conventional level of 5%. The only exception concerns the age of farmers, which is significant only at 10%. This finding validate our model: the observable characteristics of farms across the boundary are continuous. So, we can feel confident that the unobservable characteristics of farms across the boundary are also continuous/similar.

In addition, We tested whether the distance from the boundary of the PDO production area changes discontinuously. If distance changes discontinuously, it implies that farms are not randomly located near the boundary (i.e. location is endogenous) and will invalidated our design. The distribution of farms at the boundary is displayed on fig. 4.2. We observe no concentration at the boundary, implying that location does not change discontinuously, thereby validating our design.

Figure 2.3: Distance to PDO boundary in Kilometers

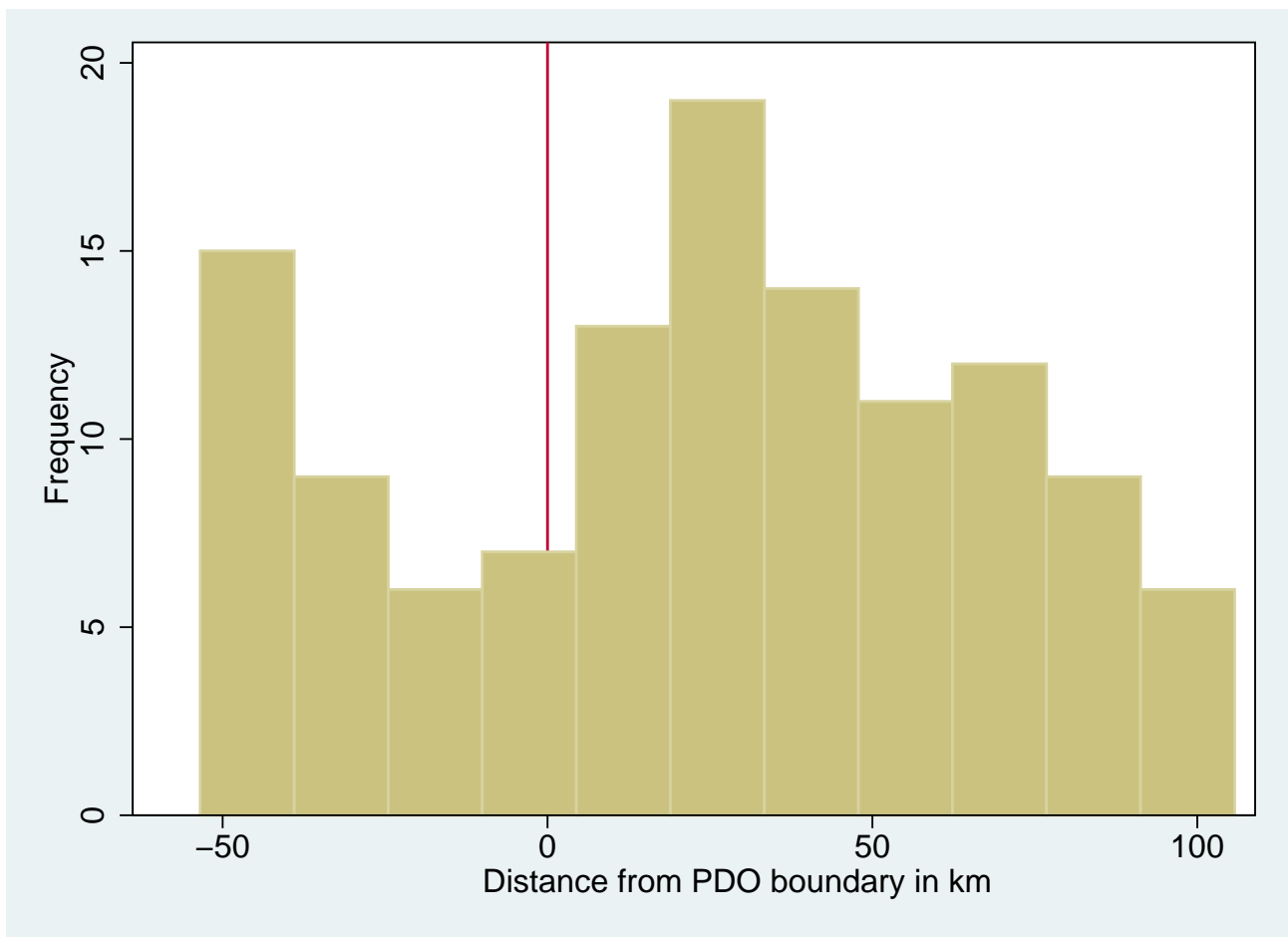


Table 2.4: Mean comparisons by PDO status

Variables	PDO farms (Nb.obs.=80)		non-PDO farms (Nb.obs.=41)		Diff(s.e.)
	Mean	(s.d.)	Mean	(s.d.)	
<b>Dependent variables</b>					
Price (euros per liter)	0.439	0.027	0.331	0.028	0.108***(0.005)
Quantity(1000 liter)	30.244	16.899	30.128	20.892	0.115(3.532)
Revenus (1000 euros)	13.397	7.935	9.981	6.890	3.416**(1.459)
Cost (1000 euros)	150.045	93.459	171.391	130.785	21.345(20.640)
<b>Independent variables</b>					
Age	45.275	9.086	48.292	7.464	3.017*(1.647)
Gender	0.950	0.219	0.878	0.331	0.071(0.050)
Milk quota	278.851	157.229	297.513	174.006	18.661(31.318)
Diversification	0.075	0.265	0.097	0.300	0.022(0.053)
Direct marketing	0.162	0.371	0.195	0.401	0.032(0.073)
Size (ha)	112.958	63.504	124.379	77.169	11.420(13.138)
Livestock	93.584	54.344	102.307	61.006	8.722(10.884)

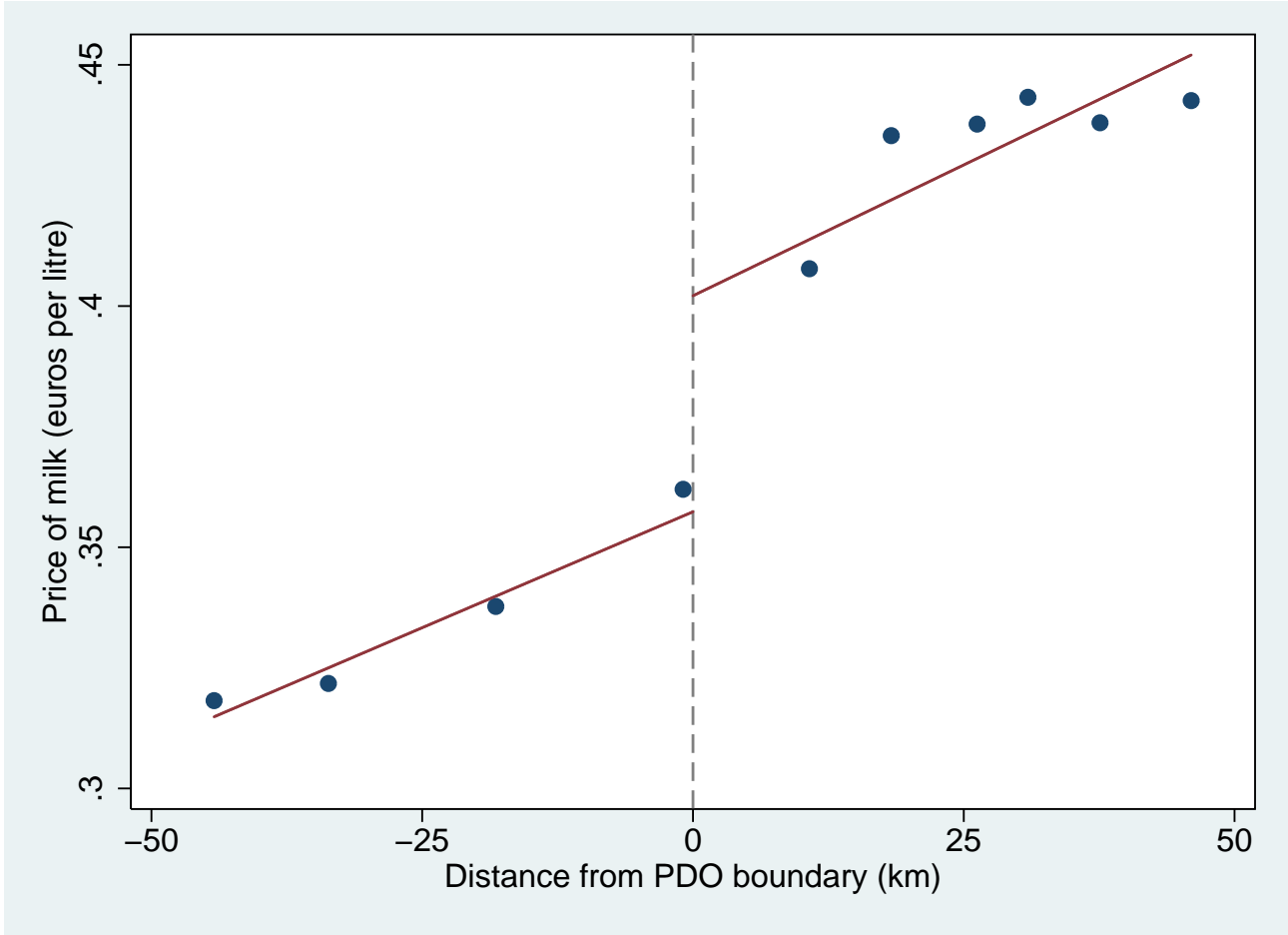
## 2.5 Econometric results

This section is devoted to the discussion of our main results. But it is useful to conduct graphical analysis before presenting the estimation results. This allows visualizing the effect and to make sure that the outcome variable (price, quantities, production costs and financial charges) actually changes discontinuously at the boundary. To illustrate such discontinuity, we plot the average price of milk across farms against the distance from the PDO production area boundary (fig. 2.4). Since the boundary is normalized to zero, farms located inside the legal production area have positive distance, whilst farms located outside the area have negative distance. Fig.2.4 provides a visual evidence of the discontinuity (“jump”) of price at the boundary of PDO production area, which is normalized to zero. As clearly shown on fig. 2.4, the price changes discontinuously at the PDO boundary. Price of PDO farms (at the right side of cut-off zero) is higher than the price of non-PDO farms (at the left side of the cut-off zero). The graphical analysis also provides a useful guidance in selecting the functional form of the equation to be estimated. As illustrated on fig. 2.4 using ten number of bins, the distribution of price can be fitted by a linear regression<sup>5</sup>.

Next, we evaluate the impact of PDO on farm gate price, quantities, production costs and financial charges using first a linear functional form and then alternative specifications to check

5. We also fitted the linear form for alternative number of bins and the result does not change systematically.

Figure 2.4: Graphical depiction of price discontinuity at PDO boundary



the robustness of the results. In the semi-logarithmic specification of eq. (2.1), a statistically significant coefficient on the dummy variable PDO indicates the PDO adoption has increased the outcome  $Y_i$  of  $g\%$ , where  $g = \exp(\alpha_1 - \frac{1}{2}V(\alpha_1)) - 1$ ,  $\alpha_1$  and  $V(\alpha_1)$  are the estimated coefficient and variance of our parameter of interest, respectively (?).

The results of the impact of PDO on milk price at farm gate are reported in Table 2.5. Within the bandwidth of 25 km, the adoption of PDO increases the price at farm gate by  $g = \exp(0.273 - 0.5 * (0.033)^2) - 1 = .313$ , that is, 31.3% (Column 1). This finding is robust to the inclusion of control variables: Age, Gender, Milk quota, Diversification, Direct marketing, Farm's size, Number of livestock and Altitude (Column 2). The results are also robust to an alternative bandwidth of 50 km. As expected, the magnitude of the effect diminishes from 31.3% (column 1) to 25.6% (column 5) as the bandwidth increases. The magnitude decreases because more we move away from the boundary, the difference in price is more likely to be explained by other factors than the PDO adoption *per se*.

This finding is consistent with previous works in Comté (Dupont, 2004; Barjolle et al.,



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2007). In 2002, Dupont (2004) found that the price of PDO milk in Comté is 14% higher than non-PDO milk price. This gap in favor of Comté PDO milk producers has increased overtime to reach 25% in 2004 (Barjolle et al., 2007). PDO certification can also increase the revenue of farmers through improving access to market.

Table 2.5: Estimates of the PDO effect on milk price at farm gate

Dependent variable: log(price)	Within 25 Km		Within 50 Km		Full sample	
	(1)	(2)	(3)	(4)	(5)	(6)
PDO	0.273*** (0.033)	0.271*** (0.045)	0.250*** (0.025)	0.249*** (0.028)	0.228*** (0.028)	0.203*** (0.029)
Constant	-1.104*** (0.016)	-1.125*** (0.073)	-1.098*** (0.015)	-1.132*** (0.044)	-1.083*** (0.016)	-1.083*** (0.042)
Distance	Yes	Yes	Yes	Yes	Yes	Yes
Distance*PDO	Yes	Yes	Yes	Yes	Yes	Yes
Distance square	No	No	Yes	Yes	Yes	Yes
Distance cubic	No	No	No	No	Yes	Yes
Sample size	33	33	77	77	121	121
Covariates	No	Yes	No	Yes	No	Yes

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To evaluate the impact of PDO on market access, we estimate the impact of PDO adoption on quantities of milk sold. The effects of PDO on quantities of milk sold are presented in Table 2.6. The adoption of PDO does not significantly increase the quantities of milk sold. This finding is expected since PDO strategy is based on quality, food safety, supply concentration and promotion (Roselli et al., 2009).

Table 2.6: Estimates of the PDO border effect on quantity sold

Dependent variable: $\log(\text{quantity})$	Within 25 Km		Within 50 Km		Full sample	
	(1)	(2)	(3)	(4)	(5)	(6)
PDO	0.263 (0.301)	0.018 (0.116)	0.101 (0.291)	-0.012 (0.126)	-0.209 (0.239)	-0.025 (0.110)
Constant	3.394*** (0.149)	2.368*** (0.188)	3.372*** (0.172)	2.427*** (0.196)	3.436*** (0.133)	2.477*** (0.157)
Distance	Yes	Yes	Yes	Yes	Yes	Yes
Distance*PDO	Yes	Yes	Yes	Yes	Yes	Yes
Distance square	No	No	Yes	Yes	Yes	Yes
Distance cubic	No	No	No	No	Yes	Yes
Sample size	33	33	77	77	121	121
Covariates	No	Yes	No	Yes	No	Yes

---

PDO quality policies can be very costly and generate little margin if production costs are high. We have estimated the effect of PDO on the production costs (Table 2.7). Additionally and in order to take into account the fact that non-PDO farms are more likely to use intensively machine relative to labor, we estimate the effect of PDO on interests and financial charges on debts, required to finance the mechanization of the production (Table 2.8). The results indicate that PDO adoption has no statistically significant effect, neither on production costs nor on interests and financial charges on debts. These findings seemed to be robust to the inclusion of control variables and various bandwidth specification. The lack of effect of PDO adoption on production costs reflects the existence of a “deadweight effect” of PDO. That is, the majority of practices in the code of practices would exist in the absence of certification. The code of practices mainly includes production practices that are anchored in production habits. So, the code of practices seems to not be restrictive and not entail any additional cost. In other words, the PDO does not *per se* increase the production costs, since the current costs are unavoidable and would have existed even in the absence of certification.

This finding contrasts with most of previous works, which concluded that PDO producers faced a disadvantaging costs of production, compared to non-PDO producers (Bouamra-Mechemache and Chaaban, 2010; Colinet et al., 2006; Arfini et al., 2006). For instance, Bouamra-Mechemache and Chaaban (2010) found that variable costs of PDO Brie cheese producers are 40% higher than non-PDO Brie producers in France. Likewise, Arfini et al. (2006) found that the costs of production for milk used in manufacturing PDO Parmigiano Raggiano in Italy is 20% higher than ones to produce milk used in manufacturing Grana Padano or other industrial purposes.

Table 2.7: Estimates of the PDO border effect on production costs

Dependent variable: log(production costs)	Within 25 Km		Within 50 Km		Full sample	
	(1)	(2)	(3)	(4)	(5)	(6)
PDO	0.202 (0.331)	-0.249 (0.217)	-0.042 (0.313)	-0.255 (0.163)	-0.346 (0.258)	-0.279** (0.138)
Constant	5.101*** (0.164)	4.278*** (0.350)	5.121*** (0.185)	4.029*** (0.254)	5.178*** (0.143)	4.316*** (0.196)
Distance	Yes	Yes	Yes	Yes	Yes	Yes
Distance*PDO	Yes	Yes	Yes	Yes	Yes	Yes
Distance square	No	No	Yes	Yes	Yes	Yes
Distance cubic	No	No	No	No	Yes	Yes
Sample size	33	33	77	77	121	121
Covariates	No	Yes	No	Yes	No	Yes

Table 2.8: Estimates of the PDO border effect on financial charges

Dependent variable: log(financial charges)	Within 25 Km		Within 50 Km		Full sample	
	(1)	(2)	(3)	(4)	(5)	(6)
PDO	1.205 (0.842)	0.127 (0.757)	0.702 (0.713)	-0.141 (0.687)	0.220 (0.614)	-0.051 (0.926)
Constant	0.777* (0.418)	2.908** (1.222)	0.812* (0.422)	1.131 (1.068)	1.048*** (0.339)	1.408* (0.793)
Distance	Yes	Yes	Yes	Yes	Yes	Yes
Distance*PDO	Yes	Yes	Yes	Yes	Yes	Yes
Distance square	No	No	Yes	Yes	Yes	Yes
Distance cubic	No	No	No	No	Yes	Yes
Sample size	33	33	77	77	121	121
Covariates	No	Yes	No	Yes	No	Yes

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## 2.6 Conclusion

Geographical indications certification confer the exclusivity right of producing a good to producers within a specific demarcated area. Producers located outside the demarcated area cannot participate to the production. We used this feature common to GIs to evaluate the causal effect of PDO certification on farmers' revenues and production costs, with a primary focus on dairy farms in the region of Franche-Comté (France).

Using a Geographical Regression Discontinuity design and a unique spatial database of farms location, we found that PDO increases the price of milk at farm gate of more than 30%; while no effect on the quantity sold was found. We also highlight "deadweight" effect of PDO certification. That is, the code of practices mainly includes production practices that are ingrained in production habits, which do not entail any additional cost. In other words, the PDO certification does not *per se* increase the production costs since the current costs are unavoidable and would have existed even in the absence of the certification.





# Evaluation of the economic impact of PDO policy at regional and national level: Evidence from France dairy sector <sup>1</sup>

This paper evaluates the impact of the Protected Designation of Origin (PDO) policy on price and added-value for dairy farmers in France. Using consistent farm-level data and a blocking estimator, we find that PDO policy is associated with a significant increase in both price and added-value. However, these average results hide important heterogeneity between different regions of origin. In particular, we find that PDO policy is effective in increasing price and added-value in the regions of Franche-Comté and Rhône-Alpes, but not in Auvergne.

*Keywords:* Protected Designation of Origin, Block estimator, impact assessment, supply chains, dairy sector.

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1. A version of this chapter has been revised and resubmitted to *European Review of Agricultural Economics* (co-authored with Philippe Jeanneaux)

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## 3.1 Introduction

One of the objectives clearly assigned to EU's Protected Designation of Origin (PDO) policy is to increase the income of farmers, especially in less-favoured areas (EC reg. n° 510/2006). However, the effectiveness of PDO policy to achieve this specific goal has not been carefully evaluated in the literature . The present article evaluates the effectiveness of PDO scheme in increasing farmers' income, with a primary focus on dairy farmers in France<sup>2</sup>. The effectiveness is defined as the extent to which PDO scheme contributes to increase the income of farmers ([Economics, 2008](#); [EuropAid, 2006](#)). Here, the effectiveness of PDO scheme is evaluated with respect to price of milk at farm gate and added-value (measured as the total output net of total intermediate consumption). The policy will be deemed effective if it increases significantly at least one of the two latter indicators.

Legal aspects of PDO scheme have been widely documented in the literature ([Josling, 2006](#); [Evans and Blakeney, 2006](#); [Barham, 2003](#); [Yeung and Kerr, 2008](#); [Fink and Maskus, 2006](#)). Yet, less attention have been paid to their economic impacts. Theoretically, PDOs could enhance welfare by conveying accurate information to consumers and limiting free-rider behavior among producers ([Lence et al., 2007](#); [Menapace and Moschini, 2012](#); [Moschini et al., 2008](#); [Zago and Pick, 2004](#)); while PDOs could also be source of undeserved rents for producers ([Mérel and Sexton, 2011](#)). Empirically, existing studies mainly focus on consumers willingness to pay for PDO/PGI products ([Bonnet and Simioni, 2001](#); [Darby et al., 2008](#); [Grunert, 2005](#); [Hu et al., 2012](#); [Menapace et al., 2011](#); [van der Lans et al., 2001](#); [Onozaka and Mcfadden, 2011](#); [Van Ittersum et al., 2007](#)); while works on supply side are scarce and mainly descriptive ([Paus and Rvion, 2010](#); [Desbois and Néfussi, 2007](#); [Barjolle and Thevenod-Mottet, 2004](#); [Arfini et al., 2009](#)). Moreover, as pointed out by [Tregear et al. \(2015\)](#), previous studies mainly compare PDO to non-PDO supply chains, assuming that PDO supply chains are homogenous while it may not be the case.

Here, we propose a rigorous empirical analysis on farmers' income. Specifically, this article contributes to the literature on determinants and impact of PDO adoption in four ways:

First, we focus on first stage actors, especially on dairy farmers in France, while empirical

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2. Although PDO/PGI is a mutli-faced scheme, our goal here is not to investigate the effectiveness of PDO/PGI scheme with respect to each objective. Instead, our analysis focuses on the evaluation of the effectiveness of PDO scheme in increasing farmers' income

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studies mainly focused on demand side. Findings on consumers' willingness to pay cannot be generalised straightforward to first stage actors at least for two reasons: *i*) consumers' willingness to pay is evaluated on the final product (e.g. cheese) and it is not guaranteed that price premium is fairly distributed up to first stage actors (i.e. raw milk suppliers) because of concentration beyond the farm gate in French agro-food supply chains; *ii*) PDO market performance can conflict with the improvement of producers' bargaining power, as recently shown by [Carbone et al. \(2014\)](#).

Second, we evaluate the impact of PDO policy on value-added measured as total output net of total intermediate consumption<sup>3</sup>. This allows us to take into account the production cost resulting from the requirement of the code of practices (e.g. cows' grazing mandatory). It has been argued in the literature that PDO producers face higher costs compared to non-PDO ones ([Bouamra-Mechemache and Chaaban, 2010](#); [Arfini et al., 2006](#)). Ignoring production costs could lead to an overestimation of PDO's actual benefits, since it is not guaranteed the price premium would be sufficient enough to cover producers extra costs of quality requirements.

Third, we conduct a thorough analysis to better understand the heterogeneity of PDOs across various regions of origin, while previous studies mainly compare PDO to non-PDO products, therefore ignoring differences across PDOs themselves.

Fourth, we contribute in improving the methods used in evaluation of PDO policy. We use blocking analysis, initially introduced by [Rosenbaum and Rubin \(1983\)](#) and recently improved by [Imbens \(2015\)](#). Intuitively, blocking analysis involves first estimating the propensity score and grouping farms into homogenous blocks of PDO status using the estimated score. The blocking analysis maximises comparability between PDO and non-PDO farms and overcomes methodological limits resulting from: (i) qualitative methods based on direct interviews of stakeholders and expert point of views (subjective bias); and (ii) synchronic comparison methods based on a limited number of cases, not allowing to control for other factors which may influence the performances (one deviant bias as well as omission bias). Specifically, we introduce a consistent farm-level dataset, which allows to deal with the subjective bias. We

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3. According to European Farm Accounting Data Network:

Total output (in euros) = sales and use of (crop and livestock) products and livestock + change in stocks of products (crop and livestock) + change in valuation of livestock-purchases of livestock + various non-exceptional products.

Total intermediate consumption (in euros) = Total specific costs (including inputs produced on the farm) and overheads arising from production in the accounting year.

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deal with the “one deviant bias” in two ways: *i*) using a large sample reduces the risk of rejecting a hypothesis because of one deviant observation since this risk decreases with the sample size ; *ii*) trimming the sample to discard observations with extreme values of propensity score. Lastly, because blocking analysis is a multivariate approach, it also allows to deal with potential “omission bias” resulting from the lack of control variables.

Our findings reveal that, on average, PDO increases significantly price and added value; however, the average effect is not homogeneously distributed across regions, implying that the legal protection offered by PDO policy does not automatically lead to actual benefits. The rest of the chapter is organised as follow. Section 3.2 presents our evaluation framework and discusses our empirical strategy. Section 3.3 describes the data used in the analysis. Section 3.4 presents results and section 3.5 concludes.

## 3.2 Conceptual framework and estimation method

To evaluate the impact of PDO, we use the potential outcome model, which is widely used in social research. This model postulates the existence of two potential outcomes for a farmer  $i$ , denoted  $Y_{i0}$  and  $Y_{i1}$ .  $Y_{i0}$  denotes the outcome that would be realized by farm  $i$  if he or she did not adopt PDO policy. Similarly,  $Y_{i1}$  denotes the outcome that would be realized by farmer  $i$  if he or she adopted PDO policy. Farmer  $i$  can either adopt or not the PDO policy, but not both, and thus only one of these two potential outcomes can be realized. As a result, we can only observe one of the potential outcome *ex post*. If farmer  $i$  has adopted PDO policy,  $Y_{i1}$  will be observed for  $i$ , and  $Y_{i0}$  will *ex post* be a counterfactual outcome. Conversely, if farmer  $i$  has not adopted PDO policy,  $Y_{i0}$  will be observed, and  $Y_{i1}$  will *ex post* be a counterfactual outcome. Therefore, the fundamental problem of impact evaluation is that we cannot observe the same farmer  $i$  with and without PDO. In other words, the counterfactual is never observed, we only observed the realized outcome for given farm  $i$ ,  $i = 1, \dots, N$ . The above discussion implies:

$$Y_i = DY_{i1} + (1 - D)Y_{i0} \tag{3.1}$$

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and

$$D = \begin{cases} 1, & \text{if farm } i \text{ adopt PDO} \\ 0, & \text{otherwise} \end{cases} \quad (3.2)$$

Given that we cannot simultaneously observe farms in both situations (with and without PDO), we have to approach as closely as possible the path that PDO farms would have followed in the absence of the PDO (i.e. counterfactual). Ideally, for a PDO farm, a reliable counterfactual implies finding a non-PDO farm with the same observable and unobservable characteristics. However, in practice, farms participating in a PDO may have no similar observable characteristics to non-PDO farms. For instance, historically PDO farms are mainly located in mountain areas, while non-PDO farms are located in plain areas with better conditions for production. Therefore, part of the difference observed between PDO and non-PDO may reflect the original difference, totally or partially, instead of the effect of PDO per se. Similarly, there may be systematic differences in unobservable characteristics between PDO and non-PDO farms (e.g. farmer motivation, managerial skills, etc.). The instrumental variable method is the standard approach for dealing with the bias resulting from the difference in unobservables. However, as pointed out by [Angrist and Krueger \(2001\)](#), the instrumental variable method crucially depends on the existence of valid instruments which take into account selection on the observable and unobservable characteristics. These, are not often available in empirical applications.

We propose to use blocking analysis, which is an application of matching methods, following [Imbens \(2015\)](#). A limitation of matching methods is that it does not take into account unobservable characteristics that may influence both the outcome and the PDO adoption decision ; it accepts the choice of selection based on observable characteristics. However, as argued by [Jalan and Ravallion \(2003\)](#), assuming that there is no selection on unobservable characteristics is no more restrictive than assuming an exogeneity of the instrument as in the case of the instrumental variable approach. The key idea of our blocking analysis is to group PDO and non-PDO farms into homogenous blocks using the estimated propensity score, and then estimate the effect of PDO per block. The thinking is that, within a valid block, there is no difference on average between PDO farm and non-PDO farm characteristics. Put differently, blocking analysis aims to obtain a constant propensity score per block in order to approach as closely as possible to a randomized experiment. It is worth noting that an estimated propensity score from a

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randomized experiment is constant (Imbens, 2015; Imbens and Wooldridge, 2009). Blocking analysis involves: *i*) estimating a propensity score, *ii*) defining an optimal number of blocks, by splitting the propensity score into homogenous blocks using a Likelihood ratio test, *iii*) estimating the effect of PDO per block and the average effect.

The propensity score is the conditional probability of an assignment to a particular treatment, given a vector of observed covariates (Rosenbaum and Rubin, 1983). For the purpose of this study, the propensity score is the probability of PDO adoption, given the characteristics of a farm. The question that then arises is the choice of variables to include in the PDO adoption decision model. This choice is simple if we have baseline data (pre-PDO adoption) and end data (post-PDO adoption); indeed, in this case, the propensity score is estimated using baseline data, since, by definition, the PDO could not impact baseline characteristics because they are before adoption. But, in our case study, given the old character of PDOs in Europe, we have mostly post-adoption data, making difficult the choice of the characteristics to be included in the propensity score. To estimate the propensity score, we use the approach suggested by Imbens (2015), which consists of three steps: step (1) select some basic covariates on theoretical/substantive grounds; step (2) select additional linear terms based on Likelihood Ratio tests of whether it is useful to add the additional variable, and if so, which one has the highest Likelihood Ratio statistic; step (3) following the same Likelihood Ratio-based procedure to determine which quadratic and interaction terms to include.

A score between 0 and 1 is obtained for the propensity score. However, to limit potential bias due to extreme values and to avoid extrapolating to regions which are too different. Crump et al. (2009) suggest discarding observations with a propensity score lower than 0.1 and observations with a propensity score higher than 0.9. Even after trimming the sample, it can have heterogeneity between individuals. Indeed, it is more reasonable to compare an individual with a propensity score of 0.31 to an individual with a propensity score of 0.34 rather than to an individual with a very different score, for example 0.8. Consequently, Rosenbaum and Rubin (1983) and Imbens (2015) suggest dividing the sample into homogeneous sub-blocks, that is, comprised of individuals with similar propensity scores. Splitting the sample into sub-blocks provides a constant propensity score by block, so PDO and non-PDO farmers are randomly selected within each block (Imbens, 2015; Imbens and Wooldridge, 2009). In a randomized

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experiment, the propensity score, that is, the probability of being treated, is constant by definition. Moreover, [Cochran \(1968\)](#) shows that splitting the sample into five identical-size blocks reduces the bias by 95%. Yet, in some cases, the optimal number of blocks may be higher or lower than 5. In the present study, the optimal number of blocks is defined, following the procedure from [Imbens \(2015\)](#). Start with a single, that is, a full-trimmed sample, then, test the null hypothesis that the current block is valid that is, within the current block, there is no difference between the averages of the PDO and the non-PDO farmers propensity scores. If the null hypothesis is rejected, the trimmed sample is split at the median value of the propensity score, and a test is performed on each of the two sub-blocks. The decision rule, i.e., rejecting the null hypothesis or not, is based on a Likelihood Ratio test (LR-test). Specifically, we reject the null hypothesis of validity of the current block if the LR-test =  $\log(\text{ps} / 1-\text{ps}) > 1.96$  or the number of observations by status (PDO vs. non-PDO) in the current block is less than 3.

Once the optimal number of blocks is obtained, the specific effect of the PDO in each block is the difference in the outcome for PDO and for non-PDO dairy farmers. For each block, the difference between the outcome of PDO and non-PDO dairy farmers is then weighted by the ratio of number of PDO farmers in the current block/total number of PDO farmers in the sample. The overall effect of the PDO is obtained by simply summing the weighted differences calculated for each block. This estimator is known as the blocking estimator, initially introduced by [Rosenbaum and Rubin \(1983\)](#). Recently, [Imbens and Wooldridge \(2009\)](#) improved this estimator to control for other characteristics. Indeed, despite the fact that the blocks have some homogeneity, individuals within the same block may, exhibit residual differences in observable characteristics. In addition to group-similar individuals in terms of propensity scores, the method can also control for observable characteristics that may differ between individuals within the same block.

Let  $J$  represent the optimal number of blocks. For each block, we estimate eq. (3.3) using ordinary least square:

$$Y_i = \beta_0 + \beta_1 D + \beta_1 X_i + \epsilon_i \tag{3.3}$$

Where  $\hat{\beta}_1$  is the parameter of interest estimated per block,  $X$  are covariates and  $\epsilon$  the error term. Without the covariates,  $\hat{\beta}_1$  is equivalent to the mean difference; therefore, estimation of



eq. (3.3) per block without  $X$  is referred to as blocking estimator. The estimation of the full form of eq. (3.3) per block, that is, with covariates, is referred to as blocking regression. The Average Treatment effect on treated (ATT) is obtained by computing the weighted average, where coefficients per block are weighted by the number of PDO farms within the current block divided by the total number of PDO farms in the sample. Specifically, the ATT is computed as:

$$\beta_{ATT} = \sum_{j=1}^J \frac{N_{tj}}{N_t} \hat{\beta}_j$$

with estimated variance

$$\hat{V} = \sum_{j=1}^J \left( \frac{N_{tj}}{N_t} \right)^2 \hat{V}_j$$

Where  $N_{tj}$  is the number of PDO farms in block  $j$  and  $N_t$  is the total number of PDO farms.

### 3.3 Data and descriptive analysis

We start our analysis with a sample of 1,110 farms specialised in dairy farming, obtained by merging two statistical sources: the Farm Accounting Data Network (FADN) survey and the French Agricultural Census of 2010; both conducted by the Service of Statistics and Forecasting of the French Ministry of Agriculture, Food Processing and Forests. The FADN survey compiles farm-specific and accounting data, but provides no information allowing discrimination between PDO farms and non-PDO farms. This crucial information is available only in the Agricultural census, which explains why we merge the two datasets. The FADN survey is available for each year, while the Agricultural census is conducted only every 10 years, making it difficult to exploit all the annual available data in the FADN survey. Therefore, we focus on the latest available agricultural census of 2010.

The definition of variables used in the analysis, along with descriptive statistics, is reported in table 3.1<sup>4</sup>. The total number of observations is 1,110 dairy farms, with almost 15% of PDO farms. Data includes information on the socio-economic characteristics of farmers. For instance, about 91% of farmers are men, with an average age of 47 years. The data also

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4. The null hypothesis of no difference is rejected, if  $t\text{-stat} > 1.92$  at the conventional level of 5%, implying a significant difference

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provides information on farms' activity. For example, the average size of farm, in the sample measured as Utilised Agricultural Area (UAA), is 95 hectares. The average milk quota (the right to produce) is 340,000 litres, and the penalty for exceeding the set quota is 139 euros on average per year. About 10% of farms are engaged in the diversification of their activities (e.g. agri-tourism, accommodation, etc.). Only 2% are engaged in a PGI scheme, which correspond to 31 farms in our sample. In our empirical strategy, we control for this variable in order to neutralise the effect of the PGI policy.

Table 3.1: Definition of variables and summary statistics

Variable	Description	Mean	Std.Dev.
<b>Dependent variables</b>			
PDO	1 if certified as “Protected Designation of Origin”, 0 otherwise	0.154	0.361
Price	Price of milk at farm gate in euros per litre	0.339	0.046
Value-added	Value-added in thousand euros per AWU	25.788	17.856
AWUs	Total Annual work unit	1.902	0.927
<b>Independent variables</b>			
Age	Age of farm head in number of years	46.770	8.176
Gender	1 if farm head is a man, 0 otherwise	0.916	0.277
Size	Utilized agricultural area in ha	94.916	54.622
Age	Age of farm head in number of years	46.297	8.658
Gender	1 if farm head is a man, 0 otherwise	0.925	0.263
Milk quota	Quantity of milk (quotas) allocated to farmers in thousand litres	340.482	181.851
Penalty	Penalties for exceeding milk quotas in euros	139.224	974.356
Young premium	1 if there is young farmer endowment, 0 otherwise	0.088	0.284
Diversification	1 if there is diversification activity on the farm, 0 otherwise	0.108	0.311
Direct marketing	1 if farmer directly sells, 0 otherwise	0.119	0.324
PGI	1 if certified as “Protected of Geographical Indications”, 0 otherwise	0.028	0.165
CCP	1 if certified conform to product “CCP”, 0 otherwise	0.044	0.206
Livestock	Livestock unit-cattle	98.206	51.768
Subsidies	Operating subsidies from public authorities or EU in thousand euros	37.347	21.256

Note: Summary statistics are based on the total number of observation of 1110 farms, with 171 PDO farms and 939 non-PDO farms.  
Value-added=Total output-Total intermediate consumption

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The mean differences are reported in table 3.2, with the t-statistics . The results indicate that, on average, PDO farmers are better off than non-PDO farmers in terms of price and added-value. More specifically, the price of PDO milk is 0.40 euro per litre, on average, while the average price of non-PDO milk is 0.33 euro per litre. Put differently, the price of PDO milk is 21% higher than the non-PDO milk, on average. PDO farms also create more added-value than non-PDO ones: 29,000 euros versus 25,000 euros per annual work unit in 2010, respectively. That is, the added-value created by PDO farms is 16% higher than the added-value created by the non-PDO ones.

We cannot consider, however, the difference observed in the price and added-value as due only to the effect of the PDO, since this difference in favour of PDO farms may come from differences in the characteristics of the farms instead of from the PDO *per se*. The t-statistics suggest that there are some differences in the characteristics of PDO and non-PDO farms. According to the t-statistic, there are significant differences between PDO and non-PDO farms, with respect to milk quota, penalty and direct marketing. Consequently, in order to isolate the specific effect of PDO, we have to adjust for differences in characteristics through a multivariate framework.

Additionally, we present the distribution of price and added-value by region in table 3.3. The three regions, selected on the basis of the large number of PDO farms within them, are Franche-Comt (80 PDO farms), Rhône-Alpes (20 PDO farms) and Auvergne (32 PDO farms). The results show that there is a significant difference in the price of milk between PDO and non-PDO farms in the three regions. In 2010 in Auvergne, this difference in milk price is, however, small: 0.326 euros per litre for PDO farms versus 0.315 euros per litre for non-PDO ones. Turning to added-value, the largest difference turns out to be in Franche-Comté; with almost 35,000 euros on average for PDO farms against 24,000 euros for non-PDO farms on average. Rhône-Alpes also shows a difference in favour of PDO farms: on average, in 2010, almost 23,000 euros for PDO farms against 20,000 euros for non-PDO farms. In contrast, in Auvergne there is no difference between PDO farms and non-PDO farms in terms of added-value.

Table 3.2: Difference in characteristics of PDO and PDO farms

Variables	PDO farms (Nb.obs.=171)		Non-PDO farms (Nb.obs.=939)		t-stat	nor-diff
	Mean	(s.d.)	Mean	(s.d.)		
<b>Dependent variables</b>						
Price	0.399	0.065	0.328	0.030	-22.409	1.397
Value-added	29.242	16.398	25.158	18.046	-2.758	0.236
AWUs	1.955	1.044	1.892	0.904	-0.824	0.065
<b>Independent variables</b>						
Age	46.263	8.652	46.862	8.088	0.881	-0.071
Gender	0.918	0.274	0.915	0.277	-0.098	0.008
Size	102.119	55.286	93.603	54.427	-1.877	0.155
Milk quota	301.429	167.886	347.593	183.470	3.064	-0.262
Penalty	549.976	2264.569	64.422	395.762	-6.094	0.298
Young premium	0.046	0.211	0.095	0.294	2.082	-0.191
Diversification	0.140	0.348	0.102	0.303	-1.476	0.116
Direct sales	0.163	0.371	0.110	0.313	-1.970	0.154
PGI	0.046	0.211	0.024	0.154	-1.627	0.120
CCP	0.017	0.131	0.048	0.215	1.842	-0.175
Livestock	93.142	50.373	99.127	51.991	1.391	-0.116
Subsidies	37.228	21.437	37.997	20.278	-0.435	0.036

Note: The null hypothesis of no difference is rejected at the conventional level of 5% if t-stat > 1.92.

Table 3.3: Distribution of price and added-value by regions

Regions	Price (€)			Value-added (€)		
	PDO	non-PDO	t-stat	PDO	non-PDO	t-stat
Franche-Comté	0.439	0.331	19.98	35.440	24.468	3.25
Rhône-Alpes	0.420	0.341	7.04	23.453	20.348	0.877
Auvergne	0.326	0.315	2.15	17.580	17.846	0.10

Note: Mean test difference between PDO and non-PDO farms by region.

The null hypothesis of no difference is rejected at the conventional level of 5% if t-stat > 1.92.

These regions are selected according to the large number of PDO farms.

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## 3.4 Results

The results are presented following to the three steps of our empirical strategy: (i) estimation of the propensity score using [Imbens \(2015\)](#)'s algorithm, (ii) definition of the optimal number of blocks using a Likelihood Ratio test, (iii) estimation of the effect of PDO on the farm gate price and the value added, using block estimator. (i) and (ii) should be regarded as methodological results.

### 3.4.1 Methodological results

In principle, the estimation of propensity score involves including all the characteristics which are correlated with PDO and the outcomes of interest: price and added-value. However, including characteristics that are associated with the outcome will increase the variance, while excluding an important variable will increase bias in the estimate. The approach suggested by [Imbens \(2015\)](#) is a trade-off to deal with this issue, since it allows the selection of important variables even if they are not statistically significant, while the remaining variables are selected according to their statistical significance. The algorithm involves three steps:

The first step is to select baseline covariates according to theory. Baseline variables are preselected even if they are not significant, since excluding these basic variables can lead to substantial bias. Based on theory, six variables are included in the propensity score : Age of the farmer, Gender, Size of farm, Young farmer premium, Altitude, and the dummy regions. The first four variables are preselected according to previous studies on the determinant of innovation and technology adoption ([Feder et al., 1985](#); [Rogers, 2010](#)), and according to empirical studies on Geographical Indications (GIs) certification ([Dorr and Grote, 2009](#); [Jena and Grote, 2012](#); [Kleinwechter and Grethe, 2006](#); [Ngokkuen and Grote, 2012](#)). Altitude and dummy Regions are preselected to take into account the historical development of PDOs in mountain areas in France and their present frequent localisation in mountainous regions. Thus, the dummy Regions will allow us to select the three regions to include in our model: Auvergne, Rhône-Alpes and Franche-Comté, selected on the basis of the large number of PDO farms located in them.

The second step is to select additional linear terms using Likelihood Ratio tests to decide whether it is useful to add them as additional variables. If so, the one with the highest Like-

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likelihood Ratio statistic (LR-statistic) would be added. Apart from the six basic variables, all remaining covariates are potentially additional variables. But as mentioned above, including all these variables would not be relevant, because it would unnecessarily increase the variance. Therefore, it is necessary to choose the most relevant additional linear terms. To do this, for each variable we test the null hypothesis that the coefficient of the additional variable term is equal to zero using a Likelihood Ratio test (LR test). The significance of the additional variable is tested against the baseline model of our six preselected variables. The null hypothesis is rejected if the LR-statistic is superior to the critical value of one, as suggested by [Imbens \(2015\)](#). Then among variables with a LR-statistic superior to one, the variable with the highest LR-statistic is selected and included in the baseline model. Our baseline model now includes the six preselected variables plus the latest selected linear term. The procedure continues until we fail to reject the null hypothesis that the coefficient of the additional linear term is equal to zero. We apply this procedure for the selection of four additional linear variables: Penalty, Diversification, Milk quota and Subsidies.

The final step is to determine which quadratic and interaction terms should be included in the estimation of the propensity score. This step is similar to the one described above in step 2. The interactive and quadratic terms are generated for all the variables of the baseline model, using all possible combinations. The null hypothesis, that the coefficient of the interactive/quadratic term is equal to zero, is tested using a Likelihood Ratio test. The significance of the quadratic/interactive term is tested against the baseline model (six basic variables and four additional linear terms). The null hypothesis is rejected if the LR-statistic is superior to the critical value of 2.71. Among interactive/quadratic terms with an LR-statistics larger than 2.71, the one with the highest LR-statistic is included in the baseline model. The procedure continues until we fail to reject the null hypothesis: the coefficient on the additional quadratic terms is equal to zero. The application of the algorithm has led to the selection of six additional interactive/quadratic terms: Altitude\*Franche-Comté, Altitude\*Penalty, Gender\*Franche-Comt, Altitude\*Auvergne, Age\*Auvergne, and Size\*Size.

Following the common practice in matching methods, we trim the sample in order to discard observations with extreme values of propensity score. An observation is deemed extreme if the estimated propensity score  $e(X)$  is lower than a threshold value  $\alpha$  or higher than  $1 - \alpha$ , with

Table 3.4: Sample sizes for subclasses with the propensity score between  $\alpha$  and  $1 - \alpha$

	Low $e(X) < \alpha$	Middle $\alpha \leq e(X) \leq 1 - \alpha$	High $e(X) > 1 - \alpha$	All
PDO	28	101	42	171
Non-PDO	759	177	3	939
All	787	278	45	1110

Note:  $e(X)$  is the propensity score

$\alpha$  is the threshold value below which the propensity score is deemed to be too small

$1 - \alpha$  is the threshold value above which the threshold the propensity score is deemed too high

Observations with a propensity score  $e(X)$  below  $\alpha$  and above  $1 - \alpha$ , are considered as extreme values

$0 \leq e(X) \leq 1$ . Using a simulation, [Crump et al. \(2009\)](#) show that in many settings, in practice  $\alpha$  equals 0.1. Following this idea, we discard observations with propensity score value lower than 0.1 and higher than 0.9. This leaves us with a sample of 278 observations with 101 PDO farmers and 177 non-PDO ones (table 3.4). As a result, the final analysis is conducted on a subsample where there is no significant difference on average between the characteristics of PDO and non-PDO farms.

Still following [Imbens \(2015\)](#), we re-estimate the propensity score on the trimmed sample, following the three steps described above. The same six preselected variables are used. But this time Imbens algorithm selects three additional linear terms (Penalty, Milk quota and Subsidies), instead of four previously, and three additional quadratic variables (Age\*Rhône-Alpes, Age\*Gender, Gender\*Auvergne), instead of six. The results of the re-estimated propensity scores are reported in table 3.5. Most of the variables are statistically significant, with the expected signs. Not surprisingly, the results show a negative correlation between the age of farmer and PDO adoption decision, implying that young farmers are more likely to adopt PDO. The average age of farmers in our sample is 47 years. Altitude is positively and significantly correlated to PDO, implying that farms located above 600 meters are more likely to adopt PDO.

The distribution of the sample by altitude suggests a positive correlation between Altitude and PDO adoption, with more than 50% of PDO adopters located at more than 600 meters high; while 72% of non-PDO farms are located at less than 300 meters. This result implies a negative correlation between non-PDO farms and Altitude (table 3.6). This finding also implies that PDOs have been mainly developed in less favoured areas since high altitude is equivalent



Table 3.5: Logit estimates of the propensity to adopt PDO strategy

Variable	est	s.e.
intercept	1.550	2.576
<b>pre-selected linear terms</b>		
Age	-0.101*	0.056
Gender of the head (1 if male)	-1.857	2.747
Size	0.004	0.007
Young farmer premium	-0.663	0.626
Altitude [base <300 m]		
300-600 m	0.816	0.520
600 m	1.948***	0.686
Franche-Comté	1.635***	0.583
Auvergne	2.650*	1.418
Rhône-Alpes	-3.524	2.192
<b>additional linear terms</b>		
Penalty	0.001**	0.000
Milk quota	0.031**	0.015
Subsidies	-0.029**	0.012
<b>additional quadratic terms</b>		
Age*Rhône-Alpes	0.076*	0.043
Age*Gender	0.056*	0.031
Gender*Auvergne	-2.862**	1.355
<b>Summary statistics</b>		
Pseudo R <sup>2</sup>	0.18	
No.of Obs.	278	

Note: Estimation of the propensity score conducted on the trimmed sample

\* significant at 10% level; \*\* significant at 5%; \*\*\* significant at 1%

Table 3.6: Distribution of sample by altitude

Altitude	PDO farm		Non-PDO farms	
	Number	Percentage	Number	Percentage
< 300 m	38	22%	674	72%
300-600 m	45	26%	144	15%
$\geq$ 600 m	88	51%	121	13%
Total	171		939	

Table 3.7: Distribution of sample by proportion of farm located to less-favoured area

Altitude	PDO farm		Non-PDO farmers	
	Number	Percentage	Number	Percentage
Plains areas	21	12%	556	60%
Mountain areas	102	60%	169	18%
Piedmont areas	29	17%	28	3%
Other less-favoured areas	19	11%	178	19%
Total	171		931	

to mountain areas. As shown in table 3.7, about 60% of PDO farms are located in mountain areas, which are less-favoured areas, while 60% of non-PDO farmers are located in plains areas, where the conditions of production are more favourable.

The estimation of propensity score also reveals that PDO schemes have been significantly adopted in the region of Auvergne and Franche-Comté. This result was expected since Franche-Comté and Auvergne account for 47% and 19% of the sample PDO farms respectively (table 3.8).

Turning to additional linear terms in the estimated propensity score, the results show that PDO farms are more likely to pay penalties for exceeding milk quota, since their milk quota is low compared to non-PDO farms (301,000 litres against 348,000 litres, respectively; see

Table 3.8: Distribution of sample by region of origin

Altitude	PDO farm		Non-PDO farmers	
	Number	Percentage	Number	Percentage
Franche-Comté	80	47%	41	4%
Rhône-Alpes	20	12%	67	7%
Auvergne	32	19%	62	7%
Other regions	39	22%	769	82%
Total	171		939	

Table 3.9: Optimal number of blocks

Subclass	Pscore		No.Non-PDO	No.PDO	Ave Pscore		Ave. diff.	
	Min	Max			Non-PDO	PDO	in Pscore	t-stat
1	0.000	0.179	62	7	0.082	0.123	0.041	2.282
2	0.179	0.323	52	18	1.092	1.109	0.017	0.260
3	0.323	0.528	42	28	0.412	0.435	0.022	1.540
4	0.528	0.680	16	19	0.602	0.586	0.016	1.161
5	0.680	0.984	5	29	0.735	0.804	0.068	3.278

table 3.2). Finally, public subsidies turn out to be negatively correlated to PDO, implying a certain degree of autonomy for PDO farms.

The estimated propensity score is next used to define the optimal number of blocks. In addition to discard extreme values, we split the trimmed sample into several sub-blocks in order to have very similar PDO and non-PDO farms in each block. The results are reported in table 3.9. PDO and non-PDO farms in Block 1 and Block 5 are not comparable, since the average difference in propensity remains large, 0.041 and 0.068, respectively. In principle, we should split again each of these two blocks in the median and assert that there is no difference in propensity score in resulting sub-blocks. Unfortunately, doing so would result in obtain sub-blocks with less than 3 observations by PDO status, which is not sufficient to estimate the effect. In contrast, the average difference of propensity score between PDO and non-PDO farms in Blocks 2, 3, and 4 is less than or equal to 0.02; suggesting that there is no significant difference in propensity within these blocks at the conventional level of 5%. Thus, the difference within each of these blocks measures the specific effect of PDO adoption. Analysis is performed on these last three blocks. We trimmed the sample to improve the internal validity, that is, to make sure that the difference in price and added-value between PDO and non-PDO farms is the only effect of PDO policy. Improving internal validity, however, is not without consequence on the external validity, that is, the extent to which the findings of our analysis can be generalised to the targeted population, for instance. Indeed, it can not be guaranteed that the trimmed sample is representative of the population of milk producers in France. The best way to confirm external validity remains to use meta-analysis and external replications (Onwuegbuzie, 2000).

### 3.4.2 Empirical results

In this section, we present first the average effect of PDO policy on price and added-value, before discussing heterogeneous effects.

Table 3.10: Average treatment effects (ATT) of PDO price at farm gate (in euro per litre)

Covariates	Full Sample		Trimmed Sample	
	1 Block	Match	3 Blocks	Match
No	0.071*** (0.005)	0.065*** (0.010)	0.057*** (0.007)	0.054*** (0.008)
Selected	0.053*** (0.005)	0.059*** (0.010)	0.058*** (0.007)	0.053*** (0.008)
All	0.052*** (0.005)	0.057*** (0.010)	0.059*** (0.008)	0.049*** (0.009)

Note:

The estimated standard errors are in parentheses

\* significant at 10% level; \*\* significant at 5%; \*\*\* significant at 1%

Selected covariates: Age, Gender, Size, Altitude and Dummy regions

All covariates: Age, Gender, Size, Altitude, Milk quota, Penalty, young premium, Diversification, Direct marketing, PGI, CCP, Livestock, Subsidies, and Dummy regions

### 3.4.3 Average Effect

The average effect is first estimated using no covariates; then using only 5 covariates-Age, Gender, Size, Altitude and the dummy Regions; and finally using all covariates (Milk quota, Penalty, Young farmer premium, Diversification, Direct marketing, PGI, CCP, Livestock and Subsidies in addition to the others). This adjustment of covariates is needed to check the robustness of the results with matching and with blocking estimator.

The average effects of PDO policy on price at the farm gate are reported in table 3.10. In table 3.10, we focus on the results obtained with an optimal number of blocks, which we estimated to be three (column 3). The results show that PDO increases the price by 0.06 euro per litre: this finding is robust to the adjustment of covariates. In contrast, the result of the analysis of one block is less robust. Indeed, if we control neither for outliers nor for other characteristics of farms, we find that PDO increases the price by 0.07 euro per litre, whereas once we control for other factors, the scale of the effect shrank (0.05 euro per litre). It is worth noting that 0.05 euro/litre corresponds to 15,000 euros per dairy farm per year in terms of extra Gross sales, which is not insignificant compared to the annual net income of 27,000 euros per dairy farm. This result emphasises the importance of controlling for the systematic differences between PDO and non-PDO farm features and discarding outliers.

Concerning the impacts of PDO on added-value reported in table 3.11, the results also show that the PDO policy is associated with a statistically significant increase in the value added. Specifically, the scale of the impact ranges between 4,389 and 5,330 euros per annual worker unit (AWU), in the 3-block analysis.

Table 3.11: Average treatment effects (ATT) of PDO adoption on added-value

Covariates	Full Sample		Trimmed Sample	
	1 Block	Match	3 Blocks	Match
No	4.083*** (1.383)	7.371*** (2.675)	4.389** (2.169)	5.683* (3.020)
Selected	5.146*** (1.523)	6.732** (2.658)	5.287** (2.294)	5.407* (2.997)
All	3.949*** (1.460)	7.925*** (2.690)	5.330** (2.593)	5.456* (3.004)

Note:

The estimated standard errors are in parentheses

\* significant at 10% level; \*\* significant at 5%; \*\*\* significant at 1%

Selected covariates: Age, Gender, Size, Altitude and Dummy regions

All covariates: Age, Gender, Size, Altitude, Milk quota, Penalty, young premium, Diversification, Direct marketing, PGI, CCP, Livestock, Subsidies, and Dummy regions

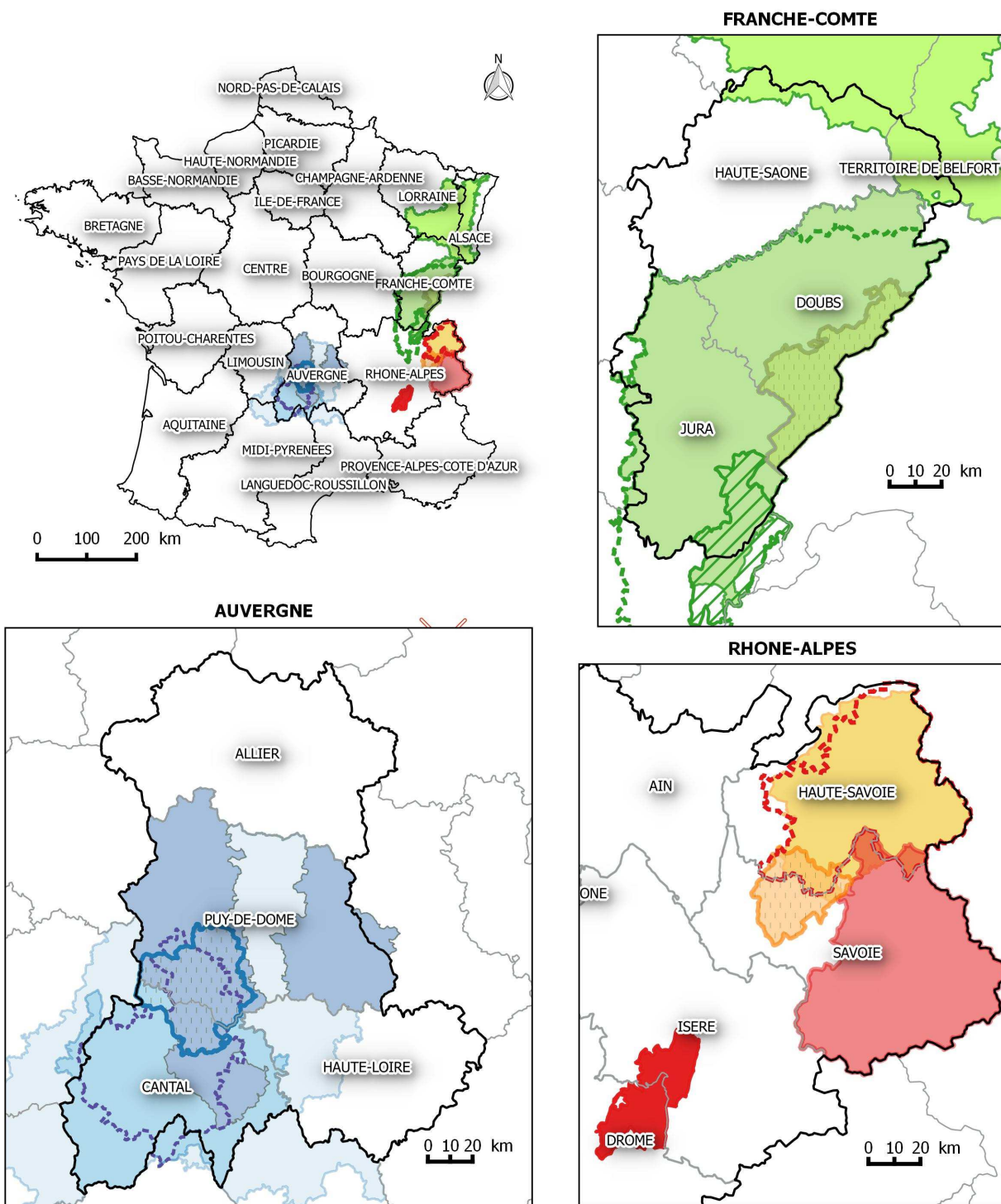
### 3.4.4 Heterogeneous effect

The average effects discussed above are not homogeneously distributed across the regions of origin. Now, we focus on the three selected regions of origin to illustrate the heterogeneous effects hidden by average effects: Franche-Comté, Auvergne, and Rhône-Alpes. They are the three most important regions for PDO cheese production. As mentioned earlier, these three regions account for almost 80% of PDO farms in the sample. The location of the three regions is shown in fig. 3.1.

As shown in table 3.12 the effect of PDO on price is only 0.036 euro per litre when we consider all regions except Franche-Comté (see PDO, column 1). When including Franche-Comté in the analysis, the effect increases by 0.073 (see PDO\*Franche-Comté, column 1) to reach a farm gate price of 0.11 euro per litre (i.e.  $0.036+0.073=0.11$ )<sup>5</sup>. In contrast, the effect of PDO is 0.089 euro per litre without Auvergne; and when including this region in the analysis, the effect is reduced by 0.083 to reach a farm gate price of 0.006 euro per litre. Fig. 3.2 depicts the marginal effect of PDO on price for the three selected regions, and the standard error. When the standard error is larger than the difference in price between PDO and non-PDO observations, it means that the effect is not statistically significant. As can be observed, the price difference in favour of PDO is statistically significant in Franche-Comté and Rhône-Alpes, but not in Auvergne. This result implies that in some regions like Franche-Comté or Rhône-Alpes the PDO causes a big price differential between PDO and non-PDO, while in others, the

5. Interactive terms are often misleadingly interpreted in the literature . For a correct interpretation of interactive terms, see Brambor et al. (2006)

Figure 3.1: PDO boundaries in selected regions of origin



**LEGEND**

**Administrative boundaries**

- Régions
- Départements

**PDO/AOC Auvergne**

- Bleu d'Auvergne
- Cantal
- Fourme d'Ambert

- Saint-Nectaire
- Salers

**PDO/AOC Franche-Comté**

- Bleu de Gex Haut-Jura
- Comté
- Mont d'Or
- Morbier

- Munster

**PDO/AOC Rhône-Alpes**

- Abondance
- Beaufort
- Bleu du Vercors - Sassenage
- Reblochon
- Tome des Bauges

Source : INSEE GEOFLA, 2015 ; INAO, 2016.  
 Author : HBR, QGIS 2.8.9, July 2016

Table 3.12: Differential impact of PDO on price at farm gate by region of origin

Covariates	Coefficient	Coefficient	Coefficient
Intercept	0.322*** (0.024)	0.286*** (0.026)	0.332*** (0.027)
PDO	0.036*** (0.010)	0.089*** (0.008)	0.046*** (0.006)
PDO * Franche-Comté	0.073*** (0.014)		
Franche-Comté	-0.013 (0.009)		
PDO * Auvergne		-0.083*** (0.011)	
Auvergne		-0.014** (0.007)	
PDO * Rhône-Alpes			0.055*** (0.019)
Rhône-Alpes			0.014 (0.009)
Nb. Obs.	175	175	175
Covariates	All	All	All

Note:

The estimated standard errors are in parentheses

\* significant at 10% level; \*\* significant at 5%; \*\*\* significant at 1%

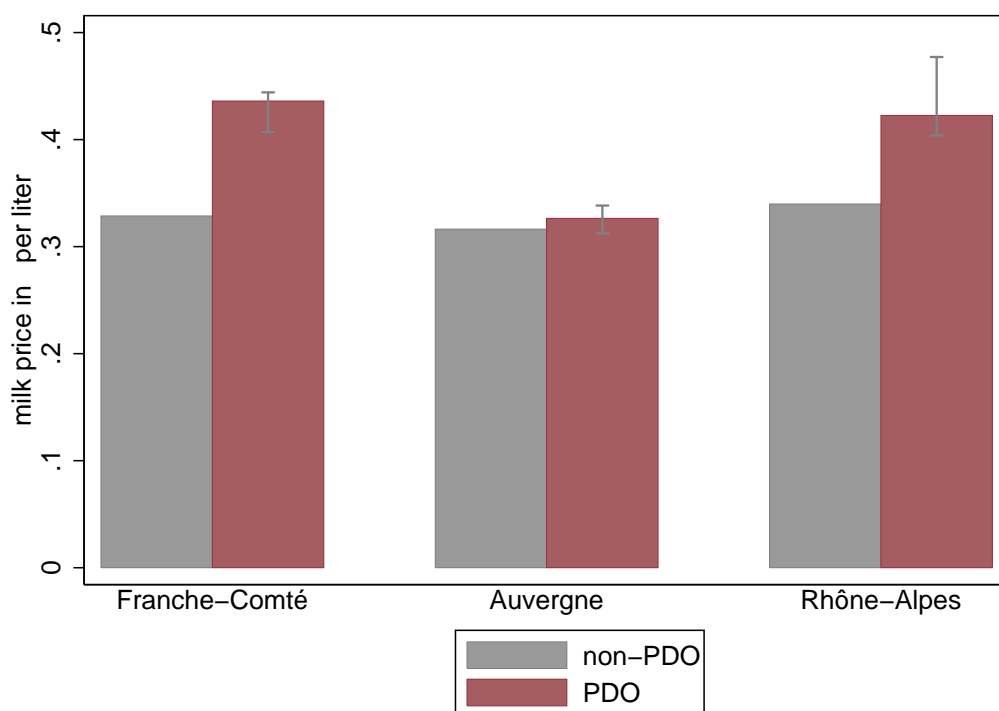
“All” means adjusted for all covariates: Age, Gender, Size, Altitude, Milk quota, Penalty, young premium, Diversification, Direct marketing, PGI, CCP, Livestock, Subsidies, and Dummy regions

difference is small (0.006 euro per litre).

The effect of PDO on the added value, by regions of origin, is reported in table 3.13. If we consider the sample without the region of Franche-Comté, the PDO increases the added value by only 3,189 euros per AWU (PDO, column 1). If we include the Franche-Comté, the effect of the PDO increases by 5,833 euros (PDO\*Franche-Comté, column 1), to reach an added-value of 9,022 euros per AWU. This finding is economically significant, but statistically insignificant. The lack of statistical significance is probably linked to low statistical power in a small sample (Andrews, 1989)<sup>6</sup> Similarly, as shown in column 3, without the region of Rhône-Alpes, PDO increases the added-value by only 3,330 euros per AWU. However, including Rhône-Alpes in the analysis increases the effect of PDO by 9,248 euros per AWU to reach an added-value of

6. Andrews (1989) introduced the concept of Inverse Power (IP) function to facilitate the interpretation when a result is economically significant but statistically insignificant. For two-sided test, the inverse power function are given by  $b = 1.960 * \hat{\sigma}_{\beta_1}$  and  $c = 3.605 * \hat{\sigma}_{\beta_1}$ ; at the conventional significance level of 5%; where  $\hat{\sigma}_{\beta_1}$  is a consistent standard error estimate for  $\hat{\beta}_1$ . For example, the IP function for the coefficient on PDO\*Franche-Comté in column 1,  $b = 1.960 * 4.944$  and  $c = 3.605 * 4.944$ . The IP function at  $\frac{1}{2}$  and 0.95, that is, b and c, is 9.690 and 17.823, respectively. Therefore, with Franche-Comté in the analysis; the result shows that the effect of PDO is less than 17,823 euros per AWU with significance level of 0.05, but the test provides no evidence that it is less than 9,690 euros per AWU.

Figure 3.2: Differential impact of PDO on price at farm gate



12,578 euros per AWU.

It can be seen that including Franche-Comté and Rhône-Alpes regions in the analysis increases the average value-added of the sample from about 3,000 euros per AWU to 9,000 euros per AWU when we include Franche-Comté, and to more than 12,000 euros when including Rhône-Alpes. Conversely, the effect of PDO on added-value is higher without the region of Auvergne (9,682 euros per AWU, column 2). Taking into account the Auvergne decreases the effect by 10,489 euros per AWU; resulting to a net negative effect of 807 euros per AWU. The marginal effect of PDO, and standard error, is shown in fig. 3.3. The difference in added-value in Franche-Comté is economically significant but only just statistically significant. In Rhône-Alpes, the marginal effect of PDO is statistically and economically significant; and in Auvergne the marginal effect is neither economically nor statistically significant.

To sum up, PDOs are effective in increasing the farm gate price and the added-value in both Franche-Comté and Rhône-Alpes regions. However, the analysis reveals that PDOs fail to increase both farm gate price and added-value in Auvergne. Below we provide potential explanations to this regional heterogeneity.

First, the regional heterogeneity reflects the difference in quality between cheeses selected



Table 3.13: Differential impact of PDO on added-value by region of origin

Covariates	Coefficient	Coefficient	Coefficient
Intercept	8.825 (8.217)	7.354 (8.776)	12.635 (8.095)
PDO	3.189 (2.147)	9.682*** (2.620)	3.330 (2.023)
PDO * Franche-Comté	5.833 (4.944)		
Franche-Comté	3.581 (4.717)		
PDO * Auvergne		-10.489** (3.860)	
Auvergne		3.478 (2.624)	
PDO * Rhône-Alpes			9.248* (5.383)
Rhône-Alpes			-2.997 (2.815)
Nb. Obs.	175	175	175
Covariates	All	All	All

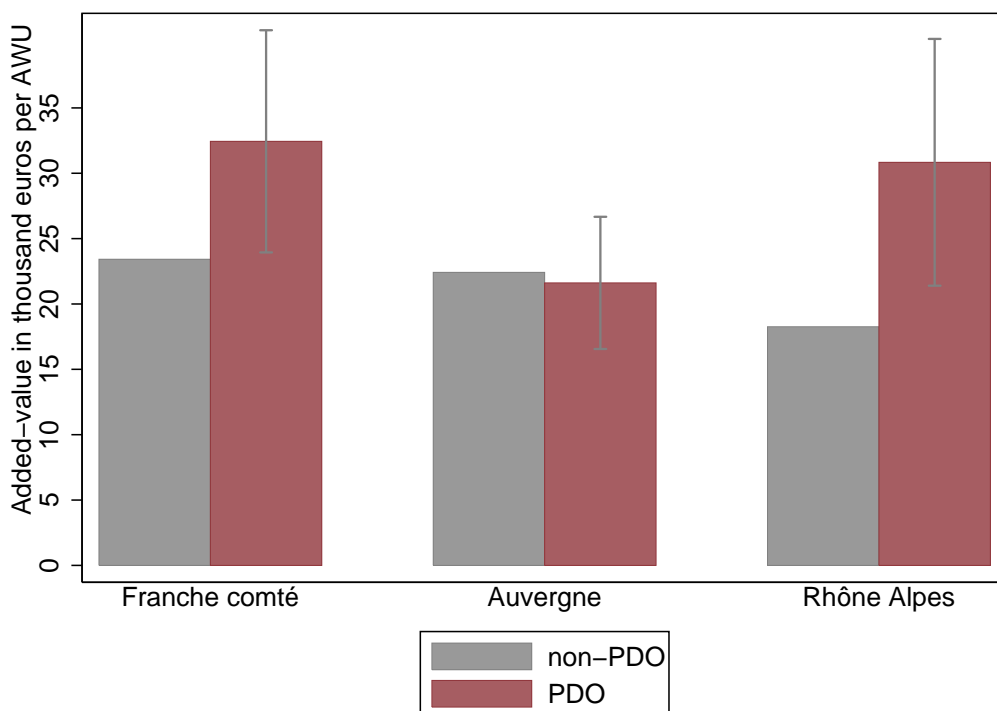
Note:

The estimated standard errors are in parentheses

\* significant at 10% level; \*\* significant at 5%; \*\*\* significant at 1%

“All” means adjusted for all covariates: Age, Gender, Size, Altitude, Milk quota, Penalty, young premium, Diversification, Direct marketing, PGI, CCP, Livestock, Subsidies, and Dummy regions

Figure 3.3: Differential impact of PDO on added-value



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by producers' organisations across regions (Mérel and Sexton, 2011). Despite the presence of PDOs, not all cheeses are deemed to be high-quality: some are produced using industrial methods, in large quantities. This logic is contradictory to the spirit of PDOs, but it must be noted that it exists. It is the case, for example, for PDO Cantal, the largest PDO in Auvergne (Barjolle and Philippe, 2012). Unlike in Auvergne, a producers' organisation in Franche-Comté, called Comité Interprofessionnel de Gestion du Comté (CIGC), sets both quality, and quantity criteria. The CIGC allied producers select high-quality cheeses through a grading system, and use also a supply control system by granting annual rights to produce cheese, called *plaques de production*. This system probably limits the quantities supplied, and so, indirectly influences prices. However, Mérel (2009) shows that such a system of supply control does not lead to non-competitive practices.

Second, the effectiveness of a PDO with respect to increasing the price at the farm gate and the added value depends on whether the differentiation of the high-quality product is based on scarce factors that farmers own (Moschini et al., 2008). This refers to two conditions. Firstly, to assess whether the differentiation is based on scarce factors requires identification of the link between the product and the territory defined in the code of practices. The closer is the link between the product and local resources, the more farmers have bargaining power when they control these local resources. For instance, in Franche-Comté, local specificities include breed selection, grazing systems, etc. This tight link in Franche-Comté is reinforced by the fact that Comté is a raw-milk cheese, for which milk quality directly reflects animal feeding and therefore the specific characteristics of the region. The quality of the cheese depends heavily on the quality of the milk. Conversely, the milk used in manufacturing Cantal in Auvergne is considered to be a generic milk, in spite of PDO certification. The code of practice does not encourage the differentiation of milk (e.g. grazing systems); therefore, the link between the final product (Cantal) and local resources is weaker. Thus, the price of milk is not linked to the final price of cheese (Perrier-Cornet and Sylvander, 2000). The second condition refers to whether farmers own the scarce factors. In Franche-Comté, farmers control the scarce resources. The historical organisation of PDO Comté is based on a technical and social specialisation along the supply chain. Historically, and still today, cheese production is under the control of milk producers gathered in small co-operatives called *fruitières* where they process milk into "fresh"

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cheese; while “maturers” who “age” fresh cheese into commercial cheese for retailers, are not involved in milk processing. This division of tasks allows a balance of power along the supply chain, and therefore gives the farmers gathered in co-operatives a higher value and as a result a higher price for their milk at the farm gate.

### 3.5 Conclusion

This study introduces consistent data at the farm level from the Farm Accounting Data Network survey and the latest France census (2010); and assesses the impact of PDO on, first the farm gate price and secondly, on the value added by taking into account production costs. The study focuses on first stage actors in the France dairy sector. From a methodological point of view, in order to overcome the biases in previous studies, we use an application of the matching method: blocking analysis. This method allows us to group PDO and non-PDO farms into homogeneous blocks in order to increase their comparability.

This approach is implemented at two levels of analysis: national and regional. These two levels of analysis are complementary because the regional analysis allows us to reach a higher level of precision, and to capture the heterogeneity between regions that the national analysis masks. The results show that, on average, PDO policy significantly increases the price and the added value for producers at the national level. However, the average national effect is not homogeneously distributed. The analysis reveals a strong heterogeneity between the three French regions which have the largest number of PDOs (Franche-Comté, Rhône-Alpes and Auvergne). PDOs are effective in increasing the price at the farm gate as well as the added-value in both Franche-Comté and Rhône-Alpes regions. However, the analysis reveals that PDOs fail to increase both price at the farm gate and the added-value in Auvergne. This finding implies that legal protection does not automatically ensure better economic performance. Additional conditions are required, such as selection of high-quality products, granting production rights, and/or strengthening the link between products and local characteristics through restrictions in the code of practices.

More research is desirable to continue building evidence-based PDO policy. It would be interesting to analyse the effectiveness of this policy in achieving the other objectives defined by the European Commission (EC reg. n° 510/2006). From a methodological point of view,

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it would also be interesting to test the validity of our method in other contexts, and also to develop alternative econometric tools taking into account the geographical location of the farms using geospatial data, for instance. This will be the subject of subsequent research projects.



# Evaluation of the economic impact of PGI policy at international level: The case study of “Café de Colombia” <sup>1</sup>

Many developing countries participating in commodity markets face low and volatiles prices. One way for developing countries to de-commodify exportation is to adopt an origin quality differentiation strategy. “Café de Colombia” is the first non-EU product to be protected as Geographical Indications (GIs) in EU. This paper evaluates the effect of protected geographical indications (PGI) on the price paid to growers in Colombia. Using synthetic control methods and a panel of coffee producing countries, we found that PGI policy increases the price paid to growers by more than 30%. This study also allowed us to draw lessons for other countries in terms of the success of such a policy, but also the challenges in the implementation of this policy.

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1. This chapter co-authored with Philippe Jeanneaux and Paulo Van Der Ven

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## 4.1 Introduction

The economic impacts of Geographical indications (GIs) have been widely documented in developed countries ([Bouamra-Mechemache and Chaaban, 2010](#); [Tempesta and Vecchiato, 2013](#); [Bonnet and Simioni, 2001](#); [Bontemps et al., 2012](#); [Enneking, 2004](#); [Grunert, 2005](#); [Hu et al., 2012](#); [van der Lans et al., 2001](#); [Menapace et al., 2011](#); [Pascucci et al., 2011](#); [Darby et al., 2008](#))<sup>2</sup>. However, as pointed out by [Bramley \(2011\)](#), works on developing countries are scarce and based on anecdotal evidence without empirical foundation. Moreover, no consensus exists among the few notable exception ([Bowen, 2010](#); [Jena and Grote, 2012](#); [Teuber, 2010](#)). [Jena and Grote \(2012\)](#) show that GI has increased the income of Basmati rice producers in India, while [Bowen \(2010\)](#) shows that the introduction of the GI has been detrimental to Tequila producers in Mexico, where the GI has led to the exclusion of small producers and the evolution of the code of practices to industrial practices harmful to the environment<sup>3</sup>.

We contribute to the accumulation of knowledge on the implementation and impact of GIs policy in developing countries in two original ways:

Firstly, we focus on the first product from a developing country to have benefited from the European Protected Geographical Indications (PGI) in 2007: café de Colombia. This case study is particularly interesting because it provides insights into the implementation of GIs policy in developing countries. Colombia uses the possibility offered by the European Union to signal the high-quality of its coffee and to protect its reputation against usurpation. Colombia is the third largest coffee producer in the world, after Brazil and Vietnam. This commercial potential increases the risk of fraud, but at the same time a sufficient large scale production is needed to face the cost of GI establishment and preventing imitation of the product ([Hayes et al., 2004](#)). The enforcement of intellectual property rights is further challenging in developing countries, where the legal protection is often felt to be missing ([Chabrol et al., 2015](#)).

Secondly, we use the synthetic control method, recently developed by [Abadie and Gardeazabal \(2003\)](#) and [Abadie et al. \(2010, 2015\)](#), to estimate a causal effect of PGI adoption on price

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2. The World Trade Organisations (WTO) Agreement on Trade-Related Aspects of Intellectual Property (TRIPS) defines GIs as “indications which identify a good as originating in the territory of a Member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin.” Example of well-known GIs from developed countries are Bordeaux wine, Comté cheese, Permigiano-Reggiano cheese. Example of GIs from developing countries include Darjeeling tea, Mexican Tequila.

3. [Bramley \(2011\)](#) provides a comprehensive review of the impact of GIs in developing countries

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paid to growers in Colombia. In our knowledge, this is the first study to apply this method to the realm of agriculture in general, and to GIs policy evaluation in particular. This method is based on a data-driven procedure, which allow to construct “synthetic control unit” based on a weighted combination of control countries. The basic idea is that a combination of control units often provides a better approximation for the treated country than any single country alone. The synthetic control method is a comparative method, that is, the number of treated unit is very limited, often one. This method is particular suitable to the evaluation of PGI adoption in Colombia since the protection concerns the whole country. Therefore, we have only one treated unit (i.e. Colombia), which we compared to other coffee producing countries. The comparison include the temporal dimension (i.e. before and after GI adoption) and a cross-section comparison (i.e. Colombia vs other coffee producing countries). Therefore, our approach also has the advantage of combining the diachronic comparison (before vs after GI adoption) and synchronic comparison (with vs without GI), used separately in case studies from European countries<sup>4</sup>

The rest of the paper is organized as follow. Section 4.2 describes the production of coffee in Colombia. Section 4.3 presents our evaluation framework. Section 4.4 describes the data used in the analysis. Section 4.5 discusses our empirical findings and section 4.6 concludes.

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4. The terminology of synchronic and diachronic goes back to (Lijphart, 1971).



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## 4.2 Café de Colombia

### Governance

Colombia has a long coffee tradition, which starts with the introduction of coffee seeds at the beginning of 1800s. Coffee is one the main Colombian export goods. The registration of “café de Colombia” as a Denomination of Origin (DO) at the national level in 2004 and as a PGI in European Union in 2007 is a result of a long coffee tradition and existing institutional framework, developed overtime to organize coffee growers ([Quiñones-Ruiz et al., 2015](#)). The National Federation of Colombian Coffee Growers (FNC) was created in 1927, with the objective of monitoring the international coffee market and protecting the interests of coffee growers. The FNC is a large coffee association, with more than 500,000 coffee growers. The FNC is a powerful entity supported by the Colombian government. It is in charge of national coffee policy, and also responsible of controlling Colombian coffee sector. It has even been considered as a State inside the State ([Montagnon, 2003](#)).

### Quality standards

“Café de Colombia” differentiation strategy started with a strong quality and control policy, applied both at the production level and at export harbors. The quality objectives were set to obtain the highest quality coffee standard. Since 1932 quality standards have been developed and modified for the exportation of Colombian coffee, with the objective of obtaining the best quality coffee in the world. This product was strongly promoted world-wide in order to be differentiated into the international coffee market. During the 60s, characterized by oversupply and low coffee price on the international market, an important campaign was built to promote the Colombian coffee. In a commodity coffee market dominated by cost-reduction strategy, the differentiation by the origin was a useful tool of differentiation and competitiveness. The marketing turns out to play an important role to reach this coffee differentiation.

### Marketing campaign

A strong marketing campaign started in 1960 with the creation of *Juan Valdez* icon; the symbol of a traditional Colombian coffee grower, promoting Colombian coffee all around the

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world (Samper, 2007). This marketing strategy was an important step for the coffee differentiation.

*Juan Valdez* has been created as a communication tool to tell the origin and the history behind a Colombian cup of coffee. For the first time, producers see coffee origins and the quality of their product communicated directly to the consumers. In fact at this period numerous brands of coffee were only composed of different coffee blends. According to the FNC, the main message conveyed with *Juan Valdez* icon was that “only extraordinary efforts must produce an extraordinary coffee” (Samper, 2007).

At the beginning of the 80s “Café de Colombia” brand was created as a branding ingredient. Like other brands (e.g. Intel, GoreTex), numerous firms started using “Café de Colombia” to signal the high quality of their product.

## Brand globalization

The use of international sports competitions was responsible for the brand globalization of “Café de Colombia”. In fact, international competitions of skiing, cycling, tennis and others, worldwide watched, were a cheaper way to attend the global consumer by sponsoring those events with the brand “Café de Colombia”.




At the beginning of the 90s, the FNC strategy was well structured: a product reputation built on the quality, a symbol recognized, a demanded brand and world partners that collaborated with product distribution. This differentiation strategy and marketing campaign allowed, in the American market, the *Juan Valdez* stamp to be known by 53% of citizens in 2000 (Lozano, 2002).

## Access to coffee niche markets

To access to new coffee niche markets, the FNC begins a new strategy in 2000s. Colombian coffee growers created their own coffee trademark, *Juan Valdez*, to compete with other international brands. Moreover, in addition to recognized special coffee shops in the USA, FNC opened his first *Juan Valdez* Café at Bogota Airport. Currently, FNC has 300 shops in 9 different countries.

The “de-commodification strategy” must be separated into two steps: *i*) a first stage that

Table 4.1: Different protection of café de Colombia

Type of protection	Extent of protection	logos
DO	Bolovia, Colombia, Ecuador, Peru	
PGI	European Union member countries	
Brand	International	

goes from the 60s to the beginning of the 2000s, characterized by a quality and reputation construction, based on origin promotion; *ii*) a second stage, from 2004 to the present, based on collective efforts to protect the reputation of “Café de Colombia” by using DO and PGI tools (table 4.1).

### Link to the *terroir*

The defined area of PGI “Café de Colombia” covers 1,5 million hectares, distributed throughout the Andean cordillera and involving 22 Colombian regions (fig. 4.1). Currently, coffee cultivation covers 921 000 hectares in 588 municipalities out of 1 100 municipalities in Colombia, reflecting the importance of coffee through the country. The PGI area only include the zones situated between 400 and 2 500 meters over the sea level, and between the latitudes 1°-11° and the longitude 72°-78°. The quality of coffee is a strongly correlation to the altitude, the more the coffee is produced in high altitudes the more the slowly coffee cherry ripeness allow the production of coffee aromas (Joët et al., 2010). The Atlantic and Pacific Oceans, the Amazonia, and the volcanic soils of the Andean cordillera, give optimal conditions of coffee-growing area, allowing to produce a high quality product with an annual average temperatures rise between 18 and 22°C. Moreover, the coffee-growing area also benefits from a well rainfall distribution, allowing the production of fresh coffee throughout the year.

The link of “Café de Colombia” to the specific origin is not limited to the pedo-climatic



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conditions but also to the human and cultural methods used during the process. One of the specificity of the “Café de Colombia” code of practice (CoP) is the manual harvesting of the ripe coffee cherries. This ripped fruit selection has a direct influence on coffee drink characteristics in terms of aromas and acidity, contrary to under ripped fruits that can disrupt the standard coffee cup quality. In addition, only few coffee varieties having specific cup qualities can be used by coffee farmers (Caturra, Typica, Bourbon, Taby, Castillo, Colombia). Another human factor involved into the coffee production process is the wet method of processing coffee. This method involves a mechanic pulping at farm level and coffee beans water washing in order to remove the impurities. Moreover, the FNC also uses technologies such as near-infrared spectroscopy, which allows characterizing the coffee beans spectral print, to control the coffee quality at different levels of the value chain. This collecting and processing coffee methods has been traditionally used by coffee growers in Colombia and are partly responsible of the reputation of “Café de Colombia” as high quality product, with a special smooth arabica coffee of medium/high acidity and pronounced aromas.

## **Certification process**

In 2000, the Cartagena accord was signed by the Andean community member countries (Bolivia, Colombia, Ecuador and Peru) to develop local frameworks in order to protect the products strongly linked to their origin. To this purpose, the Colombian government has designed the Superintendent of Industry and Trade as the entity in charge to protect locally GIs products. This first step at the Andean level allowed the FNC to protect the “Café de Colombia” as a DO at national level in 2004<sup>5</sup>.

To progress into the origin protection, “Café de Colombia” became in June 2005, the first agricultural product from a non-EU member country to apply for the PGI recognition to the EU. In September 2007, “Café de Colombia” was recognized as a PGI into the EU throughout the EC reg. n° 1050/2007. This registration was a result of the long coffee tradition and the

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5. EC reg. n° 510/2006 requires the registration a product at national level before submitting application for registration to the European Commission: “The protection afforded by this Regulation, subject to registration, should be open to the geographical indications of third countries where these are protected in their country of origin. The registration procedure should enable any natural or legal person having a legitimate interest in a member state or a third country to exercise their rights by notifying their objections Where the registration application concerns a geographical a geographical area situated in a third country the application shall be sent to the Commission, either directly or via the authorities of the third country concerned”

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well-established institutional framework of the FNC. This well organized and representative entity allowed reducing transactions costs by representing the global coffee growers objectives. At the National coffee congress in 2015, 90 coffee producers have represented more than 500 000 national coffee growers. During this event, taking place every year, the Colombian government and the FNC defined the global coffee policy and studied the difficulties of the Colombian coffee sector. The design of the rules governing the use of the PGI formally started in 2005, and was based on the quality standards developed over decades for high quality export coffees ([Quiñones-Ruiz et al., 2015](#)). About 13 000 coffee farms, was sample by the FNC and the National Coffee Research Center (Cenicafé) and various criteria was analyzed to proved scientifically the link between the product's quality and the characteristics of the defined area of production.

PGI “Café de Colombia” registration was possible not only due to the institutional framework and the link to the origin but also to the specific and well-reputed product characteristics. Moreover the well delimited zone and the capacity of the FNC to demonstrate the specificities of the product and the capacity to support usurpation controls, are also the issues of PGI “Café de Colombia” recognition in EU. Nevertheless, during the PGI registration all the value chain stakeholders as roasters, exporters, traders, retailers, were not took into account when elaborating the “rules of the game” ([Quiñones-Ruiz et al., 2015](#)). Setting collectively the rules is a key factor of success in GI certification process. Therefore, convincing all stakeholders to promote the PGI “Café de Colombia” must be one of the main challenges for Colombian coffee growers.

In a context of growing interest in GIs in developing countries, the case of “Café de Colombia” could provide useful insights on the implementation of GIs and the condition of success of using GIs as a development tool. The question we attempt to response can be presented as follow: Is there a causal effect of PGI policy adoption on price paid to growers in Colombia and how can we accurately identify the effect?

We use the synthetic control method, recently developed by [Abadie and Gardeazabal \(2003\)](#) and [Abadie et al. \(2010, 2015\)](#). The synthetic control method is a comparative method, and is particularly suitable since it combines the temporal dimension (i.e. before and after treatment) and a cross-section comparison (i.e. treated and untreated). As a result, to evaluate the impact of PGI adoption, our approach has the advantage of combining the diachronic comparison

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(before vs after PGI adoption) and synchronic comparison (Colombia vs other coffee producing countries). The next section discusses in details our methodology. In the best of our knowledge, this study is the first to implement the synthetic control method in the realm of agriculture.

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### 4.3 Evaluation framework

To evaluate the economic impact of GI we use an adapted potential outcome model, which is also known as Rubin Causal Model. Let assume that we have  $J+1$  countries. Let also assume, without loose of generality, that the first country adopts PGI policy.  $J$  countries are considered as control countries. The time period cover is  $t = 1, \dots, T$ . Let  $T_0$  represents the number of pre-adoption periods,  $1 \leq T_0 < T$ .

Let  $Y_{it}^I$  denotes the outcome that would be observed for country  $i$  if it adopts the PGI policy in periods  $T_0 + 1$  to  $T$ . Similarly, let  $Y_{it}^N$  denotes the outcome that would be observed for country  $i$  in the absence of PGI adoption. Country  $i$  can either adopt or not the policy, but not both, and thus only one of these two potential outcomes can be realized at  $t > T_0$ . If country  $i$  has adopted the policy,  $Y_{it}^I$  will be realized and  $Y_{it}^N$  will be a counter-factual outcome. If country  $i$  has not adopted the policy,  $Y_{it}^N$  will be realized and  $Y_{it}^I$  will be a counter-factual outcome. Hence, the observed outcome:

$$Y_{it} = D_{it}Y_{it}^I + (1 - D_{it})Y_{it}^N \quad (4.1)$$

and since only the first country has adopted the policy and only in periods  $T_0 + 1$  to  $T$ , we have

$$D_{it} = \begin{cases} 1, & \text{if } i = 1 \text{ and } t > T_0 \\ 0, & \text{otherwise} \end{cases} \quad (4.2)$$

The ultimate goal is to estimate  $\alpha_{1t} \equiv Y_{1t}^I - Y_{1t}^N$  at  $t > T_0$ . As discussed above,  $Y_{1t}^I$  is observed for the first country (i.e.  $i = 1$ ), but not  $Y_{1t}^N$ , which is a counter-factual. Therefore, to estimate  $\alpha_{1t}$  we have to approximate the counter-factual, that is, the path that the first country would have followed in the absence of the policy.

[Abadie and Gardeazabal \(2003\)](#) and [Abadie et al. \(2010, 2015\)](#) propose the synthetic control method to estimate the counter-factual  $Y_{1t}^N$ . They provide a data-driven procedure to construct synthetic control units based on a weighted combination of  $J$  control countries. The basic idea is that a combination of  $J$  control countries often provides a better approximation for the treated country (i.e.  $i = 1$ ) than any single country alone. The weights are chosen so that the synthetic control (i.e. proxy of counter-factual) most closely resembles the actual treated



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country in the pre-adoption periods<sup>6</sup>.

In practices, the implementation of synthetic control method requires five steps, which consist of (Gathani et al., 2013) (i) selecting the outcome variable, ii) selecting the period of analysis, iii) selecting predictor variables of the outcome variable, iv) selecting potential control countries; and v) conducting various robustness checks<sup>7</sup>.

## 4.4 Data source

We use two data sources: International Coffee Organization (ICO) data and World Development Indicators (WDI) of World Bank. ICO is the main intergovernmental organization for coffee producers, and include price data (e.g. price paid to coffee growers, retail price, world price etc.), supply data (e.g. production of coffee, domestics consumption of coffee) and trade data. This article focuses on price paid to growers in coffee producers countries between 1995-2010. This period is chosen to take into account the period before and after the European PGI adoption. Analysis is conducted at country-level. Total number of country is 49 (table 4.2). Countries are usually classified by ICO according to the type of coffee produced: Colombian milds (3 countries), Brazilian naturals (7 countries), Robustas (28 countries), and other milds (27 countries). Sixteen countries produce more than one type of coffee, which explains that the sum of countries by type of coffee is higher than the total number of 49 coffee producing countries. WDI data include variables, which served as predictors of price paid to growers.

Data on price are missing for some countries as shown in table 4.2. We restrict the sample to countries where price data are fully available between 1995-2010 (i.e. 16 observations). This leaves us with 24 countries distributed as follow: Colombian milds (1 country), Brazilian naturals (2 countries), Robustas (9 countries), other milds (12 countries). Note that Brazil is classified twice, among Brazilian milds and Robustas producers. Ecuador, India, Papua New Guinea, and Uganda are also classified among Robustas and other milds producers. Therefore, the analysis is based on 19 countries, with 1 treated country (Colombia) and 18 potential control countries: Burundi, Brazil, Costa Rica, Cuba, Dominican Republic, Ecuador, Ethiopia, Guatemala, Honduras, India, Jamaica, Malawi Papua New Guinea, El Salvador, Togo, Thai-

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6. see Abadie and Gardeazabal (2003) and Abadie et al. (2010, 2015) for details on the derivation of weights.

7. Empirical analysis are performed using Stata13.

Table 4.2: Coffee producers countries by type of coffee between 1995-2010 (Price)

Colombian Milds		Brazilian Naturals		Robustas		Other Milds	
Country	Nb.obs.	Country	Nb.obs.	Country	Nb.obs.	Country	Nb.ob
<b>Colombia</b>	16	Angolas <sup>a</sup>	0	Angola	11	Bolivia	6
Kenya	10	<b>Brazil</b> <sup>a</sup>	16	Benin	0	<b>Burundi</b>	16
Tanzania <sup>a</sup>	14	<b>Ethiopia</b>	16	<b>Brazil</b>	16	Cameroon	12
		Indonesia <sup>a</sup>	10	Burundi <sup>b</sup>	4	Congo. Dem.Rep.of	4
		Philippines <sup>a</sup>	14	Cameroon <sup>b</sup>	12	<b>Costa Rica</b>	16
		Thailand <sup>a</sup>	0	Central African Republic	14	<b>Cuba</b>	16
		Vietnam <sup>a</sup>	0	Congo. Dem. Rep. of <sup>b</sup>	9	<b>Dominican Republic</b>	16
				Congo. Rep. of	2	<b>Ecuador</b>	16
				Côte d'Ivoire	15	<b>El Salvador</b>	16
				<b>Ecuador</b> <sup>b</sup>	16	<b>Guatemala</b>	16
				Gabon	10	Haiti	6
				Ghana	0	<b>Honduras</b>	16
				Guinea	1	<b>India</b>	16
				<b>India</b> <sup>b</sup>	16	<b>Jamaica</b>	16
				Indonesia	13	Madagascar	11
				Liberia	0	<b>Malawi</b>	16
				Madagascar <sup>b</sup>	13	Mexico	14
				Nigeria	0	Nicaragua	10
				<b>Papua New Guinea</b> <sup>b</sup>	16	Panama	4
				<b>Philippines</b>	16	<b>Papua New Guinea</b>	16
				Sierra Leone	1	Peru	11
				Sri Lanka <sup>b</sup>	6	Rwanda	11
				Tanzania	14	Sri Lanka	1
				<b>Thailand</b>	16	<b>Uganda</b>	16
				<b>Togo</b>	16	Venezuela Bol Rep. of	0
				Trinida and Tobago	5	<b>Zambia</b>	16
				<b>Uganda</b> <sup>b</sup>	16	Zimbabwe	0
				<b>Vietnam</b>	16		

<sup>a</sup> This country also produces Robustas

<sup>b</sup> This country also produces other milds

\* no.obs. is the yearly number of observation of price paid to growers. no.obs.<16, implies that values of price are missing for some years.

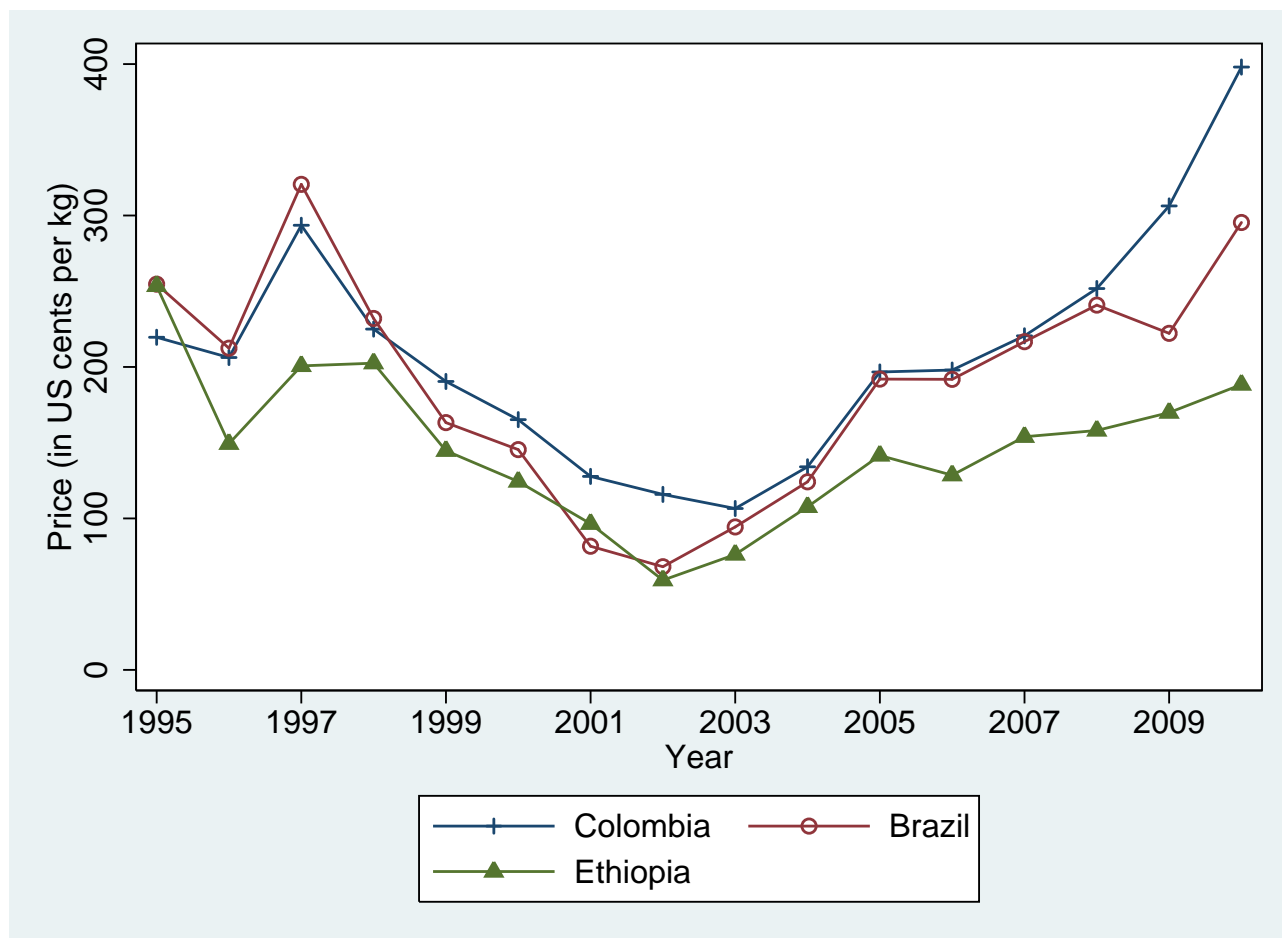
land, Uganda, Vietnam, and Zambia.

## 4.5 Empirical analysis

We start our empirical investigation of the causal effect of PGI by comparing the price paid to growers in Colombia to other coffee producing countries. We graphically compare the price paid to Colombian coffee growers to Brazilian naturals, Robustas, and other milds producing countries. This step allows to visualize potential control countries, that is, countries which follow the same path that the Colombia has experienced.

Fig.4.2 displays the evolution of price paid to growers in Colombia and the two countries of our sample producing the Brazilian naturals type of coffee (i.e. Brazil and Ethiopia). It can be seen that the price paid to growers in the three countries follows the same trajectory between 1995-2010. The evolution of price in Brazil is more similar to Colombia than Ethiopia, especially between 2003 and 2008. This implies that Brazil can be a relevant control country

Figure 4.2: Price in Colombia and in Brazilian naturals producers countries



for Colombia between 2003-2008. This also raise the question of whether the gap observed after 2008 stems from the adoption of PGI policy in Colombia.

Similarly, fig. 4.3 price in robustas producing countries follows the same trajectory as in Colombia until 2008. However, price falls in all countries after 2008, except in Colombia.

Finally, we compare the price in Colombia to price in other milds producing countries (fig. 4.4). As shown on fig. 4.4, Jamaica cannot be consider as control country since its trajectory is completely different. Similarly, Cuba reflects the trajectory of Colombia only from 2004. As a result, we discard Jamaica. While the price in other countries follow the same trend as in Colombia, no single country exactly reflect the trajectory of price in Colombia. Therefore, we construct a “synthetic Colombia”, which is a weighted combination of the most relevant countries among the 18 potential control countries, using the data-driven procedure proposed by [Abadie and Gardeazabal \(2003\)](#) and [Abadie et al. \(2010, 2015\)](#).

The results of the synthetic control are reported in table 4.3. Results indicate that a better approximation of a counter-factual for Colombia (i.e.synthetic Colombia) is a combination of

Figure 4.3: Price in Colombia and in Robustas producers countries

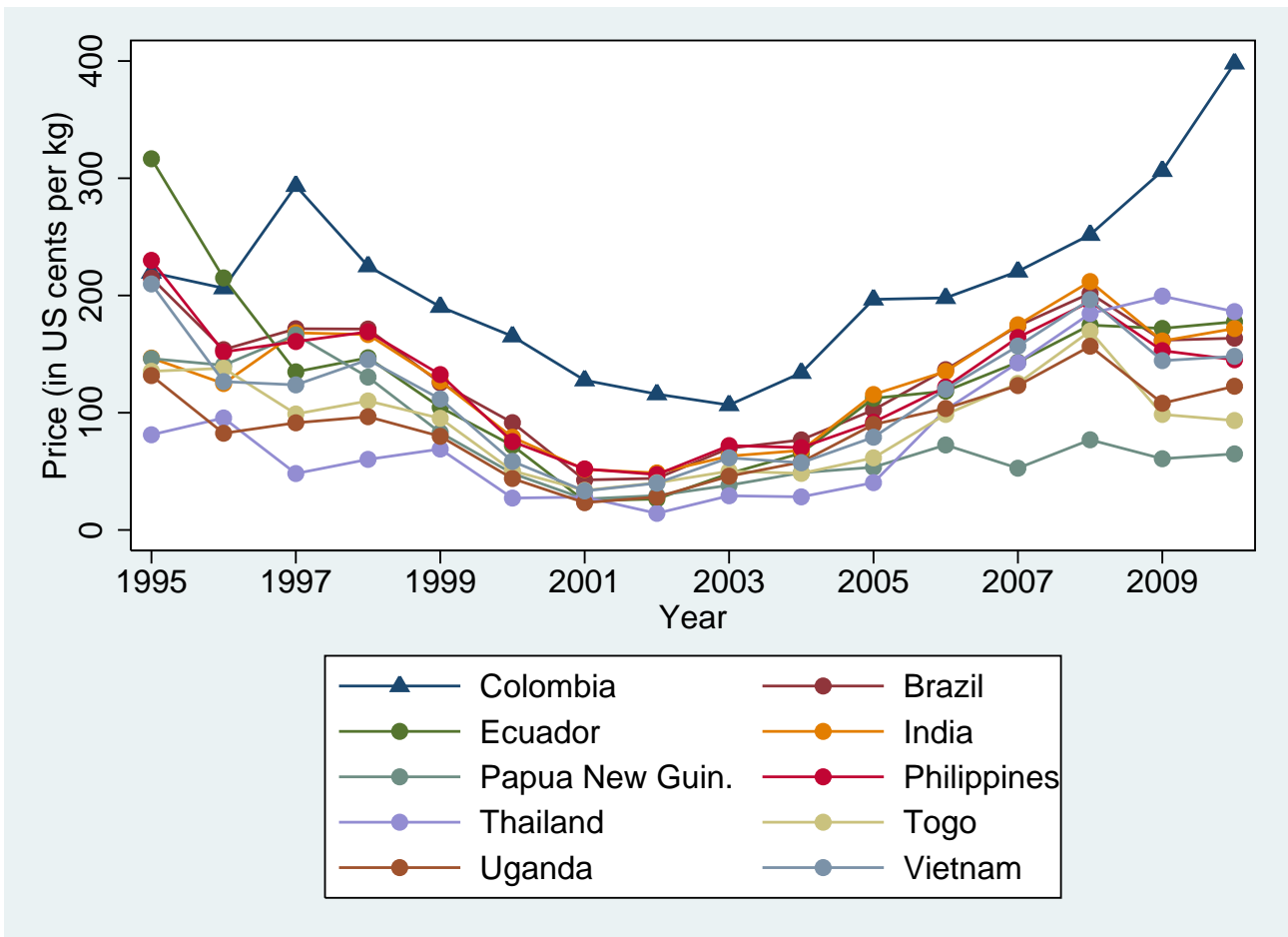


Figure 4.4: Price in Colombia and in other Milds producers countries

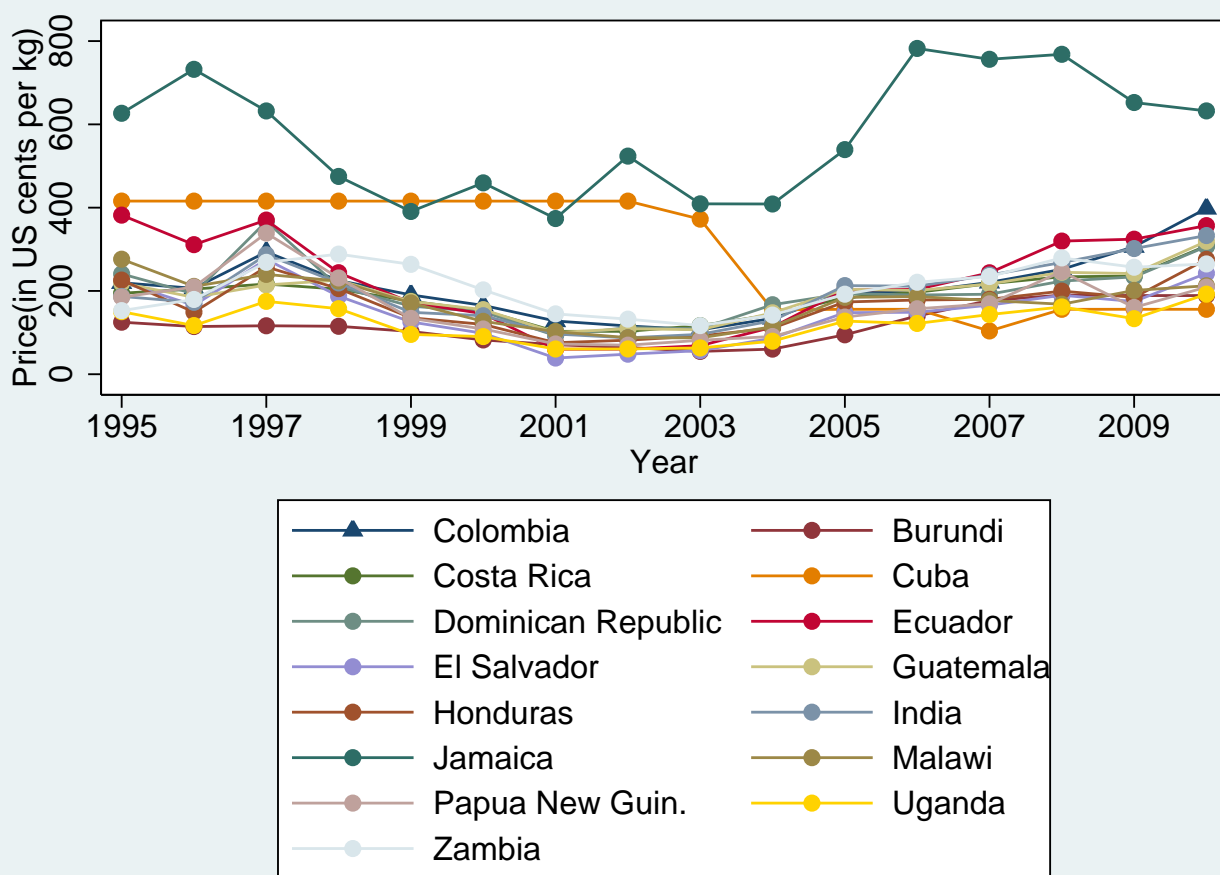


Table 4.3: Country Weights in the Synthetic Colombia

Control countries	Weight
Burundi	0
Brazil	.442
Costa Rica	0
Cuba	0
Dominican Republic	0
Ecuador	0
Ethiopia	0
Guatemala	.301
Honduras	0
India	.022
Malawi	0
Papua New Guinea	0
El Salvador	0
Togo	0
Thailand	0
Uganda	0
Vietnam	0
Zambia	.235

Table 4.4: Coffee price predictors means

Variables	Colombia	Synthetic Colombia
GDP per capita growth <sup>a</sup>	1.853	1.862
Inflation.GDP deflator <sup>a</sup>	11.899	13.546
Price in 2004	134.111	134.167
Price in 2007	220.577	220.019

<sup>a</sup> in annual % and from World Development Indicators

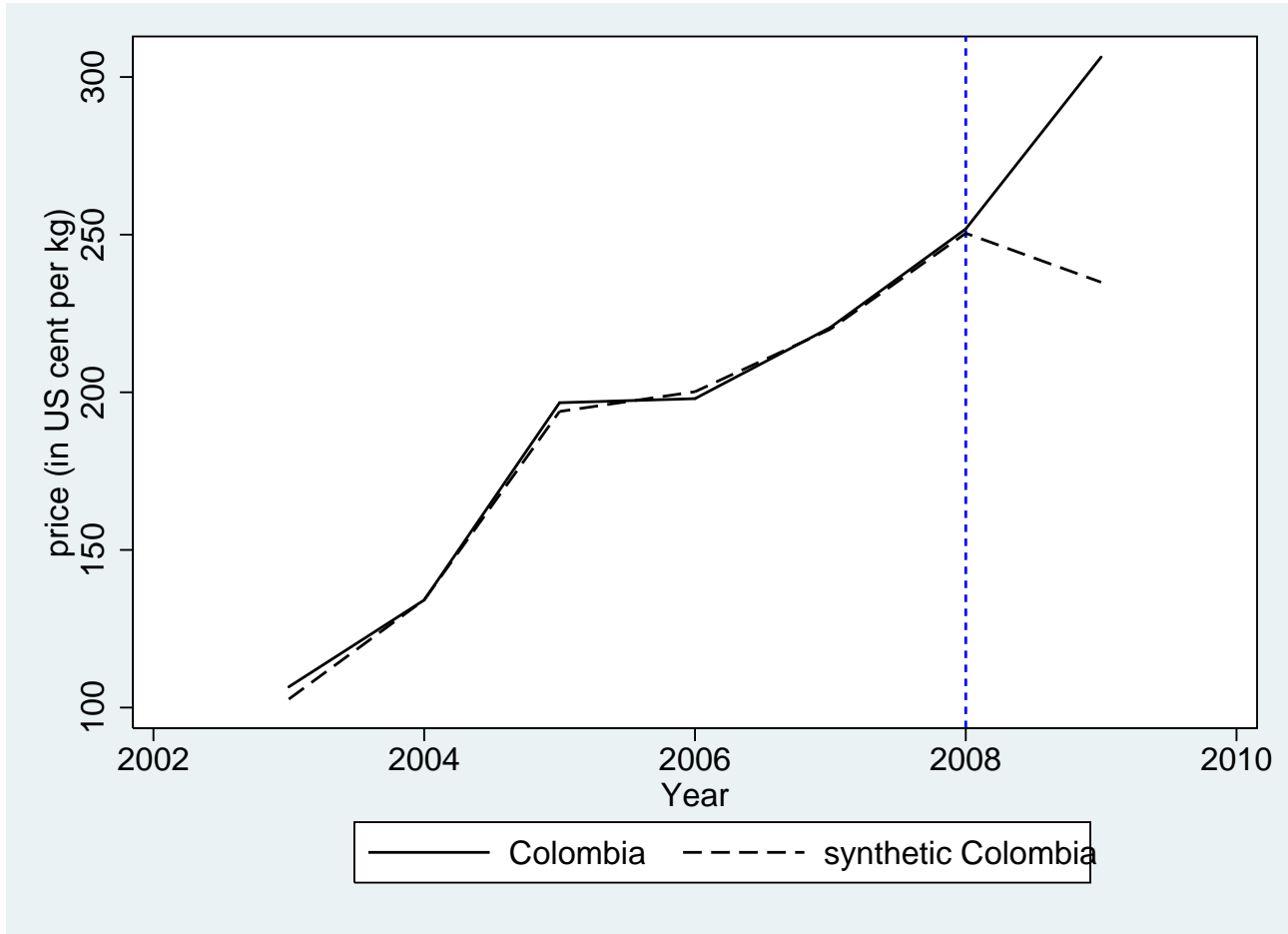
<sup>a</sup> prices are in US cent per kg, and from International Coffee Organization

Brazil, Guatemala, India and Zambia. The top two weighted countries are from Latin America: Brazil (44.2%) and Guatemala (30.1%). As shown in fig. 4.4, price of coffee in Zambia is really close to the price in Colombia before 2008. Finally, India like Colombia is among the top seven coffee producers in the world.

In table 4.4, we test the reliability of the counter-factual. If “synthetic Colombia” and Colombia have similar characteristics, we can feel confident that the weighted average of Brazil, Guatemala, India and Zambia approximate well the trajectory Colombia would follow in the absence of PGI. Results indicate that Colombia and “synthetic Colombia” do not differ, implying that the counter-factual is well approximated.

Fig.4.5 depicts the evolution of Colombia and the estimated counter-factual of Colombia

Figure 4.5: Price paid to growers in Colombia and Synthetic Colombia



(i.e. synthetic Colombia). As it can be seen, before the adoption of PGI, Colombia and Synthetic Colombia follow exactly the same trajectory. However, we can clearly see the gap between Colombia and Synthetic Colombia after the adoption of PGI, implying that the price of coffee in Colombia would have fall in the absence of PGI. In 2009, the price paid to growers in Colombia is 306 US cent per kg versus 235 US cent per kg in Synthetic Colombia, implying that PGI adoption has increased the price by more than 30%.

The positive effect of PGI on the price paid to growers is explained by the restructuring of plantations to comply with the quality requirements of PGI, resulting in supply concentration (fig. 4.6). As earlier argued by [Perrier-Cornet \(1990\)](#), there are three steps in the establishment of PGI: obtaining territorial exclusivity for the product, collectively setting the production standards defining the production system, and the management of supply. Supply reduction following PGI adoption should be considered as an element of PGI. We thus claim a positive impact of PGI adoption on the price paid to Colombian's growers.

Because synthetic control method is mainly a graphical analysis, testing statistical signifi-

Figure 4.6: Production and price paid to coffee growers in Colombia

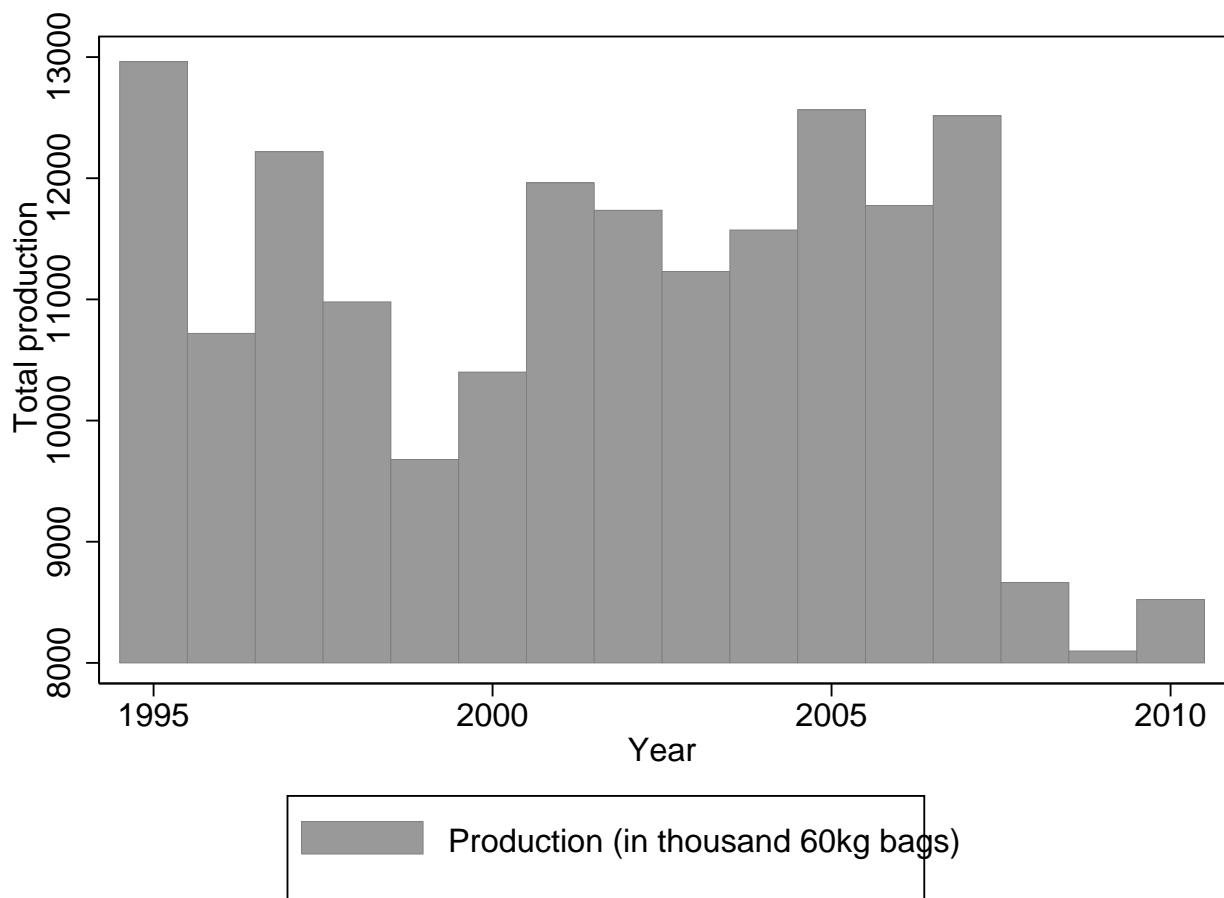
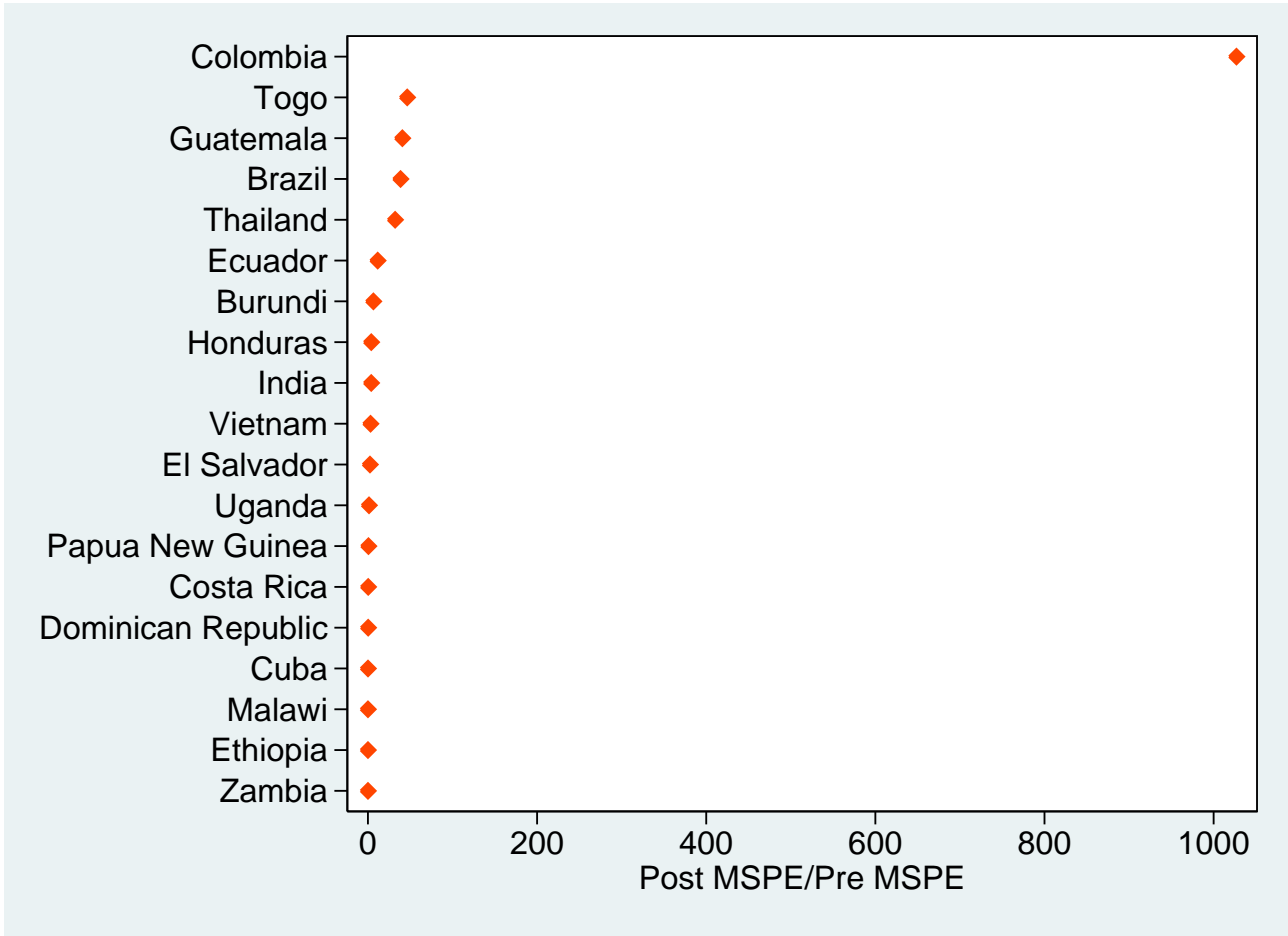




Figure 4.7: Placebo test (reassignment of treatment to control countries)



cance of the impact is not straightforward. We use placebo test to show that the effect obtained in Colombia is *unusual*. That is, similar effect is not found in any other coffee producing country. To this purpose, we consider each country in control countries group as it has adopted PGI. Then, we compare the gap observed in post-PGI adoption period to the gap of pre-PGI adoption period. We mean by gap the difference between the real of price and the price of the synthetic control of the country under consideration [Abadie and Gardeazabal \(2003\)](#) and [Abadie et al. \(2010, 2015\)](#) refers to this gap as Mean Square Prediction Error (MSPE)<sup>8</sup>. Fig.4.7 displays MPSE ratio of post-PGI and pre-PGI periods for each country. Colombia stands out as the country with the highest MPSE ratio. The post-PGI gap is 1000 times large than the pre-PGI gap, implying that the effect observed in Colombia is *unusual*. The probably of obtaining a similar impact in one of the control countries, picked randomly, is only of  $1/18 \approx 0.05$ , which is very low.

8. “The MSPE refers to the squared deviations between the outcome for the treated unit and the synthetic control unit summed over all pre-intervention periods specified”

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## 4.6 Discussion and conclusion

Most previous studies used comparative methods to evaluate the effect of Geographical Indications (GIs). They compare GI product/supply chain with similar non-GI product or industrial supply chain (i.e. synchronic comparison) or they compare the economic outcome of a supply chain before and after GI adoption (i.e. diachronic comparison). Two types of bias are associated with the synchronic comparison method. The first bias is linked to the limited number of cases (unit of analysis). Indeed, because synchronic comparison is based on limited cases, there is a risk that researchers pick up case studies subjectively in a way to validate or (reject) a given hypothesis. [Galtung \(1967\)](#) warns against “tradition quotation/illustration methodology, where cases are picked that in accordance with the hypothesis and hypotheses are rejected if one deviant case is found”. The second bias is linked to the difficulty of controlling for different factors (e.g. public support, geographical location) that may influence the performance. The difference observed between GI and non-GI units may come from these factors instead of from the GI *per se*. Therefore, a careful evaluation of GI policy requires controlling for covariates in order to maximise comparability and reduce the risk of confounding the effect of GI with other factors. Although diachronic comparison reduces this bias, by focusing on the same unit at different times, it is not sufficient because the same unit is not really the same at different times ([Lijphart, 1971](#)).

This paper uses the synthetic comparison methods and a large panel of coffee producing countries to evaluate the impact of PGI adoption on price paid to coffee growers in Colombia. Synthetic comparison method combines the diachronic and synchronic comparison, and overcome the limitations mention above. Finding reveals that PGI is associated with more than 30% increase of price of paid to growers. Although this result argues in favor of the implementation of GIs in developing countries, precautions are nevertheless required when generalizing this result.

Firstly, unlike Colombia, most developing countries have only recently begun to develop their national GI system with the support of development partners. It should be noted that the quality policy is based on reputation and collective action. The reputation of a product is built over time, and consequently the commercial gains from such a strategy are not immediate. But in the meantime, costs of setting up GIs, for example the costs of delimiting the production area,

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or the definition of the characteristics of the product in relation to the geographical conditions of the region or the costs related to the fight against fraud.

Secondly, Colombia is the third largest coffee-producing country in the world. We can imagine that the larger the size of production is the easier it is to cope with the costs. A sufficiently large size of production could be one of the keys to the success of certification. Therefore, support from public authorities and / or development partners is needed to accompany small geographical indications.

Thirdly, coffee is considered as a commodity and is mainly intended for export. A decline in international prices could seriously affect coffee producers. To avoid this type of risk, developing countries can develop a differentiation strategy based on indications of origin, which will allow them to decommidify the product. On the other hand, it is necessary to develop local demand since after all the spirit of the GIs is based on a local production destined mainly for a local consumption.

Finally, GIs are primary designed to protect producers from usurpation of the reputation of their product. Therefore, developing countries should developed the national legal system of GIs to ensure the enforcement of intellectual property rights, which is often felt to be missing.

## Conclusion

This thesis contributes to the economic literature on GIs. We have assessed the effects of GIs for well-established GIs in both developed (France) and developing countries (Colombia). Three empirical articles evaluate the effects of GIs from local to global : at the demarcated area, regional and national levels as well as at the international level.

### 5.1 Summary

The first empirical chapter analyzes the effects of PDO on economic performance at the level of the production area. Specifically, we use a regression discontinuity design (RDD), where the treatment-determining variable is the distance in kilometers of farms from the boundary of the PDO production area.

This first chapter identifies the causal effect of PDO using a main feature of GIs policy (i.e. location and demarcation of production area) and geo-localized data. The analysis makes it possible to compare the performance of farms located on both sides of the border using the RDD method. The latter has the advantage of being replicable for all GIs since it takes into account the element common to all of them, namely their location and the delimitation of the geographical area. This approach is more relevant in the case of very old GIs, especially European, for which pre-certification data are non-existent. Thus, this spatial approach seems promising for the evaluation of GIs. It also makes it possible to compare the results of studies carried out in different contexts. The method being the same, the variability due to the methodological choice is neutralized; thus facilitating the accumulation of empirical evidence.

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Finally, the RDD method is intuitive and is therefore easily spread to stakeholders and policy makers.

We applied this method to the dairy farmers in the PDO Comté production area and its adjoining area. The results show that the price paid to milk producers changes discontinuously at the common border. The price paid to producers observed in the PDO production area is 25 to 30% higher than in the non-PDO area. However, we do not find any difference between the two zones concerning the quantities of milk delivered. This indicates that the PDO increases farmers' incomes mainly through price, not volume. We also highlighted a windfall effect: the code of practices of PDO Comté includes agricultural practices which are not likely to modify production costs as one might have thought.

This highlights the impacts of PDO adoption at the production area level. PDOs are strongly linked to their spatial dimension and the GRD method identified this spatial effect. With similar production technologies, we find a significant change in price in favour of farms located in PDO area. This result shows the spatial effect of the GI.

The second empirical chapter analyzes the effects of PDO adoption on the economic performance of farms at the regional and national levels. We used matching methods to group the most similar farms into homogeneous blocks in order to isolate the specific effect of the PDO. This method allows to correct several biases associated with the comparison methods often used in the literature to evaluate the impact of GIs (omitted variable bias, one deviant bias, etc.). Within homogeneous blocks, there is no difference on average between the characteristics of PDO and non-PDO dairy farms. Therefore, the difference in economic performances can only be attributed to the PDO. At the national level, the results show that, on average, the PDO increases the price paid to farmers and the added value created. However, this result hides regional heterogeneity. In particular, we find that the PDO significantly increases prices and value added in Franche-Comté and Rhône-Alpes, but not in Auvergne. This heterogeneity shows that the legal protection afforded by PDOs is a necessary but not sufficient condition to guarantee improved economic performance.

The results of this second chapter generally show the positive effect of PDO adoption on the performance of the farms. On the other hand, this effect is heterogeneous across the regions of origin. For some regions, the adoption of the PDO is a success, for others the

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effect of PDO is marginal. Why ? In fact, the codes of practice of GIs are not really the same. Certain appellations have developed numerous institutions (the rules of the game of the economy in the sense of North, 1990) which allow (Jeanneaux and Perrier-Cornet, 2011): i) To create economic value through supply control, quality selection, better valuation of the link between territory and product, advertising; ii) To fairly distribute this value along the supply chain through the establishment of a fair value redistribution mechanism, based on (collective) contracts respected by all stakeholders; iii) To protect the competitive advantage of the PDO through setting barriers to entry in order to prevent large industrial groups taking control of the supply chain. Overall, this chapter highlights the institutional dimension of GIs, which is complementary to the spatial dimension of GIs (protection of a geographical area).

In the final chapter, we analyze the effects of a PGI, the first recognized by the EU, in a context of a developing country: Café de Colombia. This case study analyses the effects of PGI, a certification less strict than PDO, providing an overview of these certification differences. In addition, this chapter takes a look at a recent PGI (registered in 2007), while previous chapters dealt with old European designations. Finally, the study of the PGI Café de Colombia allows addressing the issue of the internationalization of GIs and their potential as a tool for development, particularly in the context of developing countries. Indeed, the establishment and democratization of designations of origin in developing countries requires specifying the conditions necessary for the proper development of supply chains and their sustainability. From a methodological perspective, this chapter contributes to the literature by proposing for the first time a method that combines synchronic and diachronic approaches, widely used in case studies. The results show that the adoption of the PGI increased the price paid to Colombian coffee producers by more than 30%, and is robust to various tests.

## 5.2 Lessons Learned

Several lessons can be drawn from this work.

The positive effect of the adoption of a GI on farm performance, in particular on the price paid to producers, is not automatic. The second empirical chapter shows the positive effects of the adoption of the PDO on economic performance (price paid to producers and value added) in two of the three regions studied: in Franche-Comté and Rhône-Alpes but not in Auvergne.

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The use of the same evaluation method in these three cases, allows to neutralization of the variability of the results due to the methodological choice. This finding illustrates the absence of an automatic effect of adoption of a GI on farm economic performance and allows a conclusion about the conditional aspect of the benefits of the adoption of the GI. Indeed, the improvement in the economic performances of farms following the adoption of an appellation will depend in particular on the establishment of internal regulation mechanisms of the supply chain (supply management, quality selection, strict definition of the code of practices and collective action).

Supply management mechanisms are particularly important in the process of building the supply chain, insofar as they make it possible to target an available quantity that is neither too low nor too high. In France, PDO Comté is the only one with an explicit supply control and an exceptional authorization by the public authorities to fix the quantities to be produced each year. In Colombia, just after the international certification of the appellation, a substantial decrease in the quantities produced was observed. On the one hand, it is necessary to respond as accurately as possible to consumer demand; and on the other hand, to achieve a sufficiently high level of production in order to afford the costs of control against fraud and of advertising in order to maintain the credibility of the appellation. Certification of the product requires the establishment of regular quality controls for products sold under the name. Therefore, before applying for certification, the supply should grow until these costs can be afforded, that is until a substantial size and a sufficiently high level of production and value are reached. If supply chains with high commercial potential producing in a context of developing countries with traditional know-how are small, they should temporarily benefit from public support through subsidies in order to ensure their capacity to sustain control costs. Development practitioners have a crucial role in supporting developing countries. Similarly, if governments believe that GIs are useful development tools, they should agree to such a budgetary effort. As GIs are above all a protection of property rights, the governments of developing countries should pass legislation to ensure this protection, for example through the establishment of a public authority in charge of quality schemes. This institution could, for example, bring together local expertise, in particular in terms of human resources, to assist stakeholders in their certification process and help in defining the code of practices (i.e. delimitation of the area, quality controls, etc.).

Although the Colombian coffee supply chain did not benefit from public support, it has

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become the third largest coffee producer in the world, and its production is mainly exported. In general, most products certified in developing countries are export products. Admittedly, in a context of stability of the international market, the labeling of export products can be effective because it brings the final consumer closer to the producers. However, in a context of instability in the international market, the sector is exposed and will show little resilience, or even collapse. The idea is to diversify market opportunities through developing local demand as well as exports.

Another risk associated with the development of GIs in developing countries concerns the definition of collective rules. Indeed, some stakeholders in a supply chain may gain from certification, while others may not. Since the rules of the code of practices are defined collectively, certain will tend to oppose the inclusion of potential constraining rules in the CoP (i.e. hygiene) and slow down the process of collective construction. These discrepancies in product quality criteria may create obstacles in the development of the supply chain or in the development of GIs in general. More generally, the internal regulation mechanisms necessary for the economic success of a certification are built in the long term thanks to close cooperation between the stakeholders located within a territory: an endogenous *bottom-up* process is required. This culture of collective action takes precedence over the appellation itself since it allows the removal of obstacles. For example, the success of the recent appellation of origin Café de Colombia (2007) is partly explained by a long-standing tradition of collective action which has structured the supply chain since the 1950s (with the brand of Juan Valdez) well before the appellation registration at the national level.

### 5.3 Limitations and Directions for Future Research

This thesis covers case studies from both developed and developing countries. Methodologies adapted to the data of each case were used to minimize the potential biases inherent in the evaluation of the impact of public policies.

However, in order to improve the external validity of the results found in this thesis, it would be interesting to replicate the tools developed here to other cases of GIs and / or other times. The use of the same methodology in future work would make it possible to neutralize the variability linked to the methodological choice and to improve the comparability of the results.



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Thus, it would facilitate the accumulation of knowledge on the subject. In this respect, the GRD method based on the geographical delimitation of appellations of origin seems interesting to us.

Although works are emerging on the effects of GIs in developing countries, they are still very scant and often anecdotal. The scarcity of these studies is largely due to the lack of data in the context of developing countries. So, the implementation of GIs should include a GI monitoring and evaluation process in order to determine their effects and improve their implementation. This involves carrying out investigations before, during, and after the introduction of the GI.

Finally, although Chapter three highlights the conditional effects of GIs, we do not directly test mechanisms through which GIs affect economic performances. It would be interesting to carry out more in-depth analyzes. This can be done through mediation analysis or by ruling out the mechanisms one after another. This will be the subject of future work in order to formulate recommendations on more precise economic policies.

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# Appendix

## A

### Source of data used in chapter two and three

Rigorous impact evaluation requires a comprehensive dataset. We used French Agricultural Census dataset and the Farm Accounting Data Network (FADN) for year 2010, to assess the impact of PDO adoption on producers' performances. Agricultural census is conducted every ten years; the latest available one is the 2010 census. Both datasets are obtained from the Service of Statistics and Prospective of the French Ministry of Agriculture, Food Processing and Forests. Because data used in this are individual, they are protected by statistic secrets; therefore, a specific procedure was required to have access to these data.

In 2010, there were 516,152 farms in France (table 1). The census data includes socio-demographic information (such as age and gender of the head of the farm), geographical information (such as the region of location of farm), the altitude and whether the farm is located in a plain or mountain area. Census data also provides information on the characteristics of a farm (such as farm size), the quota of a milk farm that has the right to produce, but most importantly, it provides information on whether a farm is certified as PDO-product offering. The dummy variable PDO represents the treatment variable in the present study, and the unit of analysis is the farm.

Unfortunately, we cannot exploit all observations available in the census dataset and have to restrict the data in two respects. First, census data provides no information on economic indicators, and since the primary goal of the present study is to evaluate the impact of PDO on economic performances, we have to use survey samples to obtain economic information. For this purpose, we merge census with the FADN survey, which provides information on the income of agricultural holdings and is a tool for evaluating the impact of Common Agricultural Policy (CAP). In 2010, there were 7,452 farms in the FADN survey. It is worth noting that the FADN survey is sampled among the Census' medium and large farms, that is, the gross production of farms in the FADN sample is higher than 25,000 euros (table 2). The FADN survey provides information on the description of farms, technical and economic performance, including our

Table 1: Distribution of Census and FADN dataset by OTEX

OTEX	Census		FADN	
	#Obs.	Percent.	#Obs.	Percent.
Cereals and oilseeds	84 711	16.41%	1 132	15.19%
General crops ( other field crops)	47 000	9.11%	550	7.38%
gardening	7 364	1.43%	207	2.78%
Flowers and diverse horticulture	8 952	1.73%	222	2.98%
Wine growing	69 962	13.55%	1 074	14.41%
Fruit and other permanent crops	21 909	4.24%	336	4.51%
bovine milk	50 340	9.75%	1 150	15.43%
cattle meat	61 745	11.96%	730	9.80%
mixed cattle	10 861	2.10%	275	3.69%
Sheep and Goats	30 810	5.97%	376	5.05%
other herbivores	25 863	5.01%	39	0.52%
pigs	6 458	1.25%	168	2.25%
Poultry	15 321	2.97%	171	2.29%
mixed granivores	9 112	1.77%	137	1.84%
Polyculture polyculture	63 778	12.36%	885	11.88%
Non-classified farms	1 966	0.38%		
Total	516 152		7 452	

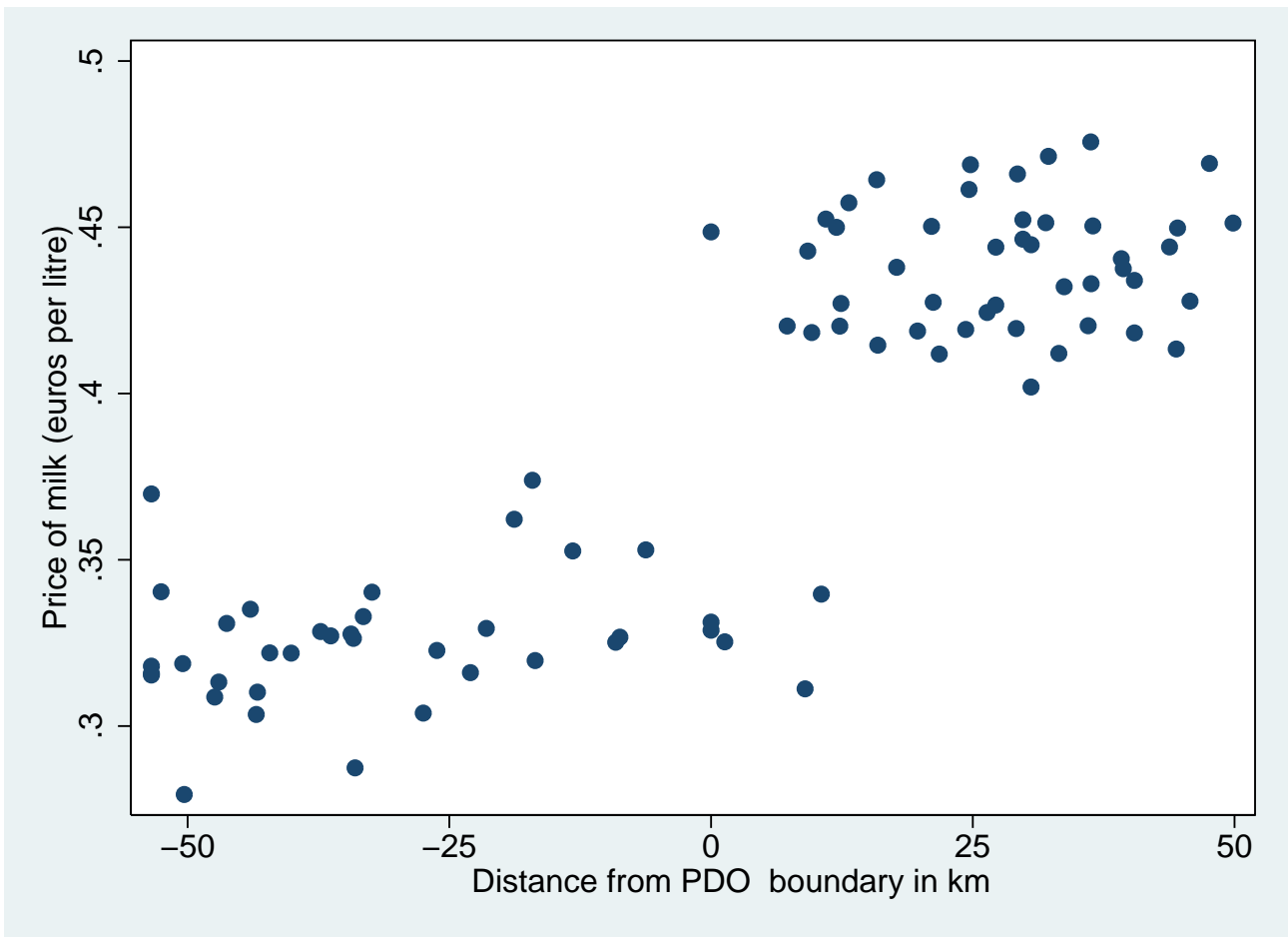
Table 2: Distribution of Census dataset by size

Size	Stadard Groos production (in euros)	Number of farms	Percentage
Small	$SGP < 25\ 000$	199 246	38.40%
Meduim	$25000 \leq SGP < 100\ 000$	156 697	30.20%
Large	$SGP \geq 100\ 000$	162 982	31.41%
Total		518 925	

outcome variables. Put succinctly, our outcome variables come from the FADN survey, while the treatment variable is obtained from the census. In other hands, we restrict data farms specialized in cow milk production. As shown in Table 1, in 2010, there were 50,340 farms, and 1,150 farms specialized in cow milk production, in the census and FADN, respectively.

Then, we use the code SIREN, which is a common identification number for the two datasets and specific to each farm to merge Census and FADN survey datasets.

Figure 1: Graphical depiction of price discontinuity at PDO boundary



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## B

### Main steps of the Colombian coffee differentiation strategy



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## C

### **Distribution of EU's PDO and PGI schemes in January 2015**

European PDO/PGI pertain to most agricultural and foodstuffs such as fruit, vegetables and cereals; oils and fats, cheeses, fresh meat etc. By January 2015, there were almost 1300 product benefiting from EU protection. About 99% were from EU countries. However, almost 98% of the PDO/PGI are concentrated in Mediterranean UE countries (Italy, France, Spain, Greece, Slovenia, Croatia and Cyprus). This concentration is explained by the cultural and gastronomic history of these countries. The gap between Mediterranean and other EU countries have been decreasing overtime due to increasing number of registration from Germany, United Kingdom and Scandinavian countries.

Turn to non-EU countries, by January 2015, only seven non- EU countries were protected by EU regulation, which are China, Thailand, Andorra, Colombia, India, Turkey and Vietnam. Among non-EU countries, China has the largest number of products recognized by EU with ten denominations registered (6 PGIs and 4 PDOs), followed by Thailand with three PGI (Hom Mali rice, Doi Chaang Coffee and Doi Tung Coffee); Andorra ("PGI Carn d'Andorra") which is a fresh meat; Colombia (PGI "Café de Colombia") and India (" PGI Darjeeling tea"). Two remarks emerge from the distribution of GIs in non-European countries. In one hands, most of the denomination are registered as PGI, implying that some stages of production could take place in other places than product origin. In other hands, most of denominations cover non-perishable product such as tea, coffee etc.

### **Countries files**

This section describes the distribution of PDO and PGI schemes by product. We first present table for EU Mediterranean countries (Italy, France, Spain, Greece, Slovenia, Croatia, Cyprus) before moving to non-EU countries.

Table 3: Distribution of EU's PDO and PGI across countries

Origin of product	PDO	PGI	Total
Italy	162	110	272
France	97	123	220
Spain	98	81	179
Portugal	64	68	132
Greece	74	27	101
Germany	11	72	83
United Kingdom	23	33	56
Czech Republic	6	23	29
Poland	8	19	27
Slovenia	8	11	19
Austria	9	6	15
Belgium	3	10	13
Hungary	6	7	13
China	4	6	10
Netherlands	5	5	10
Slovakia	1	9	10
Finland	5	2	7
Denmark	0	6	6
Ireland	1	4	5
Lithuania	1	4	5
Sweden	2	3	5
Luxembourg	2	2	4
Croatia	2	1	3
Thailand	0	3	3
Bulgaria	0	2	2
Cyprus	0	2	2
Andorra	0	1	1
Colombia	0	1	1
India	0	1	1
Latvia	0	1	1
Norway	0	1	1
Romania	0	1	1
Turkey	0	1	1
Viet Nam	1	0	1
Total	593	646	1239
Total IG UE 28	588	633	1221
Total IG Mediteranean UE	505	423	928
Total IG Non-EU countries	5	13	18
% of UE 28's IG	99%	98%	99%
% Mediteranean UE's IG	85%	65%	75%
% Non-EU cuntries	1%	2%	1%

Table 4: PDO-PGI scheme by product in Italy

Product certified	PDO	PGI	Total
Fruit, vegetables and cereals fresh or processed	34	70	104
Cheeses	48	1	49
Oils and fats (butter, margarine, oil, etc.)	42	1	43
Meat products (cooked, salted, smoked, etc.)	21	19	40
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	2	8	10
other products of Annex I of the Treaty (spices etc.)	6	2	8
Fresh meat (and offal)	1	4	5
Other products of animal origin	5	0	5
Fresh fish, molluscs, and crustaceans and products derived therefrom	2	3	5
Pasta	0	2	2
Essential oils	1	0	1
Beers	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	162	110	272



Table 5: PDO-PGI scheme by product in France

Product certified	PDO	PGI	Total
Fresh meat (and offal)	9	59	68
Cheeses	45	6	51
Fruit, vegetables and cereals fresh or processed	19	30	49
Meat products (cooked, salted, smoked, etc.)	3	11	14
Oils and fats (butter, margarine, oil, etc.)	10	0	10
Other products of animal origin	4	5	9
Other products of Annex I of the Treaty (spices etc.)	4	3	7
Fresh fish, molluscs, and crustaceans and products derived therefrom	1	3	4
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	3	3
Pasta	0	2	2
Mustard paste	0	1	1
Hay	1	0	1
Essential oils	1	0	1
Beers	0	0	0
Natural gums and resins	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	97	123	220

Table 6: PDO-PGI scheme by product in Spain

Product certified	PDO	PGI	Total
Fresh meat (and offal)	24	36	60
Cheeses	31	0	31
Fruit, vegetables and cereals fresh or processed	26	2	28
Meat products (cooked, salted, smoked, etc.)	0	16	16
Oils and fats (butter, margarine, oil, etc.)	5	10	15
Other products of animal origin	0	14	14
Other products of Annex I of the Treaty (spices etc.)	8	0	8
Fresh fish, molluscs, and crustaceans and products derived therefrom	3	1	4
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	1	2	3
Pasta	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	98	81	179

Table 7: PDO-PGI scheme by product in Greece

Product certified	PDO	PGI	Total
Fresh meat (and offal)	27	15	42
Cheeses	18	11	29
Fruit, vegetables and cereals fresh or processed	21	0	21
Meat products (cooked, salted, smoked, etc.)	2	0	2
Oils and fats (butter, margarine, oil, etc.)	2	0	2
Other products of animal origin	2	0	2
Other products of Annex I of the Treaty (spices etc.)	1	0	1
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	1	1
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	1	0	1
Pasta	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	74	27	101

Table 8: PDO-PGI scheme by product in Slovenia

Product certified	PDO	PGI	Total
Fresh meat (and offal)	0	8	8
Cheeses	4	0	4
Fruit, vegetables and cereals fresh or processed	2	1	3
Meat products (cooked, salted, smoked, etc.)	1	1	2
Oils and fats (butter, margarine, oil, etc.)	0	1	1
Other products of animal origin	1	0	1
Other products of Annex I of the Treaty (spices etc.)	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Pasta	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	8	11	19

Table 9: PDO-PGI scheme by product in Croatia

Product certified	PDO	PGI	Total
Fresh meat (and offal)	0	1	1
Cheeses	1	0	1
Fruit, vegetables and cereals fresh or processed	1	0	1
Meat products (cooked, salted, smoked, etc.)	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Other products of animal origin	0	0	0
Other products of Annex I of the Treaty (spices etc.)	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Pasta	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	2	1	3

Table 10: PDO-PGI scheme by product in Cyprus

Product certified	PDO	PGI	Total
Fresh meat (and offal)	0	2	2
Cheeses	0	0	0
Fruit, vegetables and cereals fresh or processed	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Other products of animal origin	0	0	0
Other products of Annex I of the Treaty (spices etc.)	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Pasta	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
Total	0	2	2

Table 11: PDO-PGI scheme by product in China

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Fruit, vegetables and cereals fresh or processed	3	3	6
Other products of Annex I of the Treaty (spices etc.)	1	1	2
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	1	1
Pasta	0	1	1
Fresh meat (and offal)	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Beers	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>4</b>	<b>6</b>	<b>10</b>

Table 12: PDO-PGI scheme by product in Thailand

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Other products of Annex I of the Treaty (spices etc.)	0	2	2
Fruit, vegetables and cereals fresh or processed	0	1	1
Fresh meat (and offal)	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Beers	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Pasta	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>0</b>	<b>3</b>	<b>3</b>



Table 13: PDO-PGI scheme by product in Andorra

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Fresh meat (and offal)	0	1	1
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Fruit, vegetables and cereals fresh or processed	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Other products of Annex I of the Treaty (spices etc.)	0	0	0
Beers	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Pasta	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>0</b>	<b>1</b>	<b>1</b>

Table 14: PDO-PGI scheme by product in Colombia

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Other products of Annex I of the Treaty (spices etc.)	0	1	1
Fresh meat (and offal)	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Fruit, vegetables and cereals fresh or processed	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Beers	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Pasta	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>0</b>	<b>1</b>	<b>1</b>

Table 15: PDO-PGI scheme by product in India

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Other products of Annex I of the Treaty (spices etc.)	0	1	1
Fresh meat (and offal)	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Fruit, vegetables and cereals fresh or processed	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Beers	0	0	0
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Pasta	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>0</b>	<b>1</b>	<b>1</b>

Table 16: PDO-PGI scheme by product in Turkey

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	1	1
Other products of Annex I of the Treaty (spices etc.)	0	0	0
Fresh meat (and offal)	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Fruit, vegetables and cereals fresh or processed	0	0	0
Fresh fish, molluscs, and crustaceans and products derived therefrom	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Pasta	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>0</b>	<b>1</b>	<b>1</b>

Table 17: PDO-PGI scheme by product in Vietnam

<b>Products</b>	<b>PDO</b>	<b>PGI</b>	<b>Total</b>
Fresh fish, molluscs, and crustaceans and products derived therefrom	1	0	1
Bread, pastry, cakes, confectionery, biscuits and other bakers wares	0	0	0
Other products of Annex I of the Treaty (spices etc.)	0	0	0
Fresh meat (and offal)	0	0	0
Meat products (cooked, salted, smoked, etc.)	0	0	0
Cheeses	0	0	0
Other products of animal origin	0	0	0
Oils and fats (butter, margarine, oil, etc.)	0	0	0
Fruit, vegetables and cereals fresh or processed	0	0	0
Beers	0	0	0
Natural gums and resins	0	0	0
Mustard paste	0	0	0
Pasta	0	0	0
Hay	0	0	0
Essential oils	0	0	0
Flowers and ornamental plants	0	0	0
Wool	0	0	0
<b>Total</b>	<b>1</b>	<b>0</b>	<b>1</b>

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