SUPPLY CONTROL AND PRODUCT DIFFERENTIATION EFFECTS OF EUROPEAN
PROTECTED DESIGNATIONS OF ORIGIN CHEESES

by

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B. S., Pan American School of Agriculture ZAMORANO, 2006

A THESIS

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Agricultural Economics
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2008

Approved by:

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2008

Abstract

The purpose of this research was to analyze the impact of supply control variables such as market share; DO/PGI cheese hedonic quality attributes such as country of origin, type of milk, and age; and the price of a substitute artesian or farmstead cheese on the price of imported cheeses. The literature review found that the EU has been a leader in developing a process for verifying foods produced in a local geographic area. It also revealed that the ability to control supply of a differentiated product transferred consumer surplus to producer surplus. The economic theory suggests that PDO/PGI certification results in the ability of the group of producers and / or processor to control supply by effectively causing a vertical kink in the supply curve and sufficiently differentiated products have a relatively inelastic demand curve.

Data was collected on 83 PDO cheeses manufactured in the EU and sold in the US. This data included market share defined as the total tons of that PDO cheese produced in that geographic region divided by the total hectares of land. Hedonic variables characterize the PDO cheeses based on aging time, type of input and country of production. The price of a competing artisan cheese similar to the PDO cheese was identified. All of these variables were used in an ordinary least squares regression model to explain the variation in the price of the imported cheese. The regression results founded that market share, country of origin (Italy and Spain), and the price of a substitute were significant in explaining the variability in imported PDO cheese prices. Market share had a greater magnitude of change suggesting that, at the margin, a small change in supply can cause a larger change in supply which was not surprising given an inelastic demand curve and a fixed supply curve. Substitutes were actually complements which at first glance appears surprising. Finally, as one might suspect, a cheese that is more mature, like wine, has a greater value.

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Acknowledgements

Dedication

This work is dedicated to all who gave me moral support in this journey: God, Family, Friends and much more.

CHAPTER 1 - INTRODUCTION

A geographical designation protection to regional groups of producers has been implemented for centuries in France to protect agricultural products against imitations of those products. For example, the guarantee of protection to Roquefort cheese was given for perpetuity by the Parliament of Toulouse to the inhabitants of Roquefort-sur-Soulzon in the XVII century. In the 1800s, Napoleon III established the Grand Crus of the Bordeaux area as a starting point for the geographical designation for protection of products in Europe. By the end of the 19th century, the French government had created the AOC (Appellation d'Origine Contrôlée) in order to ensure fair competition for producers and guarantee the origin of wines for consumers. This concept was then adopted by other countries in Europe.

In 1992 the European Union (EU) established PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) labels for all agricultural products by Regulation No. 2081/92 of the Council of the European Commission (EC). Products with PDO names have inherent characteristics resulting exclusively from the terrain (air, climate, land and native species) and the producers' know-how with regard to production practices from a specific geographical area. For example, climatic conductions of a production area are favorable for abundant and high-quality fodder used to feed dairy cows and for development of the microbiological agents that give organoleptic and color characteristics to Gorgonzola cheese. All the process of production happens in a specific area in Italy. PGI products have specific characteristics or reputation linked to a geographical region and are at least produced and/or processed and/or prepared in that particular region. For example, the PGI label accredited to Mortadella Bologna is due to the traditional production consisted exclusively in the technical skills of the operatives. A general harmonized framework for protecting designations of origin throughout the EU had as an overall objective of encouraging producers to diversify their agricultural production, improve their income and revitalize rural economies as well as informing consumers of the specific characteristics of the products (Fact Sheet-European Policy for Quality Agricultural Products 2007).

Once a specific brand name has been approved by the EC, all the producers/processors in the designated region who fulfill all the specifications of the product can market under the PDO or PGI registered name. This framework gives producers/processors property rights in order to prevent imitations, the ability to communally market a differentiated product and the capacity to identify niches among consumers in order to capture a price premium (Fact Sheet-European Policy for Quality Agricultural Products 2007). Given that the labeled product can only come from a select geographical area and must meet specific requirements based on the attributes of the region, supply control is asserted under the PDO/PGI protection system. One of the most widely certified products under this system are cheeses and it is the category of focus for products in this thesis. An example of PDO/PGI is what constitutes Parmesan Cheese. Parmesan Cheese originated in Italy and actually is PDO/PGI produced only in the provinces of Bologna, Mantua, Modena, Parma, and Reggio Emilia. But Kraft, a large US food manufacturer created a "Parmesan Cheese" in a green container that is manufactured in the US. The legal issue is whether Parmesan Cheese has some unique characteristics that come from a geographical region in Italy or whether that same cheese can be produced in the U.S. which is a different geographic region using a different production technology in a different package.

1.1 Background on PDO and PGI

Cheese is one of the most widely consumed foods and a large category of products in the PDO/PGI data base. According to legend, cheese was discovered accidentally when hunters killed a calf and the milk was curdled in the stomach due to the present of rennet. Another legend says that milk was stored in a sheep's dry stomach and the digestive enzymes turned the milk into cheese curd. A temple in Mesopotamia has a frieze that indicates people were making sour cream in 5000 B.C. Considered an aphrodisiac, cheese was a very important commodity in the ancient Greek society. Fresh goat cheese was a staple of the ancient Roman diet, produced in great quantities in the center of the Roman Empire. During the Middle Ages, cheese crafting was entrusted to monks and nuns. The cheese production was optimized and many recipes were written down and preserved showing that cheese was a very important food in fast time (religious holidays such as Lent when some foods cannot be eaten) and crucial in winter time to prevent hunger when food production was limited (Iburg 2004).

In 1992 the EU introduced a voluntary system to protect and promote traditional and regional products under a PDO/PGI designation. The regulations were updated in 2006 in order to simplify the system and receive applications from non-EU countries producers/processors groups ruled by the WTO (World Trade Organization). In order to apply for a PDO/PGI label certification a group of producers and/or processor from the EU must characterize their product's specification accurately and apply to the correct EU Member State. Any other non-EU country producers and/or processor groups must submit application directly to the EC. Application forms specified in Annex-I in the Commission Regulation (EC) No 1898/2006 are available to the public in the EC website (http://ec.europa.eu/agriculture/foodqual/quali1_en.htm). For example, Café de Colombia (Colombian Coffee http://juanvaldez.com/) is a PGI label given to the groups of producers of the Federación Nacional de Cafeteros de Colombia (National Federation of Coffee Producers of Colombia (http://www.cafedecolombia.com/index.jsp)) and the respective inspection body is ALMACAFÉ (a Federación Nacional de Cafeteros de Colombia company created in 1965 with the objective to improve the coffee growers quality of life and generate added value). Both organizations were developed by Colombian coffee growers. Colombian Coffee is registered under the other Annex-I products category in the EU system. The specification of the products must include the name and description of the product, a definition of the geographical area and evidence of origination in that particular area. It should detail any labeling requirements and any requirements needed by the EU or national provisions. It is necessary that the group of producers/processors contract an inspection institution that verifies that the requirements of the registered specifications are met. After the application is analyzed by the respective national authorities and if accepted, it is passed on to the EC. The EC is in charge of publishing in the Official Journal of the European Union if it has been approved. Once published, producers can begin marketing their products under the PDO/PGI name using the respective label shown in figure 1.1.

Figure 1.1 Official labels for PDO (Protected Designation of Origin) and PGI (Protected Geographical Indications)

Source: EC (Department of Agricultural and Rural Development) 2008

Table 1.1 shows 832 products registered under the EU protected food name scheme. France, Italy, and Spain are countries that developed a system to link product characteristics to a geographical region prior to the 2006 regulations which explains why these countries have so many PDOs/PGIs. In August 2008, the products produced in these countries represented 54% of the total PDO and PGI products. Germany, Portugal, and Greece have registered 118, 87, and 81 products, respectively, or another 35% of the total PDO and PGI products. Café de Colombia (Colombian Coffee) is the only Non-EU origin product under the production system. The larger categories of products are fruit, vegetables and cereal which account for 169 registered products; cheeses (163); fresh meat (107); oils and fats (105); and meat base products (86).

In the 19th century with the discovery of the microbiological composition of cheese technological advances in cheese production produced larger scale and more homogeneous cheese products. Currently, cheese is very extensively consumed and traded. In fact, the overall largest dairy products trade flow is cheeses from the EU to the US (USDA-ERS, 2006). Figure 1.2 shows an increase in EU exports from 115,754 tons to 119,357 tons from 2006 to 2007 (FAOSTAT 2008). France, Italy and Spain are responsible for 50% of the total cheese exported to the U.S. in 2007 (FAOSTAT 2008).

American (Cheddar, Colby, Monterey Jack and stirred curd) and Italian (Mozzarella, Parmesan, Provolone, Ricotta, Romano and others) cheeses are the most-consumed cheeses in the US, equivalent to 13 and 13.7 annual pounds per capita, respectively followed by Cream and Neufchatel, Swiss, Muenster and others with 2.51, 1.26, 0.32, and 11.76 pounds per capita, respectively, of the total cheese consumed in 2006 (USDA-ERS 2008). The overall per capita

consumption of cheese by Americans was 31.5 pounds in 2006 which represented 17.2% more than the 26.9 pounds per capita consumed in 1995 (USDA-ERS 2008). More specifically, the Secretaría General de Agricultura y Alimentación (General Secretary for Agriculture and Food) of Spain reported that 9.33% of the total production in Spain was exported to Non-EU countries in 2005. The CLAL (Consultancy and Market Research Food and Dairy) of Italy reported that exports to the US of Parmigiano Reggiano and Grana Padano, Gorgonzola, Asiago (including Montasio, Caciocavallo and Ragusano), and Provolone constitute 18.04%, 2.08%, 21.66%, and 21.88% of the total exports, respectively, in 2005. The production of PDO/PGI cheeses was 196,101 tons, representing 18% of the total production of cheese in France. This required 72% of the total milk production of the country to produce these cheeses and approximately 10,000 tons were exported in 2005. Comte, Cantal, Roquefort, Reblochon, Saint-Nectaire, Camembert de Normandie, Munster, Brie de Meaux, Blue D'Auvergne and Morbier are the premier PDO/PGI cheeses in France, representing 78% of total PDO/PGI production.

Figure 1.2 European Union cheese and curd exports to the United States
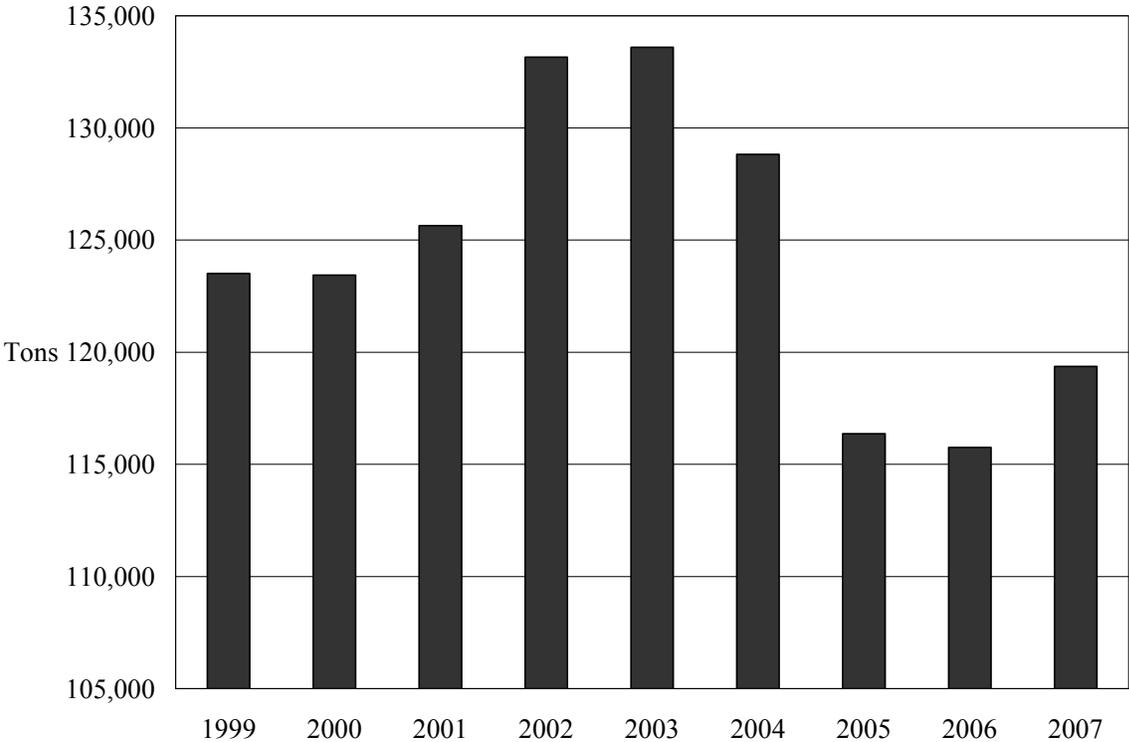
Source: EUROSTAT 2008.

Table 1.1 PDO/PGI registered products in the EU as of August 1, 2008

Country	Total	Cheese	Meat Base	Fresh Meat	Fish	Other Animal Products	Oils and Fats	Table Olive	Fruit, Vegetable and Cereals	Bread and Bakery	Beer	Other Drinks	Other
Austria	12	6	2	0	0	0	1	0	3	0	0	0	0
Belgium	5	1	2	0	0	0	1	0	0	1	0	0	0
Colombia	1	0	0	0	0	0	0	0	0	0	0	0	1
Cyprus	1	0	0	0	0	0	0	0	0	1	0	0	0
Czech Republic	13	0	0	0	3	0	0	0	2	5	3	0	0
Denmark	3	2	0	0	0	0	0	0	1	0	0	0	0
Finland	1	0	0	0	0	0	0	0	1	0	0	0	0
France	155	45	4	52	2	6	9	3	27	2	0	5	0
Germany	118	4	8	3	52	0	1	0	3	4	12	31	0
Greece	81	20	0	0	1	1	26	10	22	1	0	0	0
Hungary	1	0	1	0	0	0	0	0	0	0	0	0	0
Ireland	4	1	1	1	1	0	0	0	0	0	0	0	0
Italy	164	33	29	2	0	2	38	2	53	3	0	0	2
Luxemburg	4	0	1	1	0	1	1	0	0	0	0	0	0
Poland	2	2	0	0	0	0	0	0	0	0	0	0	0
Portugal	87	12	10	27	0	10	6	1	21	0	0	0	0
Slovakia	1	0	0	0	0	0	0	0	0	1	0	0	0
Slovenia	1	0	0	0	0	0	1	0	0	0	0	0	0
Spain	130	20	28	13	1	3	21	0	33	7	0	0	4
Sweden	2	1	0	0	0	0	0	0	0	1	0	0	0
The Netherlands	6	4	0	0	0	0	0	0	2	0	0	0	0
United Kingdom	40	12	0	8	13	1	0	0	1	0	2	3	0

Source: EC (Department of Agricultural and Rural Development) 2008

The cheeses are produced from raw or pasteurized cow, sheep, goat, and buffalo milk made in a specific geographical area and/or from specific breed animals such as Ossau-Iraty-Pyrenees cheese that are made exclusively from Basco-Béarnaises or Manech sheep's milk. The milk is heated or pasteurized and then the curd formed with animal rennet (found in the digestive system of young calf, sheep or goat). The curd is used to produce, for example, Cabrales (sheep's rennet) or with plant enzymes used to produce, for example, Queso la Serena (from the flowers of *Cynara Cardunculus*). The curd is obtained and acidified, salted, molded or pressed depending on the type of cheese resulting in fresh cheese. The fresh cheese is salted (depending on the variety) and stored for ripening in a controlled chamber or natural environment, like the Roquefort cheese stored in the cellars in the Roquefort village. The ripeness time depends on the specification of the cheese. However some cheeses are sold fresh (non-ripe cheese) or matured (ripe cheese). A general protocol for production of cheese is shown in figure 1.3.

In general, all cheeses are organized into eight groups according to the German cheese standards, considering the content of water in the fat-free cheese mass. Those with the highest content of dry mass generally mature from three months up to a year. Hard cheese has a maximum amount of water of 56%. Sliced cheese has 54% to 64% of water content and matures quicker and slices more easily. Semi-hard sliced cheese has a water content from 61% to 69% and most of them are produced in low fat or double cream versions. Soft cheese is characterized by a water content higher than 67% and the total amount of fat is lower than harder cheeses. Pasta Filata is a type of cheese that, after the acidification process, is put into a scalding hot liquid, then kneaded and made into strings with a water content from 62% to 76%. Sour cream cheeses have water content from 60% to 73% and are low in fat and high in protein. Leftovers of different kinds of mature cheeses are ground, salted and heated up to obtain processed cheese which exists in all fat categories (Iburg 2004). Fresh cheese usually has around 80% water content and has not matured.

Figure 1.3 General protocol for cheese manufacture

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                        ┌─────────────────────────┐
                        │          Milk           │
                        └─────────────────────────┘
                                   │    Selection
                                   │    Standardization
                                   │    Heat treatment (< 104° F for raw milk
                                   ▼    cheeses)
                        ┌─────────────────────────┐
                        │       Cheese Milk       │
                        └─────────────────────────┘
                                   │    Addition of:
                                   │    Starter culture (acidification)
                                   │    Color (optional)
                                   │    CaCl₂ (optional)
                                   ▼    Coagulation (rennet or acid)
                        ┌─────────────────────────┐
                        │      Coagulum (gel)     │
                        └─────────────────────────┘
                                   │    Cut coagulum
                                   │    Stir
                                   │    Heat
                                   │    Acidification (rennet-coagulated cheeses)
                                   ▼    Separation of curds from whey
                        ┌─────────────────────────┐
                        │          Curds          │
                        └─────────────────────────┘
                                   │    Acidification
                                   │    Special operations (e.g. cheddaring,
                                   │    stretching)
                                   │    Salting (some varieties)
                                   │    Molding
                                   ▼    Pressing (some varieties
                        ┌─────────────────────────┐
                        │      Fresh Cheese       │
                        └─────────────────────────┘
                                   │    Salting (most varieties)
                                   ▼    Ripening (most rennet-coagulated cheeses)
                        ┌─────────────────────────┐
                        │      Mature Cheese      │
                        └─────────────────────────┘
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Source: Fox P.F., Guinee T.P., Cogan T.M., and McSweeney P.L. Fundamentals of cheese science. 2000 Aspen Publishers p. 11

1.2 Role of Geographical Indication in the International Market

Geographical indication issues are addressed in the TRIPS (Trade-Related Aspects of Intellectual Property Rights) Agreement in the WTO. Under the TRIPS Agreement, Article 22 defined geographical indications as identification of a good originated in the territory Member, or region/locality, where quality, reputation or other characteristic of the good is attributable to its geographical origin and stated a standard level of protection (TRIPS-Annex 1C). They have to be protected in order to prevent unfair competition and misleading of consumers. Wines and spirits have a higher level of protection even if misuse would not cause any misleading of consumers with some exceptions which are under international negotiation at the present time.

For example, if a trademark identifying a good was applied before the geographical indication is protected, then implementation of the geographical indication shall not prejudice eligibility or registration or/and the right to use of a trademark identical or similar to the geographical indication. Currently, there are two issues of debate on the TRIPS Agreement related to geographical indications. These are 1) the multilateral register for wines and spirits that consist in creating a multilateral system for notifying and registering geographical indications and 2) extending the higher level of protection to all products (TRIPS: Geographical Indications 2005).

The EU, Switzerland and other countries have advocated extension of the Article 23 (intellectual protection of wines and spirits) protection to all products, a multilateral system of notification and registration for all products that would have effect on participant and non-participant countries and prohibited the use of well-known geographical indications in third countries. On the other hand, Australia, Canada, the US and other countries argue that actual protection is good and higher protection would disrupt actual marketing practices and added protection as either unnecessary or undesirable, blocking competition from new source of foods and giving an advantage to European producers (Josling 2005).

1.3 Objective and Hypothesis

Initially, the objective was to analyze determinants of price for PDO/PGI foods imported into the US. However, as will be shown, the scope of the thesis is limited to the cheese category. The purpose of this research is to analyze the impact of supply control variable such as market share, PDO cheese hedonic quality attributes such as country of origin, type of milk, and age,

and the price of PDO substitutes such as artesian and farmstead cheeses on the price of PDO imported cheeses. The hypothesis is that these variables influence the observed price of PDO cheeses sold in the US.

1.4 Organization of the Thesis

The organization of this thesis is as follows. Chapter 2 provides a review of literature on the EU quality label. The economic theory underlying on supply control and product differentiation is discussed in chapter 3. The theoretical model is explained in chapter 4. Chapter 5 provides a description of the data and chapter 6 describes the results. Chapter 7 discusses conclusions and implications of this research

CHAPTER 2 - LITERATURE REVIEW

The literature review is organized in three sections. The first section discusses the success and limitations of the PDO label system. The next section focuses on studies related to the demand for PGI/PDO products, such as consumer willingness to pay premiums in different regions. The last section presents the supply implications for producers' organizations that relay on geographical indication label system.

2.1 International Implications of Geographical Indication

Doster (2006) discussed the EU decision to extend protection to cheeses to the Article 23 of TRIPS in Cancun, Mexico in 2003. There was no agreement on this issue because the US refused to accept the EU proposal augmenting that policy is strictly protectionism. For example the EU proposal will not allow US companies to use anglicized terms like Parmesan for cheeses because it is derived from Parmigiano Reggiano and also any of the words "style" or "imitation" before a GI name. The argument used by the EU for this proposal is that it is crucial to protect consumers from misleading information due to the fact that cheeses are much altered from the original in the manufacturing process. The qualities are completely different from the originals. Therefore those cheeses should not be named under their original cheese. For example, Italian Mozzarella made from buffalo's milk is tender, nutty and is sold fresh packed in whey. However, the American equivalent is made from pasteurized milk, is drier and its packed and preserved in plastic bags. The EU traditional cheese producers would be replaced by more efficient standardized corporations that would process these cheeses in large quantities. The author described that the US would benefit from making an agreement with the EU. First the US consumers would benefit from acquired information and second the US industry would benefit by labeling their product under the GI system.

Marette et. al (2007) analyzed the international trade implications on the Word Trade Organization (WTO) decisions regarding Geographical Indications (GIs). The authors suggested that GIs are used to mitigate or offset inefficiencies resulted from misleading consumers from lack of relevant information on a given product. The authors also expressed that GIs are widely used in several countries around the world such as India (Darjeeling tea), Colombia (Colombian Coffee) and Chile (Valle del Maipo wine). The authors compared the GI regulations in the EU

and the US. EU GIs cannot change ownership, are accessible to any producer in the GIs region and product control (quality) standards are created by the owner group. In the US, the GIs are registered and protected under the trademarks and they cannot be registered unless distinctiveness is proved.

Marette et. al (2007) suggested that some of the challenges GIs would face from trade liberalization are that it may lead to increase in GI labeling. This would necessitate local differentiation of products against incoming competition. Another point the authors mentioned is that globalization could decrease the numbers of producers and the numbers of brands derived from high-quality (fixed cost) producers excluded low-quality producers from the market. Globalization also could homogenize quality standards around the world limiting GIs exclusively to climate and territory specifications. The authors mentioned that recent discussion of GI regulation in the WTO suggested that each player (the EU and the US) want to implement their own system of GI registrations. The authors explained that the US has accused EU of violating the WTO principle of national treatment (foreign treated as domestic) regarding intellectual property rights. The WTO decided that the EU could not refuse GI protection to third country products (where the GIs system is not equivalent to the EU system). Therefore the EU imposed a new regulation beginning March 31, 2006 where third country GIs could be registered and recognized within the EU system. The authors stated that the difficulty is establishing who is a third country. Currently, there is only one product from a third country registered and published by the EC quality scheme which is Colombian Coffee (EC-Department of Agricultural and Rural Development).

Marette et. al (2007) addressed seven points related to the acceptance and risk of rejection of a third country register application. First, there are no fee schedules for third countries and those could be high given that every group should cover their costs. Second, for the EU organic certification label, very few non-EU countries are considered to have an equivalent regulation system. Thus third countries who apply to the EU have a very expensive and difficult process. However for the GI process, third countries must apply to the EC and this would probably make the process less difficult and costly. Third, the EU allows any group or individual to object against PDO/PGI labels but the objections are restricted to those defined by the regulation. Fourth, foreign products must meet the EU food standards which could limit some producers from registering under the PDO/PGI system Fifth, the use of subsidies to promote

foreign registered product is uncertain because domestic products may not benefit from the marketing efforts. Sixth, farmers in developing countries are more likely to use the certification system in order to enter a "high-quality market". However the market share in the EU is relatively small. Seventh, if third country application is rejected then the group can appeal to EU court but could result only in a request for WTO dispute resolution. The authors concluded that several issues are still not solved in the international ambitious such as obligatory or voluntary wine and spirit registered system. However several bilateral agreements on these products have been made (the EU and Australia). The EU guide to mutual recognition of GI registration system and the WTO process is compatible with the EU efforts on GIs.

2.2 Success and Limitations of Geographical Indication Label System

The authors' objective was to describe the EU voluntary and mandatory labeling policies including consumers' taste/preferences, and the globalization of products and the diversification on quality signs away from geographic indications. Bureau and Valsceschini (2003) reviewed EU labeling systems literature to identify some of the success and limitation factors of those policies. The authors identified the use of geographical link labels which allows a collective group of producers to earn exclusive benefits from the value added of these products. The authors suggested that the limitation of this "cartelization" behavior is considered for other producer organizations and firms as an anticompetitive practice and also could leave room for opportunist behavior from other producers in the area.

The authors reported that increased confidence of consumers was a positive aspect due to the accurate traceability system verified by a control institution on quality labels products. They also suggested that another positive aspect is that producers improve and regulate their production methods in order to meet the appellation standards. The authors mentioned that food quality labeling is a more cost efficient policy because it segments and differentiates products more efficiently than CAP (Common Agricultural Policy) methods. The authors specified that the down side of this policy is that the implementation process leads to political collusion on defining the exact area to grant an appellation leading to a very bureaucratic process. Bureau and Valceschini (2003) concluded that producers are unable to transmit the quality perception outside of the EU where commercial brands can have more efficient promoting systems. Also, the EU

labeling system is used as a trade barrier tool. However, efficient strategies for differentiated quality products could successfully compete with the EU labeling system.

2.3 Demand Analysis of Quality Agricultural Products

Bonnet and Simioni (2001) analyzed French consumer's variation in willingness to pay for several brands of PDO label Camembert cheese PDO label versus non-label brands. They used a mixed multinomial logit model using optical scanner data for 4,627 French households in 1998. The results suggest that brand variables capture the brand specific quality characteristics and the quality attributes of all cheeses. A specific case of price premium was Le Petit (PDO label cheese) with 16.31 cents per unit. However, most of the consumers attributed a price discount to products associate with PDO labels. In fact, in fact consumers preferred to buy non-PDO Camembert cheeses. These results clearly suggest that French consumers of Camembert value other attributes besides PDO label in their purchase decision as a quality guarantee. However, the PDO brands market share diminishes more slowly when the consumers' income increases. The authors concluded that brand is a variable that widely affects consumers' choices/purchase decisions and PDO labels seems not to matter to consumers, given that at the same price, 84% of consumers prefer to buy non PDO label Camembert cheeses.

Loureiro and McCluskey (2000) estimated comsumer's willingness to pay among Spanish consumers for PGI label Galician Veal, traditional and natural beef meat from Galicia. They used data collected by Universidad de la Coruña (University of the Coruña) from 157 families who reported meat consumption during a five week period in 1997. They developed two empirical models, one with a variable label that captures the presence of PGI labeling in the products, and one with a variable label interacting with all the types of meat. The hypothesis test for the first model suggested that the presence of PGI label adds a premium of 32 pesetas per kilo to the price of fresh meat. From the interactions results of label and type of meat they found that this label only affects prices of expensive steaks, ribs and other quality cuts. The authors concluded that the PGI label is very significant in affecting fresh meat prices only for high quality cuts. Therefore the label system expresses quality signals only in combination with other quality factors.

Loureiro and Umberger (2003) analyzed consumer preferences and willingness to pay for mandatory country of origin label on beef products. Also, they calculated the market premium

for US label beef products versus imported products. In the US a voluntary label for perishable products began in 2002. However the labeling program became obligatory in the Farm Bill of that same year. The authors used a logit model based on diachotomous choice questions to consumers at grocery stores in three different cities in Colorado. For two products, "US Certified Steak" and "US Certified Hamburger", they found that consumers were willing to pay 38% and 58% above the normal price, respectively. They emphasized that females and beef eaters who were the main shoppers were more likely to pay a premium for the country of origin labels. The authors concluded that consumers were motivated to pay a great premium for the mandatory country of origin labeling program and also for US Certified Steak and US Certified Hamburger.

2.4 Supply Analysis of Quality Agricultural Products

Hayes et. al (2005) described and analyzed the economics of Farmer-Owned Brand (FOB) referring to the geographical indications by the EU and marketing orders in the case of the US. They used four case studies in order to address the success of some FOBs through supply control mechanisms. Hayes et. al (2005) suggested that in order to have a successful FOB it is necessary to control the quantity of supply. They listed four ways to legally control supply: 1) restrict the production to a specific region (based on the unique attributes of the region); 2) limit the number of producers; 3) implement strong production and/or quality standards on the product; and 4) require some ingredients controlled by the producer. The authors recommend regulation to protect property rights in order to restrict imitators from entering the market.

The first case study presented by the authors is the Parma Ham (Prosciutto di Parma) produced in Parma Italy and the brand is owned by a group of processors. The authors mention that the justification to restrict production of Parma Ham to that region is due to the environmental characteristic of the region which provides the high quality characteristics of the ham that cannot be compensate in any other region. Hayes et. al explained that the Parma Ham consortium (the group of PDO Parma Ham processors) implemented a 30 to 50 percent reduction on individual quality quotas of pork legs, with two years authorization by the Italian antitrust regulators, as an "affirmative defense" against the decrease in ham consumption predicted for 1995. The authors mentioned that after the two years of exemption the quotas were not reestablished and that prices of Italian pork leg have considerably increased.

The San Daniel Ham consortium implemented similar rules. They questioned whether products like Parma Ham have value due to the long history and reputation or in the case of newer products in the production restriction to their traditional areas. They cited research by Arfini (1999) who found that a large portion of the brand value was due to the long history record. However, he found some value on the newer brands with respect to commodity products.

Hayes et. al analyzed the Brunello di Montalcio (Montalcio Valley Tuscan, Italy) wine for the second case study. The authors pointed that the Brunello Consortium owns the Brulleno di Montalcio (registered as Designation of Controlled and Guaranteed Origin) and three other Designation of Controlled Origin brands and has the legal power to organize and coordinate production and commercialization of their brands given by Law 164. Examples of supply control mechanisms used by the Brunello Consortium are the restriction of cultivated area with registered grape vines, prohibited of irrigation, limited grape yields and limited yield of wine from grapes. Hayes et. al suggested that this control can be reflected in the fact that Brunello di Montalcino vineyards are sold for $120,000 per acre and the other vineyard brands sold for $22,000 per acre, on average.

The third case is 3A PTA (3A Parco Tecnologico Agroalimentare), a certification and inspection company in Italy. The authors explained that 3A PTA is the inspection body for EU regulatory protected products such as Vitellone Bianco dell' Appennino Centrale (Central Mountain Range White Calf), Lenticchia di Castellucio di Norcia (Castelluccio di Nurcia Lentils) and other regulatory and voluntary registered brands. The authors stated that 3A PTA suggested that the certification and inspection cost for FOB is 1% of the value of the product considering that the price of Central Mountain Range White Calf is two to four times higher than the regular beef. Therefore for products with a long reputation, the EU scheme protects the product so producers can extract a premium from commercializing the brand. The fourth case presented by the authors is Vidalia Onions (Trademark from Georgia, US). The authors cited Boyhan and Torrance paper where they stated that almost all the supply of Vidalia Onions are cultivated in 15 acres and sold for $2.7 per cwt above the maximum price of other states onions. The authors concluded with some examples where FOB protection laws could help producers to promote their products such as the I-80 Beef given that Japanese consumers believe that the beef produce along the I-80 interstate highway in Iowa was a better flavor than the rest of the US beef.

Lence et. al (2007) analyzed several producers organizational structures and supply control mechanisms in order to sequentially present producers' surplus for each of them and discuss the societal welfare derived from geographical indication policies. The authors' objective was to present a model that would analyze market and welfare effects by different types of supply control according to various types of organizations based on producers and social welfare contributions. Control over land and/or technology were the supply control factors and they focused on five types of Geographically Differentiated Agricultural Products (GDAP) organizations. The first case was where the GDPA cannot control supply at all. The second case was complete market power from the GDPA. The third case was where the GDPA is allowed to control land and production practices. The fourth case was where the GDPA can only control land. The last case was where producers can only control production practices. Lence et. al's research shows that under perfect competition, producers' surplus is equivalent to the total amount of land used to produce times the maximum profits from producing a commodity. Therefore, the only way producers will organize is if the change in producer surplus is greater after the GDPA is developed, but that change depends on the type of producers' organization. From the social planner standpoint, the authors suggested that the social planner will invest in developing the producers' organization only if the fixed cost of development is low enough because it will positively affect social welfare.

According to the type of organization under a perfect competitive scenario, producers will keep from paying the fixed cost involved in developing a GDAP, given that it will be hard to generate profits from the organization. The legal framework that allows producers to behave in a monopolistic way leads to the maximum producers' surplus situation and the loss to society is due to the fact that producers will decrease the amount of land under production and amount harvested as well. The authors specified that the producers' surplus in a monopoly is greater than controlling land and production practices simultaneously and this surplus is greater than either controlling only for land, or only for production practices, but less than or equal to a perfect competitive organization surplus.. In this context, the authors reported that for those EU GDAP with ancestral origins, the 1992 EU GI legislation only gave them the right to extract producers' surplus from consumers, leaving a net loss in social welfare. Distinctively, those EU GDAP that would not exist without the 1992 EU GI legislation improved social welfare. In 2006, the EC made revision on the PDO/PGI regulations making the registration process simpler. However the

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property rights structure was left the same as 1992. Therefore, even with this revision, the situation might not be different (Fact Sheet-European Policy for Quality Agricultural Products 2007). The authors concluded that stronger levels of property rights provide greater incentive to form GDAP that without protection were not be able to exist. Nevertheless, legislation giving market power to GDAP may bring on technological distortions to the system. However, they demonstrated positive producers and social effects from extending GDAP rules in the US.

2.5 Summary

The research on PDO/PGI suggested that the ability to control supply and differentiation based upon unique production factors linked to weather, geography, climate and similar factors or producer know-how are important in the development of a PDO/PGI. The legal framework in the EU has changed over time to be more transparent such that they are not price distorting. No implicit study has analyzed the linkage between price and quality characteristics and supply control. This thesis contributes to the theoretical literature on PDO/PGI by focusing on an explicit product, cheese.

CHAPTER 3 - ECONOMIC THEORY

The literature review indicated that the success of a PDO/PGI is dependent upon its ability to effectively control supply and provided a product differentiated by local geographic factors such as weather, climate or production process (e.g., know-how). In other words, by limiting the amount of land that can be used to produce the PDO/PGI, it may be possible to increase the price paid to producers if consumers perceive value associated with it and demand increases for that product through the marketing of the attributes. It is relevant to assume that the available productive land is fixed as defined by the EU 1992 Quality Label legislation for each of the producer organizations. The implication of a fixed factor permits the producers to control supply in order to artificially increase the PDO/PGI cheese prices.

The supply control effect is shown in figure 3.1. By limiting the area of production producers/processor fix the quantity of product available in the market which causes a kink in the supply curve consequently supply shift from S_1 to S_2. The market equilibrium remains the same at P_1 and Q_1. However since now S_2 is fixed at Q_1, any future increase in demand will have a higher price. Product differentiation makes the demand more inelastic (steeper demand curve) and thorough product promotion the demand of these higher differentiated products increases so Figure 3.2 illustrates a shift from D_1 to D_2 in the demand curve with a resulting price increase from P_1 to P_2 and quantity supply increase from Q_1 to Q_2 leading to a new market equilibrium at P_2 and Q_2. Note that this figure assumes no supply control.

Figure 3.1 Market responses to supply control mechanisms
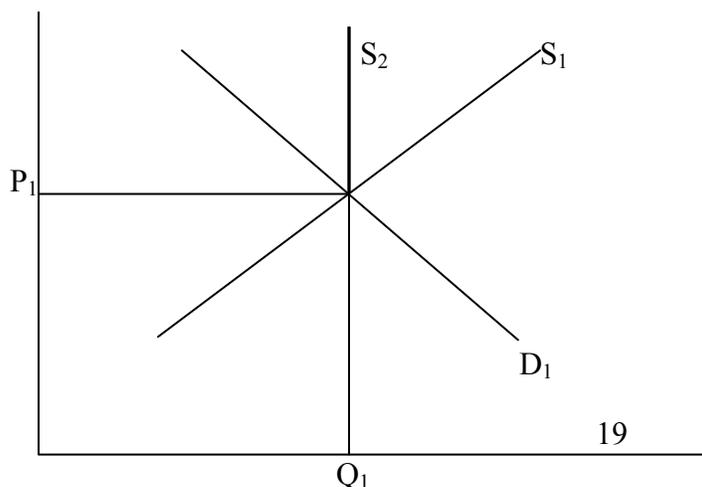
Figure 3.2 Market responses to product differentiation
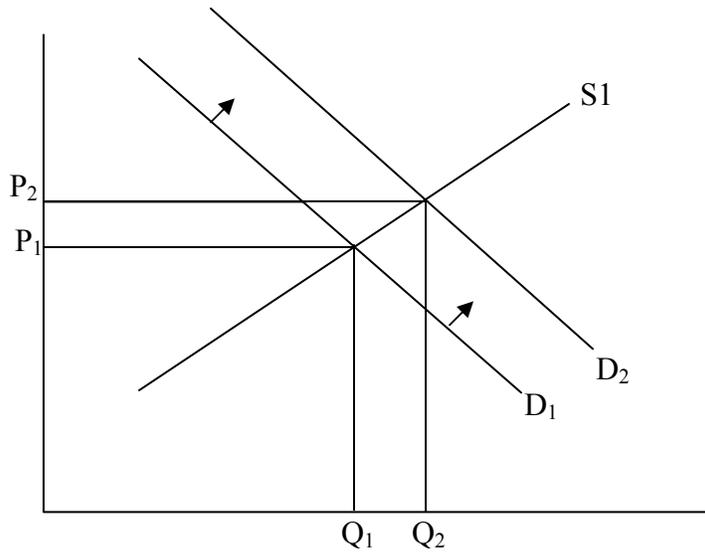
Figure 3.3 shows both changes resulting from supply control and product differentiation. The combine effects results on price increase from P_1 to P_3 due to the fixed supply curve S_2 and the shift to the right in the demand curve. The new price equilibrium in the market is composed by P_3 and Q_1. Producers' surplus increase is represented by the shadow area between P_3 and P_1. Therefore, the net outcome of both changes is an increase in price and a fixed quantity of supply.

Figure 3.3 Market net effect of supply control mechanisms and product differentiation
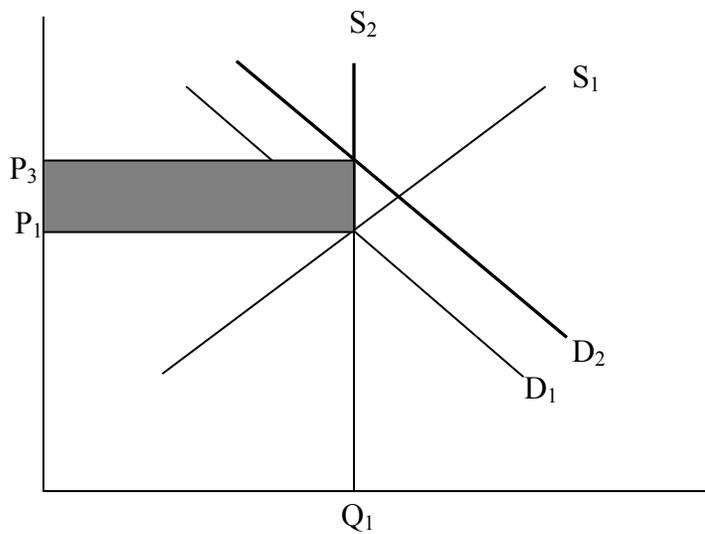
3.1 Summary

This chapter provided the economic theory underling the market effects of supply control and product differentiation practices. The net market effect observed from both events taking place in the market simultaneously is an increase in price due to the fixed quantity of supply and an increase in the demand of the good. Overall, the producer surplus is higher at the new market equilibrium due to a surplus transfer from the consumers to the producers.

CHAPTER 4 - METHODOLOGY

A hedonic price model approach was selected to measure the impact of the cheese attributes variable on PDO/PGI price. Also, the theoretical model included supply control and substitutes variables to measure the impact of those variables on this PDO/PGI price.

4.1 Conceptual Model

Lancaster (1966) developed the concept that utility is derived from the attributes or qualities of a good. Since then, the hedonic pricing method has been widely used to evaluate the contribution of quality characteristics in the observed price of a good. All these efforts are based on the fact that consumers and producers acknowledge these attributes or qualities in the same ways, leading to equilibrium as a merit of the choices each group make, without any incentive to leave this equilibrium stage. Under the assumption that products can be differentiated simply and uniquely by their attributes, a subsequent hedonic pricing method can be defined as a statistical measurement of the relation between the price paid by the consumers and the set of attributes or qualities of that given good (Huang and Lin 2007).

4.2 General Theoretical Hedonic Model

The utility, Q, is expressed as a function of the quantity of goods consumed, x, and the characteristics on each good Z:

(4.1) $Q_i(x_1, x_{2, \ldots}, x_n, Z_{1j}, Z_{2j}, \ldots, Z_{nj}) = f_j(x_1, x_{2, \ldots}, x_n, Z_{1j}, Z_{2j}, \ldots, Z_{mj})$

for $i = 1, 2, ..., n$, and $j = 1, 2, \ldots, m$

In the first equation Q_i represents the total amount of the ith product characteristic from all products, x_i stands for the quantity of ith product consumed and Z_{ij} represents the jth characteristics for each of the ith products. Assuming that consumers acquire one unit of a good with a particular value, z, and x is all other goods consumed. Then a consumer's utility function of the total attributes or qualities present from all the goods consumed is stated as follows:

(4.2) $U = U(x, z_1, \ldots, z_n)$

from the utility maximization process subject to a budget constraint, $\Sigma p_i x_i = M$, which consists of choosing x and $z_1, z_2, \ldots, z_n$ to satisfy the first-order conditions, deriving the standard hedonic price function expressed as follows:

(4.3) $P_i = f_i(z)$

where P_i represents the observed price for ith product in the market and z is a vector of attributes for each of the ith goods. Therefore, maximum utility results from purchasing a good with a preferred set of characteristics which identifies the tradeoff that consumer will make between income and an attribute or quality of a given good (Huang and Lin 2007). Independent hedonic variables should be chosen such that they can be easily measured and identified by consumers. Such variables are related to product quality and could include claims made on labels related to a characteristic of the PDO/PGI.

There is little theoretical guidance with respect to using independent variables that would capture the supply control factor in the regression analysis. A study by Hayes et. al (2005) showed that in order to assert supply control, producers' organizations, defined by the authors as Farmer-Owner Brands (FBO), must be based on some fixed attribute. For example, specifying that a branded product can only come from a specific area justifies the restrictions due to specific attributes of the region. The authors specify that the government is legal support to FBO is basically to assign property rights for their products. Thus they can administer them in a profitable way, a fact that would most likely cause producers to limit supply as shown in the Parma Ham case study mentioned in their paper. Also, Lence et. al (2007) emphasized that reduction in land used and reduction in productivity is clearly a producers' response in order to limit supply and achieve more profits from an price increase.

4.3 PDO Hedonic, Supply Control and Price Substitute Model

The theoretical model used in this research incorporates quality attributes, supply control and substitutes variables. It can be represented as the following

(4.4) $P = f(\text{hedonic, supply control, substitutes})$

The hedonic variables measure the unique attributes of the terrain or producers knowhow that enable the PDO/PGI to be unique to consumers and therefore create demand for the product. The supply control variables measure the ability of producers to control supply as

suggested by Lence et. al (2007). The substitute variable measures the product that is an imitation of the PDO/PGI.

4.4 Summary

This chapter has built a theoretical model guided by the literature review and economic theory that found that product differentiation and supply control are important for the development and success of a PDO/PGI. The model uses hedonic variables to measure differentiation and variables to measure supply control and substitutes.

CHAPTER 5 - DATA

This chapter describes the sources and the variables used in this research. Cross sectional data were collected on country of origin, PDO/PGI price, price of substitutes, product quality land, and production for each PDO/PGI in the EU. A summary of the data follows in table 5.1 through 5.3.

5.1 Survey Design

The DPO/PGI label names were obtained from each of the producers' association webpage and/or the promoting organizations in the respective countries from the official EU rural development and agriculture site (http://ec.europa.eu/agriculture/foodqual/quali1_en.htm). The contact information for each group of producers/processors association was obtained from internet searches of their webpage and through some of the promotional information in some of the countries such as Asociación para la Promoción de Quesos de España (Asociation for the Promotion of Spanish Cheeses-http://www.asocpromocionquesos.es/index.html); PDO/PGI official government websites such as Il Portale del Formaggio in Italy (The Portal of Cheese-http://www.formaggio.it/) and Maison du Lait in France (House of Milk- http://www.maison-du-lait.com); tourism promotion websites such as Serviços Informação e Turismo S.A. in Portugal (Tourism and Information Services S.A.-http://www.lifecooler.com/) and non-profit organization such as Origin Food (www.origin-food.org). After the contact information was obtained, six categories of product were chosen to use in this research. The chosen producer organizations represented the majority of products registered (77.64%) and provided online services where the surveys could be delivered. This selection eliminated beer, bread-and-bakery, fish, other animal products, other drinks, and other categories. These product numbers were smaller with respect to market share.

Six separate surveys were made to address producers' organizations in the following categories: cereal and vegetables, cheeses, fresh meat, fruits and table olives, meat based products and olive oil. Fruit and table olives were combined in one category because the production process on both products is very similar attributed to the perennial characteristic in both products. In the same way cereal and vegetable were collected in one category because

these are annual crops with similar production process. In order to increase the response rate the surveys were translated to their respective languages according to the contact information data base. The translation and verification was closely done between the author and the translators. Ms. Graciela Andrango worked on the Spanish version. Ms. Andrango is a graduate student in agricultural economics at Kansas State University and a native Spanish speaker from Ecuador. Mr. Gerardo Galeano-Zarza worked on the Portuguese version. Mr. Galeano-Zarza is a graduate student in agricultural economics at Kansas State University and did his undergraduate degree in Brazil where he spoke Portuguese as a second language. Mr. Marc Neubert worked on the German version. He is a graduate student in political science at Kansas State University from Germany. Mr. Jacques Abadie and Mr. Yorick Miquel worked on the French version. They are French exchange students at Kansas State University for the spring 2008 semester from Purpan University in Toulouse, France. Mr. Michal Jama worked on the Polish version. He is a Polish graduate student in computer engineering at Kansas State University. Ms. Kim Steinke worked on the Italian version. Ms. Steinke is a native Italian speaker and undergraduate student at Kansas State University. The different versions of the cheese surveys are provided in appendix A.

5.2 Resources Used to Develop the Survey

The creation and administration of the survey website was done by Mr. Chuck Mickelsen who is an extension assistant for the Arthur Capper Cooperative Center (ACCC) at Kansas State University. The site was built upon the Department of Agricultural Economics server in order to express credibility to the recipients through the university name. The survey website contained 35 surveys and 35 tables to store the answers. Explicitly, by product category, there were 6 cereal-and-vegetable surveys, 7 cheese surveys, 6 fresh meat surveys, 5 fruit-and-table-olive surveys, 6 meat product surveys, and 5 olive oil surveys. For example, http://www.agecon.ksu.edu/pdoppgisurvey/debrasanchez/prome/PROMI.asp is the link to the meat products survey in Italian. Mr. Mickelsen's vast experience in computer science made it possible to send the surveys to the EU after solving major security issues which did not allow it in the beginning. The surveys were sent using the contact information compiled earlier through a mail merge using a Kansas State University official cover letter translated in the respective

language. This process of developing, translating and resolving the security issues took five months.

From the 316 surveys sent, 27 surveys were filled and submitted to the data base and the author received 25 emails with information regarding with the surveys. Further contact with some of the individuals contributed significantly to this research. Mr. Michael Lough is an experienced professional in the quality label system in the UK and the contact person for the Beacon Fell Lancashire Cheese. He provided some of his work on the PDO situation in the UK. Mr. Juan Antonio Espejo Calvo from the Consejo Regulador de la Denominación Especifica del Esparrago de Huérto Tájar is an expert in the PDO legislation. He has worked on it since 1993 and he has promoted 10 PDOs in the south of Spain. Mrs. Espejo Calvo introduced and explained very well the different levels of legislation and their contents during further communications. Ms. Emmanuelle Gallienne from Service Consommateurs Société (Roquefort Society Customer Service) provided the official government website for the PDO/PGI statistics in France. The author would like to thank those individuals for their cooperation.

5.3 Cheese was chosen as PDO of Interest

The area of study in this analysis includes the PDO cheeses imported from France, Italy, Portugal and Spain. The rest of the countries of the EU were excluded because of a lack of production information about them. Based on the survey responses, 27 answers from the 52 responses were from cheese producers/processors organization. The answers represented France, Italy, Portugal, Spain, and United Kingdom. Only two cheese producers/processors organization responded from United Kingdom and the information provided was incomplete so these observations were removed as well as the other countries producers/processors organization that did not respond. The population of cheeses was 45 cheeses from France, 33 (Italy), 20 (Greece), 20 (Spain), 12 (Portugal), 12 (United Kingdom), 6 (Austria), 4 (Germany), 4 (The Netherlands), 2 (Denmark), 2 (Poland), and 1(Belgium, Ireland, and Sweden, respectively) reported by the EC. Cheeses from France (34 cheeses), Italy (21 cheeses), Portugal (7 cheeses) and Spain (21 cheeses) constituted the 83 observations which comprised 51% of all PDO cheeses in the EU. This percentage is based on the number of cheeses. However, as a percentage of volume, those cheeses are greater than 51% with about 80% market share in the EU. In addition, the majority of

cheeses not included in this study are not exported to the US. Appendix B has a description of PDO European cheeses from Babcock and Clemens 2004.

The surveys identified questions regarding the amount of land certified under the PDO, number of members, type of products, production levels, productivity, type of market and brands. More specifically, the model of equation (5.1) represents factors reflecting supply and demand influences on PDO prices and is specified as follows

(5.1) $PP_i = \beta_0 + \beta_1 MS_i + \beta_2 AG_i + \beta_3 PS_i + \beta_4 Italy_i + \beta_5 Portugal_i + \beta_6 Spain_i +$
$B_7 Sheep_i + \beta_8 Goat_i + \beta_9 Mix_i + e_i$

where PP_i is the imported US price paid for each of the ith PDO labeled product ($i = 1, \ldots , 83$); MS_i represents the productivity defined as total cheese produced in the PDO divided by the total amount of land specified under the PDO limits; AG_i represents the ripened age at retail for each of the PDO label ith cheeses; Italy, Portugal and Spain are binary variables with value of 1 or 0 of the ith observations depending on the country of origin of the cheese (France was left out for regression purposes because it has a long history of well known cheeses and therefore it constitutes a good point of comparison); Sheep, Goat and Mix are binary variables with values of 1 or 0 for every ith observations depending on the type of milk used to make the cheese (Cow was left out for regression purposes because cow milk cheeses are the most consumed and therefore provides a good point of comparison); PS_i represents the price of a substitute artesian or farmstead cheese produced in the US (specifically in the states of: California, Minnesota, Texas, Vermont, Virginia, Wisconsin); and e_i represents the error term. Table 5.1 describes the specific definition of each variable in the model. In this study, the initial functional form chosen for this model is a linear-linear model because it directly captures the monetary impact of the dependent variables on the PDO cheese price.

5.4 Expected Sign of the Coefficients

Supply control variable is measured through a market share variable. Only an increase in the market share leads to an increase in production on a given PDO due to the fact that land is a fixed factor by EU legislation. The expected sign for the market share coefficient should be negative because by definition land is fixed and only the production of cheese varies. Therefore if the production increases the supply increases and the prices are going to go down, or vice versa.

By definition, DPO are seen as a unique product and linked to a specific region in the world. Thus consumers are willing to pay a premium for the product of one country relative to another country's products. Therefore, the respective signs could be either positive or negative depending on the consumer preferences.

Type of milk is an intrinsic characteristic of the cheese and is related to the preferences and taste of the consumers. Consumers might be willing to pay a premium for a type of milk cheese compared to another cheese made from a different type of milk. Therefore the expected sign of the type-of-milk coefficients could be either positive or negative, depending on consumer taste and preferences.

Substitute cheese is defined as an artesian or farmstead cheese produced locally that has similar characteristics in term of type of milk, style or manufacture process to the PDO cheese. Substitute products have opposite signs. Therefore the sign expected for this coefficient is positive. In other words, as the price of PDO cheese increases, the price of the substitute increases.

5.5 Product Attributes Data

Data on age (ripeness), country of origin, and type of milk are given in table 5.2. Age was obtained from the importer's specification of the products if the producers provided this data. The minimum ripeness time was taken from the book entitled *The Cheese Lover's Companion* (2007) by Sharon Tyler and Ron Herbst. The authors are award winning food authors and consultants and are very respected in the wine, food and cheese industry. Country of origin was obtained from the PDO section in the EU Agriculture and Rural Development webpage. Type of milk was obtained from each PDO webpage. In the event the PDO did not have a webpage this information was obtained from the book *The Cheese Lover's Companion.*

5.6 Production and Land Data

Data on 2005 PDO production and geographical boundaries are given in table 5.2. Those were obtained from the survey answers, PDO producers' organization webpage, and other organizations for each country given in table 5.3.

5.7 Market Share Data

The computation of market share was obtained by dividing cheese annual production by total amount of land within the PDO limits. The percentages are given in table 5.4. As would be expected, this calculation yields a very small number because calculations are bound between zero and one.

Table 5.1 Description of the variables used in the model

Variable	Definition	Mean (Std. Dev.)
Dependent Variable		
PDO price (PP)	Unit price of PDO cheeses, dollars per pound	21.92 (8.49)
Supply Control Variables		
Market Share (MS)	ratio = PDO production/total PDO certified land	0.89 (1.71)
Substitute Price Variable		
Price of Substitute (PS)	Unit price of artesian local produced cheeses, dollars per pound	21.11 (7.66)
Hedonic Variables		
Country(CO)		
France	= 1 if the country of origin is France = 0 otherwise	N/A
Italy	= 1 if the country of origin is Italy = 0 otherwise	N/A
Portugal	= 1 if the country of origin is Portugal = 0 otherwise	N/A
Spain	= 1 if the country of origin is Spain = 0 otherwise	N/A
Type of milk (TC)		
Cow	= 1 if is made from cow's milk = 0 otherwise	N/A
Sheep	= 1 if is made from sheep's milk = 0 otherwise	N/A
Goat	= 1 if is made from goat's milk = 0 otherwise	N/A
Mix	= 1 if is made from any mix of cow, sheep, and/or goat milk = 0 otherwise	N/A
Age (AG)	Years of age for the cheese	0.2811 (0.4088)

5.8 Price Data

PDO prices and price of substitute products are provided in table 5.2 and were obtained from gourmet or specialty food online stores for the last two weeks of June 2008. Prices are reflected in US dollars per pound and were calculated by dividing total price by the total weight of each item. The weight varied from 0.125 pounds to a 80 pound cheese wheel.

The data collection converted 26 observations from igourmet.com, 15 from desdespanabrandfoods.com, 12 from cheesesupply.com, 11 from dibruno.com and gourmetfoodstore.com, respectively, 3 from caviarmore.com, 3 from murrayscheese.com, 1 from latienda.com, and 1 from idealcheese.com. Igourmet.com is a gourmet food online store since 1997 but founded by Charles Chesman in 1918. It has been named the best gourmet food web site by the business webpage Forbes (www.forbes.com) for the last 5 years and is located in northeastern Pennsylvania. Despaña Brand Foods, located in New York, was founded 1971 as a chorizo factory and currently is an authentic Spanish products online store. Cheesesupply.com provided more than 700 cheeses and cheese accessories and it is located in Bellingham, Washington. Di Bruno Bros. established in 1939 in Philadelphia offers more than 500 varieties of gourmet cheeses. The Gourmet Food Store offers a variety of fine gourmet products including a wide variety of cheeses from Italy, France, Portugal, Spain, and Switzerland. Caviar & More is a store located in Miami that offer gourmet cheeses from the northern European countries as well as France, Italy and United Kingdom. Murray's food store founded in 1940 in Los Angeles and currently offers cheeses and specialty food from Spain and Italy. La Tienda sells Spanish products since 1996 and it is located in Williamsburg Virginia. Ideal Cheese is a gourmet food store founded more than 50 years ago operating from New York.

Artesian or farmstead cheeses produced locally, made from the same type of milk, and belonging to the same type of cheese or that were derived from specific European cheeses were considered substitute products. Dr. Karen Schmidt a professor of animal sciences and industry at Kansas State University advised the author on selecting the substitutes depending on the type of cheeses based on the production process, type of milk and the style of cheese. The criteria used to select the substitutes were type of milk, texture and style of cheeses. The prices of the substitutes were obtained from Albrecht's cheese, artisiancheese.com,

beechershandmadecheese.com, dibruno.com, igourmet.com, and murrayscheese.com. Albrecht's cheese in Wisconsin was established in 1974 and sells Wisconsin cheeses. The Beecher's Story was established in Seattle and sells local cheeses since 2002.

5.9 Summary

This chapter justifies the author's decision to focus the research on cheeses. The data recompilation method, description, computation and source are described in this chapter. The empirical model used in the research and the respective coefficients expected signs are described. The next chapter provides the results.

Table 5.2 PDO registered products used in this study

	PDO Name	Country	Age (years)	Type Milk	Price (US$/lb)	Substitute Price (US$/lb)	Land (ha)	Production (tons/year)
1	Abondance	France	0.2466	Cow	$22.44	$14.30	350,000	1,400
2	Banon	France	0.0479	Mix	$27.38	$34.64	450,000	60
3	Beaufort	France	0.3333	Cow	$29.98	$25.98	400,000	4,000
4	Bleu d'Auvergne	France	0.0577	Cow	$16.66	$17.98	2,000,000	6,600
5	Bleu de Gex Haut Jura	France	0.0577	Cow	$16.78	$17.98	135,000	550
6	Bleu des Causses	France	0.1918	Cow	$19.61	$17.98	1,400,000	800
7	Brie de Meaux	France	0.1644	Cow	$20.14	$13.98	1,700,000	7,000
8	Camembert de Normandie	France	0.0959	Cow	$22.95	$13.98	3,000,000	12,500
9	Cantal	France	0.3333	Cow	$16.47	$14.75	1,000,000	19,000
10	Chabichou du Poitou	France	0.0577	Goat	$43.35	$21.32	800,000	533
11	Chaource	France	0.0769	Cow	$23.24	$21.00	350,000	2,000
12	Chevrotin	France	0.1644	Goat	$45.71	$39.98	350,000	100
13	Comté	France	0.3333	Cow	$24.02	$21.98	1,200,000	45,000
14	Crottin de Chavignol	France	0.0769	Cow	$55.92	$39.98	550,000	1,140
15	Epoisses	France	0.0769	Cow	$43.13	$19.98	650000	0.81
16	Fourme d'Ambert	France	0.0833	Cow	$15.99	$17.98	800,000	6,000
17	Laguiole	France	0.3333	Cow	$13.98	$13.50	210,000	700
18	Langres	France	0.0833	Cow	$16.99	$13.98	500,000	400
19	Livarot	France	0.1667	Cow	$32.00	$13.98	100,500	1,300
20	Morbier	France	0.1667	Cow	$20.04	$25.98	1,000,000	7,000
21	Munster	France	0.1644	Cow	$20.69	$27.14	130,000	8,000
22	Ossau Iraty	France	0.2466	Sheep	$28.53	$32.99	650,000	3,200
23	Picodon	France	0.0673	Goat	$31.96	$21.32	1,300,000	600
24	Pont-l'Evêque	France	0.5833	Cow	$34.72	$25.98	350,000	3,000

| 25 | Pouligny Saint-Pierre | France | 0.0962 | Goat | $23.62 | $32.99 | 70,000 | 300 |

Table 5.2 Continuation

	PDO Name	Country	Age (years)	Type Milk	Price (US$/lb)	Substitute Price (US$/lb)	Land (ha)	Production (tons/year)
26	Reblochon	France	0.1442	Cow	$17.26	$27.14	400,000	17,000
27	Roquefort	France	0.3333	Sheep	$28.62	$17.98	1,500,000	19,000
28	Sainte-Maure	France	0.0865	Goat	$33.98	$29.00	1,000,000	1,000
29	Saint-Nectaire	France	0.1644	Cow	$13.98	$19.98	190,000	14,000
30	Selles-sur-Cher	France	0.0673	Goat	$30.16	$24.85	300,000	800
31	Vacherin Mont-d'Or	France	0.0577	Cow	$33.33	$21.98	140,000	4,000
32	Tomme de Savoie	France	0.2083	Cow	$15.98	$25.98	438,800	6,000
33	Tomme des Pyrénées	France	0.5000	Goat	$30.41	$21.98	2,944,700	2,434
34	Valençay	France	0.1058	Goat	$29.09	$37.60	700,000	340
35	Afuega´L Pitu	Spain	0.0833	Cow	$20.00	$13.98	170,170	132
36	Arzúa-Ulloa	Spain	0.0833	Cow	$14.00	$17.98	432,210	2,347
37	Cabrales	Spain	0.2500	Mix	$25.98	$17.98	33,050	470
38	Gamonedo	Spain	0.2500	Mix	$20.91	$23.98	28,820	45
39	Idiazábal	Spain	0.1667	Sheep	$19.98	$17.99	1,645,750	1,308
40	Mahón-Menorca	Spain	0.4167	Cow	$15.25	$21.98	69,570	2,316
41	Queso de Cantabria	Spain	0.0833	Cow	$14.50	$13.98	462,320	208
42	Queso de L'alt Urgell	Spain	0.1667	Cow	$15.38	$25.98	189,070	239
43	Queso de La Serena	Spain	0.2500	Sheep	$22.00	$32.99	300,000	211
44	Queso de Murcia	Spain	0.0822	Goat	$13.98	$25.98	1,131,240	20
45	Queso de Murcia al Vino	Spain	0.2500	Goat	$16.43	$22.21	1,131,240	261
46	Queso de Valdeón	Spain	0.2500	Mix	$16.08	$17.98	16,460	123
47	Queso Ibores	Spain	0.2500	Goat	$18.00	$21.98	629,070	115
48	Queso Majorero	Spain	0.2500	Goat	$21.00	$39.98	165,900	230
49	Queso Manchego	Spain	1.0000	Sheep	$15.99	$17.98	6,724,150	8,682

	PDO Name	Country	Age (years)	Type Milk	Price (US$/lb)	Substitute Price (US$/lb)	Land (ha)	Production (tons/year)
50	Queso Tetilla	Spain	0.0833	Cow	$12.00	$13.98	2,950,660	2,739

Table 5.2 Continuation

	PDO Name	Country	Age (years)	Type Milk	Price (US$/lb)	Substitute Price (US$/lb)	Land (ha)	Production (tons/year)
51	Queso Zamorano	Spain	0.5000	Sheep	$22.05	$17.98	1,056,110	472
52	Quesucos de Liébana	Spain	0.0833	Mix**	$18.89	$21.98	62,900	77
53	Roncal	Spain	0.3333	Sheep	$17.65	$29.98	41,270	458
54	San Simón da Costa	Spain	0.1667	Cow	$15.00	$13.98	182,310	268
55	Torta del Casar	Spain	0.2500	Sheep	$24.00	$13.98	400,000	332
56	Asiago d'Allevo	Italy	0.4167	Cow	$13.99	$12.99	900,000	23,621
57	Asiago Pressato	Italy	0.0822	Cow	$11.98	$12.99	900,000	23,621
58	Bra	Italy	0.5000	Mix	$13.98	$13.98	1,372,875	1,028
59	Caciocavallo Silano	Italy	0.2500	Cow	$19.98	$7.00	5,250,082	1,119
60	Castelmagno	Italy	0.5000	Mix	$33.98	$22.99	689,874	201
61	Fiore Sardo	Italy	0.1667	Sheep	$19.99	$17.98	1,582,430	466
62	Fontina	Italy	0.2500	Cow	$17.98	$11.98	325,859	3,606
63	Gorgonzola	Italy	0.2083	Cow	$17.75	$23.98	2,940,306	48.48
64	Grana Padano	Italy	1.0000	Cow	$13.99	$15.99	7,857,429	159,607
65	Montasio	Italy	0.1667	Cow	$13.98	$19.98	1,075,775	8.19
66	Monte Veronese	Italy	0.0822	Cow	$18.99	$12.99	312,079	537
67	Parmigiano Reggiano	Italy	3.0000	Cow	$25.99	$15.99	1,447,393	118,979
68	Pecorino Romano	Italy	1.0000	Sheep	$14.06	$14.99	3,174,783	23,855
69	Pecorino Siciliano	Italy	0.3333	Sheep	$13.98	$14.99	2,570,682	13.1
70	Pecorino Toscano	Italy	0.1096	Sheep	$17.98	$17.98	2,836,074	1,869
71	Provolone Valpadana	Italy	0.2500	Cow	$10.99	$12.99	5,117,348	12,745
72	Ragusano	Italy	2.0000	Cow	$21.98	$12.57	372,219	169
73	Raschera	Italy	0.1644	Cow	$13.98	$13.98	689,874	994

Table 5.2 Continuation

	PDO Name	Country	Age (years)	Type Milk	Price (US$/lb)	Substitute Price (US$/lb)	Land (ha)	Production (tons/year)
74	Taleggio	Italy	0.1041	Cow	$14.75	$25.98	1,932,966	9,196
75	Toma Piemontese	Italy	0.0411	Cow	$13.98	$13.98	2,314,315	1,234
76	Valtellina Casera	Italy	0.1918	Cow	$11.98	$13.98	321,436	1,464
77	Queijo de Azeitão	Portugal	0.1644	Sheep	$26.40	$25.98	4,684,200	25
78	Queijo de Évora	Portugal	0.1644	Sheep	$27.41	$14.99	852,300	240
79	Queijo de Nisa	Portugal	0.1233	Sheep	$27.98	$33.98	292,340	178
80	Queijo São Jorge	Portugal	0.4167	Cow	$18.98	$21.98	23,760	1,800
81	Queijo Serpa	Portugal	0.1644	Sheep	$29.98	$39.98	1,339,800	20
82	Queijo Serra da Estrela	Portugal	0.0959	Sheep	$29.16	$17.98	474,593	211
83	Queijos da Beira Baixa	Portugal	0.1644	Mix	$24.99	$33.98	701,660	300

Table 5.3 Production and land data sources by country

Parameter	Country	Data Source	Webpage
PDO Production	All countries	Surveys	
	French	INAO (Instituto Nacional d'Apellation Origine)	www.inao.gouv.fr
	French	La Maison du Lait	www.maison-du-lait.com
	Italy	CLAL (Consultancy and Market Research Food and Dairy)	www.clal.it
	Portugal	Lifecooler (Serviços Informação e Turismo S.A.)	www.lifecooler.com
	Spain	MAPA (Ministerio de Agricultura, Pesca y Alimentación)	www.mapa.es
PDO Land	All countries	Surveys	
	French	INAO (Instituto Nacional d'Apellation Origine)	www.inao.gouv.fr
	Italy	Ministerio delle Politiche Agricole Alimentari e	www.politicheagricole.gov.it

		Forestali	
	Portugal	Veraki	www.portugal.veraki.pt
	Spain	Servidor de Cartografía del SIGA (Servicio de Información Geográfico Agrario)	www.mapa.es/siga/inicio.htm

Table 5.4 Market share and productivity percentages

PDO Name	Market Share	PDO Name	Market Share
Abondance	0.40%	Reblochon ou reblochon de Savoie	4.25%
Banon	0.01%	Roquefort	1.27%
Beaufort	1.00%	Sainte-Maure	0.10%
Bleu d'Auvergne	0.33%	Saint-Nectaire	7.37%
Bleu de Gex Haut Jura	0.41%	Selles-sur-Cher	0.27%
Bleu des Causses	0.06%	Vacherin Mont-d'Or	2.86%
Brie de Meaux	0.41%	Tomme de Savoie	1.37%
Camembert de Normandie	0.42%	Tomme des Pyrénées	0.08%
Cantal	1.90%	Valençay	0.05%
Chabichou Du Poitou	0.07%	Afuega´L Pitu	0.08%
Chaource	0.57%	Arzúa-Ulloa	0.54%
Chevrotin	0.03%	Cabrales	1.42%
Comté	3.75%	Gamonedo	0.16%
Crottin de Chavignol	0.21%	Idiazábal	0.08%
Epoisses	0%	Mahón-Menorca	3.33%
Fourme d'Ambert	0.75%	Queso de Cantabria	0.05%
Laguiole	0.33%	Queso de L'alt Urgell	0.13%
Langres	0.08%	Queso de La Serena	0.07%
Livarot	1.29%	Queso de Murcia	0%
Morbier	0.70%	Queso de Murcia Al Vino	0.02%
Munster	6.15%	Queso de Valdeón	0.75%
Ossau Iraty	0.49%	Queso Ibores	0.02%
Picodon	0.05%	Queso Majorero	0.14%
Pont-l'Evêque	0.86%	Queso Manchego	0.13%
Pouligny Saint-Pierre	0.43%	Queso Tetilla	0.09%
Queso Zamorano	0.04%	Pecorino Toscano	0.07%
Quesucos de Liébana	0.12%	Fiore Sardo	0.03%
Roncal	1.11%	Queijo São Jorge	7.58%
San Simón da Costa	0.15%	Queijo de Azeitão	0%
Torta del Casar	0.08%	Queijo Serpa	0%
Grana Padano	2.03%	Queijo de Évora	0.03%
Gorgonzola	0%	Queijo de Nisa	0.06%
Asiago Pressato	2.62%	Queijos da Beira Baixa	0.04%
Asiago d'Allevo	2.62%	Queijo Serra da Estrela	0.04%
Parmigiano Reggiano	8.22%	Provolone Valpadana	0.25%

Table 5.5 Continuation

PDO Name	Market Share
Taleggio	0.48%
Fontina	1.11%
Valtellina Casera	0.46%
Toma Piemontese	0.05%
Bra	0.07%
Raschera	0.14%
Caciocavallo Silano	0.02%
Castelmagno	0.03%
Ragusano	0.05%
Pecorino Romano	0.75%
Pecorino Siciliano	0%
Montasio	0%
Monte Veronese	0.17%

CHAPTER 6 - RESULTS

The previous chapter described the methodology used in this thesis. This chapter presents the results. All of the models presented were estimated in STATA version 9 and estimated again with SAS version 9.1 to double check the results.

Heteroskedasticity is very common in cross-sectional data models. Heteroskedasticity exists when the constant variances assumption is not a valid assumption. In order to test for heteroskedasticity, the Breusch-Pagan test was calculated (Maddala 2001). The null hypothesis was rejected ($|F_{B-P}(9, 73)|= 1.80 <|F_C(9, 73)|= 8.22$) suggesting that there is not a heteroskedasticity problem in this data. Consequently, ordinary least squares estimation is used.

6.1 Discussion of the Hypothesis Tests

The estimation results from equation 5.1, a linear model, are presented in Table 6.1. The regression R^2 is 0.4796 indicating a good degree of fit for this cross sectional data.

The variable associated with supply control, market share, has the expected negative sign which means that for every 1% increase in market share, the PDO cheese price decreases by $0.98 per pound, holding everything else constant. Given the theoretical importance of this variable it bears closer examination.

6.2 Market Share Variable

The average market share is 0.62%. A 1 percent increase in market share is 1.01*0.62% or 0.6262%. Assuming land is fixed, the average market share variable is calculated as 7,277 tons of cheese/1,171,491 hectares or 0.62%. This one percent change means that 0.6262% multiplied by 1,171,491 hectares is equal to the increase in cheese produced on the same number of hectares. This equals 7,336 tons or a 59 ton increase in cheese produced. On the margin, this represents an additional 129,800 pounds of cheese or 59 tons multiplied by 2,200 pounds in a metric ton.

Assumed a PDO exports approximately 15% of their production (Asiago, Caciocavallo, Grana Padano, Gorgonzola, Montasio, Parmigiano Reggiano, Provolone, and Ragusano exported this amount in 2005). Therefore, the exports would increase by 8.88 tons (59 tons multiplied by

15%) or 19,536 pounds per year plus the actual average exports (15%*7,277 or 1,092 ton) which constitutes 1,100 tons or 2,420,946 pound of total cheese sold on average in the US in a year. The economic impact of a one percent increase in market share represented by an increase in 19,536 pounds in exports leads to a decrease of $2,372,527 of total revenue of cheese per year (2,420,946 pounds exported * $0.98 per pound = $2,372,527). While $2.3 million is a big number, it is relatively small when spread over 300 million people living in the US.

Table 6.1 Estimations results from the linear hedonic model

Variable	Coefficient	Standard Errors
Constant	18.22***	2.80
Price of Substitute (PS)	0.32***	0.1181
Age (AG)	4.71**	2.10
Market Share (MS)	-0.98*	0.51
Italy	-8.59***	2.14
Portugal	-2.28	3.10
Spain	-9.67***	1.98
Sheep	2.09	2.25
Goat	3.33	2.51
Mix	3.36	2.74

$n = 83$ df $=747$ and $R^2 = 0.4796$
***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

The market share values are only approximate estimations of the market share value due to the fact the exact amount of land used to produce milk within the PDO region is unknown. Therefore, the total amount of land used were those described in the EU Regulation No. 2081/92 as a geographical location of each PDO geographical (specified in communes in France, provinces in Italy, municipios in Spain and concelhos in Portugal). However, depending upon the country, there are other agricultural activities and some land is not adaptable for traditional dairy production. Thus, the market share variable is not an exact measurement but is approximate enough for purposes of this thesis. For example, from the 100,500 hectares registered for the production of Livarot cheese in the communes of Calvados, Eure, and Orne only approximately 50,000 are under production annually. It must be remembered that producers in PDO have a relatively inelastic demand curve. Furthermore there is no incentive to increase supply because

the know-how or process may limit the introduction of more productive technology. Thus, it is not surprising to see small changes.

6.3 Hedonic Quality Attribute Variables

The estimated coefficient for age is statistically significant at the 95% significant level. Age affects positively the PDO cheese price as expected given that most of the cheeses acquire their sensorial characteristics (aftertaste, flavor, odor and texture) during the aging process which differentiates them and makes a particular cheese desired by the consumers. The estimated result showed that a 1 year increase in the age leads to $4.71 increase in the PDO cheese price per pound, holding everything else constant. The age variable coefficient represents a reasonable magnitude. For example, a 1 year Queso Manchego's per pound cheese price is about $2.24 dollars higher than a 3 month Queso Manchego's cheese price.

The estimated coefficients for Italy and Spain are statistically significant at 99% significance level. The small representation of Portugal cheeses in the data base (7 observations) might be causing its insignificance. The PDO price per pound of an Italian cheese is $8.59 less per pound compared to a French cheese, holding everything else constant. Spanish cheeses are $9.67 less expensive than French cheeses, holding everything else constant. These results are not surprising due to the fact that most of the best known cheeses in the world such as Roquefort, Brie, Banon and Camembert come from France. The economic significance of French cheeses in the international market is higher compared to the other countries. France exported 562,330 tons of cheese followed by Italy (221,240 tons), Spain (57,850 tons) and Portugal (2,620 tons) in 2005 (FAOSTAT-Agriculture 2008).

The type of milk variables (sheep, goat and mix) are not statistically significant and it might be that consumers are more aware of the final output characteristics (odor, taste, texture, color and smell) rather than in the input type used to produced the cheeses. Also the imported cheese market is dominated by cow milk cheeses. The US imported 174,780 tons of cheese made from cow milk. However, approximately 19% and 0.05% of that cheese is made with sheep milk and goat milk respectively mostly from the EU in 2005 (FAOSTAT-Agriculture 2008).

6.4 Price of Substitutes Variable

The sign on the estimated coefficient price of substitutes (artesian or farmstead cheeses) suggests that as expected artesian or farmstead cheeses are substitutes of PDO cheeses. Given the nature and differentiation of both types of goods, the results suggest that both cheeses are substitutes as predicted in the data chapter. The fact these cheeses are substitutes is reflected in the fact that both cheeses are sold for about the same price in the US. Considering an average PDO cheese price of $21.92 per pound and $21.11 as an average price of a substitute cheese per pound, the results are consistent with these values.

Artesian farmstead cheese production has increased significantly in the US since 2003 to almost 900 million pounds in 2006. On per capita basis, consumption of those cheeses have increased five times faster than the total cheese consumption. A survey of 160 cheese makers by the University of Nebraska Food Processing Center in 2007 reported that these were no price leaders in the market which implied that demand is relatively inelastic. In addition, the cheese makers were not worried about imported PDO cheeses.

6.5 Summary

This chapter provided the results of the regression analysis and explained the impact of supply control variables, hedonic variables and substitute price in the PDO cheese sold in the US.

CHAPTER 7 - CONCLUSIONS

The purpose of this research was to analyze the impact of supply control variables such as market share; PDO cheese hedonic quality attributes such as country of origin, type of milk, and age; and the price of a substitute artesian or farmstead cheese on the price of imported cheeses. The hypothesis was that there are supply control variables and hedonic quality variables that influence the observed price of PDO cheeses sold in the US.

The literature review found that the EU has been a leader in developing a process for verifying foods produced in a local geographic area using inputs unique to that geography or a processing process that used unique know how found in that local area. The regulations developed by the EU have been the subject of much debate in the world because the process of certification is different than the US and thus, the property rights created under the EU certification are different than those found in the US. The literature also revealed that the ability to control supply of a differentiated product transferred consumer surplus to producer surplus.

The economic theory suggests that PDO certification results in the ability of the group of producers and / or processor to control supply by effectively causing a vertical kink in the supply curve. In addition, the process of creating the product is sufficiently different enough such that a relatively inelastic demand curve exists. In the US, the certification system does not necessarily result in a kinked supply curve. Thus, the property rights are different between countries.

Data were collected on 83 PDO cheeses manufactured in the EU and sold in the US. This data included market share which was defined as the total tons of that PDO cheese produced in that geographic region divided by the total hectares of land. In addition, a binary variable was used to denote whether the cheese was made in France, Italy, or Spain. Other binary variables were used to denote the type of animal whose milk was used to produce the cheese. The length of aging for the cheese was used as another variable to explain the differences in the price of imported cheeses. Finally, the price of a competing artesian or farmstead cheese similar to the PDO cheese was identified. All of these variables were used in an ordinary least squares regression model to explain the variation in the price of the imported cheese.

The regression results were quite robust and found that market share, country of origin (Italy and Spain), and the price of a substitute artesian or farmstead were significant in

explaining the variability in imported PDO cheese prices. Market share, while small in actual terms, had a greater magnitude of change suggesting that, at the margin, a small change in supply can cause a larger change in supply which was not surprising given an inelastic demand curve and a fixed supply curve. Artesian or farmstead cheese and PDO cheeses are substitutes as predicted. Finally, as one might suspect, a cheese that is more mature, like wine, has a greater value.

7.1 Limitations of the Results

There are limitations of this research. First, the results are limited to only those cheeses identified in this thesis from France, Italy, and Spain. PDO cheeses from other countries may not have the same results. Second, there are omitted variables that may be useful in explaining further variation in the price of imported cheeses. These include the year the cheese process was first discovered. The older the cheese making process, the more likely for it to have reputational affects which might lead to a higher price. Other variables might include a measure for packaging or retail cheese size. A more precise market share variable could have been developed using the actual number of hectares used for the PDO as a fraction of total hectares. Finally, it would have been useful to have a market share variable by individual firm in the PDO. Because each PDO has many different firms of different sizes as measured by volume, such market share measure would have been useful.

7.2 Implications

There are several implications for producers of PDO cheeses and producers of artesian or farmstead cheeses. First, the ability to control supply legally enables producers to receive a higher price that they might not have received for these cheeses which have been designated as a PDO. Second, an increase in demand for specialty cheeses which comprise most PDO cheeses with a fixed supply creates an opportunity for US producers of artesian and farmstead cheeses. If these cheeses are to remain truly differentiated and given the inability of US cheese makers to effectively control supply, it is important that these cheese makers consider ways to retain their true uniqueness. Finally, a time as measured by maturity is important. The ability to store cheese for more than a few months has value.

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Appendix A - CHEESE SURVEYS

A sample of the cheese survey in English, French, German, Italian, Polish, Portuguese, and Spanish are attached in the appendix 1.

Appendix A.1 Cheese Survey-English Version
PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) Cheeses Survey
Kansas State University
Department of Agricultural Economics

1) How many producers are members of the PDO/PGI?

   _____

2) What type of milk is your cheese made off?

   ☐   Cow milk

   ☐   Goat milk

   ☐   Buffalo milk

   ☐   Sheep milk

3) How many hectares of land are including in the PDO/PGI?

   _____

4) How many of these hectares are actually in production?

   _____

5) Which months are the PDO/PGI cheeses produced?

   _____

6) How many animals in the PDO/PGI produced milk in the last year?

   Cattle _____

   Goat _____

   Buffalo _____

   Sheep _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI? Preference to list the most recent year production.

Cattle _____

Goat _____

Buffalo _____

Sheep _____

8) How many litters of milk are used to produce 1 kg of cheese?

_____

9) What type of market do you focus on your product? Sect only one from the list bellow.

☐   Local Market

☐   Regional Market

☐   National Market

☐   International Market

10) What are some of the brands that your products are commercialize with? Please list the brands.

_____

Appendix A.2 Cheese Survey-French Version

AOP (Appellation d'origine Protégée) IGP (Indication Géographique Protégée)
Questionnaire pour le Fromage
Kansas State University

Département d'économie Agricole

1) How many producers are members of the PDO/PGI?
   Combien de producteurs font parti de l'AOP/IGP?

_____

2) What type of milk is your cheese made off?
   Votre fromage est fait à partir de quel type de lait?

☐ Cow milk (*Lait de vache*)
☐ Goat milk (*Lait de chèvre*)
☐ Buffalo milk (*Lait de bufflonne*)
☐ Sheep milk (*Lait de brebis*)

3) How many hectares of land are including in the PDO/PGI?
   Quelle est la surface couverte par l'AOP/IGP?

_____

4) How many of these hectares are actually in production?
   Quelle est la surface actuelle de production?

_____

5) Which months are the PDO/PGI cheeses produced?

Durant quels mois de l'année les fromages AOP/IGP sont ils produits?

_____

6) How many animals in the PDO/PGI produced milk in the last year?
Combien d'animaux dans L'AOP/IGP ont produit du lait l an dernier?
     Cattle (*Vache*) _____
     Goat (*Chèvre*) _____
     Buffalo (*Bufflonne*) _____
     Sheep (*Brebis*) _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI? Preference to list the most recent year production.
     En moyenne, quel est le volume de lait produit par jour et par animaux sur l'AOC/IGP? Sur la dernière année.
     Cattle (*Vache*) _____
     Goat (*Chèvre*) _____
     Buffalo (*Bufflonne*) _____
     Sheep (*Brebis*) _____

8) How many litters of milk are used to produce 1 kg of cheese?
     Que est le volume de lait utilisé pour produire 1 kg de fromage?

_____

9) What type of market do you focus on your product? Sect only one from the list bellow.
     Pour quel type de marché est destiné votre produit? Cochez une case dans la liste suivante.

    ☐   Local Market (*Le marché local – sur l'AOP/IGP*)
    ☐   Regional Market (*Le marché régional – interne au pays le pays*)
    ☐   National Market (*Le marché Européen*)
    ☐   International Market (*Le marché international – plus particulièrement les Etats-Unis*)

10) What are some of the brands that your products are commercialize with? Please list the brands.
     Avec quelles marques votre produit est-il commercialisé ? Pouvez-vous les énumérer.

_____

Appendix A.3 Cheese Survey-Italian Version

Indagine su Formaggi Tutelatu dai Marchi DOP (Denominazione di Origine Protetta) e IGP (Indicazione Geografica Protetta)

Kansas State University

Dipartimento di Economia Agraria

1) How many producers are members of the PDO/PGI?
     Quanti produttori hanno prodotti tutelati da i marchi DOP/IGP?

_____

2) What type of milk is your cheese made off?
> ***Con che tipo di latte sono prodotti i vostri formaggi?***

☐   Cow milk (***Latte di Mucca***)
☐   Goat milk (***Latte di Capra***)
☐   Buffalo milk(***Latte di Bufala***)
☐   Sheep milk (***Latte di Pecora***)

3) How many hectares of land are including in the PDO/PGI?
> ***Quanti ettari de terra sono protetti dalle certificazioni DOP/IGP?***

_____

4) How many of these hectares are actually in production?
> ***Quanti di questi ettari di terra sono attualmente sotto produzione?***

_____

5) Which months are the PDO/PGI cheeses produced?
> ***In che mesi dell'anno vengono prodotti i formaggi tutelati dalle certificazioni DOP/IGP?***

_____

6) How many animals in the PDO/PGI produced milk in the last year?
> ***Quanti capi di animale sono prodotti annualmente?***
Cattle (***Mucca***) _____
Goat (***Capra***) _____
Buffalo (***Bufala***) _____
Sheep (***Pecora***) _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI? Preference to list the most recent year production.
> ***In media, quanti litri di latte, al giorno, produce un animale?***
Cattle (***Mucca***) _____
Goat (***Capra***) _____
Buffalo (***Bufala***) _____
Sheep (***Pecora***) _____

8) How many litters of milk are used to produce 1 kg of cheese?
> ***Quanti litri di latte sono usati per produrre 1 Kg di formaggio?***

_____

9) What type of market do you focus on your product? Sect only one from the list bellow.
> ***Su quale tipo di mercato viene concentrata la vendita del prodotto? Scegliere solo una risposta:***

☐   Local Market (***Mercato regionale***)
☐   Regional Market (***Mercato nazionale***)
☐   National Market (***Mercato europeo***)
☐   International Market (***Mercato internazionale - in modo specifico USA***)

10) What are some of the brands that your products are commercialize with? Please list the brands.
> ***Quali sono alcuni dei marchi con cui il prodotto viene commercializzato? Elencare:***

_____

Appendix A.4 Cheese Survey-German Version

**Geschützte Ursprungsbezeichnung (g.U.) und geschützten geografischen
Angabe (g.g.A.) Käse Umfrage
Kansas State University**

Department of Agricultural Economics

1) How many producers are members of the PDO/PGI?
    Wie viele Hersteller sind Mitglied in (g.U.)/(g.g.A.)?

    _____

2) What type of milk is your cheese made off?
    Aus welcher Milch wird ihr Käse hergestellt?

    ☐   Cow milk (*Kuhmilch*)
    ☐   Goat milk (*Ziegenmilch*)
    ☐   Buffalo milk (*Büffelmilch*)
    ☐   Sheep milk (*Schaafsmilch*)

3) How many hectares of land are including in the PDO/PGI?
    Wie viele Hektar Land befinden sich unter (g.U.)/(g.g.A.) Beglaubigung?

    _____

4) How many of these hectares are actually in production?
    Wie viele dieser Hektar sind in Produktion?

    _____

5) Which months are the PDO/PGI cheeses produced?
    In welchen Monaten wird der PDO/PGI Käse hergestellt?

    _____

6) How many animals in the PDO/PGI produced milk in the last year?
    *Wie viele Tiere produzieren jährlich Käse? Listen sie bitte das letzte Jahr der
    Produktion auf:*

    Cattle (*Rinder*) _____
    Goat (*Ziegen*) _____
    Buffalo (*Büffel*) _____
    Sheep (*Schafe*) _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI?
    Preference to list the most recent year production.
    *Wie viele Liter Milch werden jährlich pro Tier im Durchschnitt hergestellt im Rahmen
    des PDO/PGI? Listen sie bitte das letzte Jahr der Produktion auf:*

Cattle (***Rinder***) _____

Goat (***Ziegen***) _____

Buffalo (***Büffel***) _____

Sheep (***Schafe***) _____

8) How many litters of milk are used to produce 1 kg of cheese?
Wie viele Liter benötigen sie für die Produktion eines Kilos Käse?

_____

9) What type of market do you focus on your product? Sect only one from the list bellow.
Auf welchen Markt zielen sie ab?

☐   Local Market - *Lokaler Markt (im Gebiet der (g.U.)/(g.g.A.))*

☐   Regional Market - *Regionaler Markt (in ihrem Land)*

☐   National Market - *Nationaler Markt (innerhalb der EU)*

☐   International Market - *Internationaler Markt (besonders die Vereinigten Staaten)*

10) What are some of the brands that your products are commercialize with? Please list the brands.
        Nennen sie einige Marken unter denen ihrer Produkte vertrieben werden? Bitte nennen sie die Marken:

_____

Appendix A.5 Cheese Survey-Polish Version

Sondaż na temat serów objętych ochroną PDO (Chroniona Nazwa Pochodzenia) i PGI (Chronione Oznaczenie Geograficzne)

Uniwersytet Stanowy w Kansas

Wydział Rolnictwa

1) How many producers are members of the PDO/PGI?
        Ilu producentów sera jest członkami PDO/PGI?

_____

2) What type of milk is your cheese made off?
        Z jakiego typu mleka jest wytwarzany Państwa ser?

☐   Cow milk (**Mleko krowie**)

☐   Goat milk (**Mleko kozie**)

☐   Sheep milk (**Mleko owcze**)

3) How many hectares of land are including in the PDO/PGI?
        Ile hektarów ziemi jest ujęte w PDO/PGI?

_____

4) How many of these hectares are actually in production?
   Na chwile obecna ile z tych hektarów jest wykorzystywane w produkcji?

   _____

5) Which months are the PDO/PGI cheeses produced?
   W których miesiącach wytwarzane są sery objęte ochroną PDO/PGI?

   _____

6) How many animals in the PDO/PGI produced milk in the last year?
   Ile sztuk bydła w Państwa gospodarstwie wykorzystywanych było do produkcji mleka w zeszłym roku?
   Cattle (*Krowy*) _____
   Goat (*Kozy*) _____
   Sheep (*Owcze*) _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI? Preference to list the most recent year production.
   Ile średnio litrów mleka uzyskują Państwo z jednego zwierzęcia dziennie (proszę uwzględnić jedynie to mleko której jest później wykorzystywane do produkcji sera objętego ochrona PDO/PGI)?
   Cattle (*Krowy*) _____
   Goat (*Kozy*) _____
   Sheep (*Owcze*) _____

8) How many litters of milk are used to produce 1 kg of cheese?
   Ile litrów mleka jest potrzebne do wytworzenia 1kg sera?

   _____

9) What type of market do you focus on your product? Sect only one from the list bellow.
   Na który z poniższych rynków kierują Państwo większość swojej produkcji? Proszę wybrać tylko jeden.

   ☐   Local Market - *Rynek lokalny (w rejonie objętym ochrona PDO/PGI)*
   ☐   Regional Market - *Rynek reginalny (w obrębie Polski)*
   ☐   National Market - *Rynek europejski (w obrębie Unii Europejskiej)*
   ☐   International Market - *Rynek międzynarodowy (w szczególności USA)*

10) What are some of the brands that your products are commercialize with? Please list the brands.
    Proszę wymienić pod jaką marką (lub kilkoma) sprzedają Państwo swój produkt.

    _____

Appendix A.6 Cheese Survey-Portuguese Version

PDO (Designacao de Origem Protegida) e IGP (Indicacao Geografica Protegida)

Inquérito sobre Queijo

Kansas State University

55

Departmento de Economia Agricola

1) How many producers are members of the PDO/PGI?
   Quantos produtores sao membros do DOP/IGP?
   _____

2) What type of milk is your cheese made off?
   De que tipo de leite e produzido o seu queijo do DOP/IGP?
   ☐ Cow milk (*Leite de vaca*)
   ☐ Goat milk (*Leite de cabra*)
   ☐ Buffalo milk (*Leite de buffala*)
   ☐ Sheep milk (*Leite de ovelha*)

3) How many hectares of land are including in the PDO/PGI?
   Quantas hectares de terra estao certificadas pelo DOP/IGP?
   _____

4) How many of these hectares are actually in production?
   Quantas hectares certificadas pela DOP/IGP estao atualmente em producao?
   _____

5) Which months are the PDO/PGI cheeses produced?
   Durante quais meses do ano e produzido o queijo do DOP/IGP?
   _____

6) How many animals in the PDO/PGI produced milk in the last year?
   Quantas cabecas de gado sao produzidas anualmente? E preferido listar a producao do ano mais recente.
   Cattle (*Vaca*) _____
   Goat (*Cabra*) _____
   Buffalo (*Buffala*) _____
   Sheep (*Ovelha*) _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI? Preference to list the most recent year production.
   Em promedio, quantos litros de leite por animal por dia sao produzidos pelo DOP/IGP?
   Cattle (*Vaca*) _____
   Goat (*Cabra*) _____
   Buffalo (*Buffala*) _____
   Sheep (*Ovelha*) _____

8) How many litters of milk are used to produce 1 kg of cheese?
   Quantos litros de leite sao usados para produzir 1 kg. de queijo?
   _____

9) What type of market do you focus on your product? Sect only one from the list bellow.
   Em que tipo de mercados listados a continuacao enfocam mais seus produtos? Selecione somente uma opcao.
   ☐ Local Market - *Mercados Locais (Dentro de área geográfica da DOP/IGP)*
   ☐ Regional Market - *Mercados Regionais (Nível país)*
   ☐ National Market - *Mercados Nacionais (Dentro de la União Europeia)*

☐ International Market - *Mercados Internacionais (Especificamente os Estados Unidos)*

10) What are some of the brands that your products are commercialize with? Please list the brands.
        Quais sao algumas das marcas da sua DOP/IGP? Por favor liste suas marcas a continuacao.

_____

Appendix A.7 Cheese Survey-Spanish Version

Encuesta sobre Quesos de POD (Denominación de Origen Protegida) y IGP

(Indicación Geográfica Protegida)

Kansas State University

Departamento de Economía Agrícola

1) How many producers are members of the PDO/PGI?
        ¿Cuántos productores son miembros de la DOP/IGP?
        _____

2) What type of milk is your cheese made off?
        ¿De qué tipo de leche producen el queso de DOP/IGP?
        ☐ Cow milk (*Leche de vaca*)
        ☐ Goat milk (*Leche de cabra*)
        ☐ Buffalo milk (*Leche de búfala*)
        ☐ Sheep milk (*Leche de oveja*)

3) How many hectares of land are including in the PDO/PGI?
        ¿Cuántas hectáreas de tierra están certificadas bajo la DOP/IGP?
        _____

4) How many of these hectares are actually in production?
        ¿Cuántas de las hectáreas certificadas DOP/IGP están actualmente en producción?

        _____

5) Which months are the PDO/PGI cheeses produced?
        ¿Durante cuáles meses del año se produce el queso de DOP/IGP?

        _____

6) How many animals in the PDO/PGI produced milk in the last year?
        ¿Cuántas cabezas de ganado son producidas anualmente? Deseable listar producción del año más reciente.
        Cattle (*Vacas*) _____
        Goat (*Cabras*) _____

Buffalo (***Búfalos***) _____

Sheep (***Ovejas***) _____

7) On average, how many litters of milk per animal per day are produced in the PDO/PGI? Preference to list the most recent year production.

En promedio, ¿Cuántos litros de leche por animal por día son producidos en la DOP/IGP?

Cattle (***Vacas***) _____

Goat (***Cabras***) _____

Buffalo (***Búfalos***) _____

Sheep (***Ovejas***) _____

8) How many litters of milk are used to produce 1 kg of cheese?

¿Cuántos litros de leche se usan para producir 1 Kg. de queso

_____

9) What type of market do you focus on your product? Sect only one from the list bellow.

¿En cual de los mercados listados a continuación son enfocados más sus productos? Seleccione solamente una opción de las lista a continuación.

☐ Local Market (***Mercado local dentro del área geográfica de la DOP***)

☐ Regional Market (***Mercado a Nivel de País***)

☐ National Market (***Mercado dentro de la Unión Europea***)

☐ International Market (***Mercado Internacional especialmente los Estados Unidos de América***)

10) What are some of the brands that your products are commercialize with? Please list the brands.

¿Cuáles son algunas de las marcas con las que se comercializan sus productos? Por favor liste sus marcas a continuación.

_____

Appendix B - PDO Cheeses Description

Product Name Designation—Country	Description/Geographical Area/Link[a]
Feta PDO—Greece	Description: White table cheese stored in brine and produced from sheep's milk or from a mixture of sheep milk and goat milk, with the latter not exceeding 30 percent of the milk net weight. Geographical area: Macedonia, Thrace, Thessaly, Central Mainland Greece, the Peloponnese, and Lesbos prefecture. Link: The milk used for the cheese comes from fully adapted sheep and goat breeds reared traditionally in the defined geographical areas. Their diet is based on the flora of the areas.
Fontina PDO—Italy	Description: Semi-cooked cheese made from whole cow's milk, medium-mature, and cylindrical in shape. Geographical area: The entire territory of the autonomous region of Valle d'Aosta. Link: The typical mountainous environment of the region gives particular qualities to the raw material, which are reflected directly in the characteristics of the cheese. There is traditional rearing of the indigenous *pezzata rossa valdostana* cow breed and continuity of the technique used to make the cheese. The product is mainly distributed and consumed in Northern Italy.
Gorgonzola PDO—Italy	Description: Soft, uncooked table cheese with green/blue veining, made from whole cow's milk. Geographical area: The entire territory of the provinces of Bergamo, Brescia, Como, Cremona, Cuneo, Milan, Novara, Pavia, Vercelli, and the adjacent commune of Casale Monferrato in the province of Alessandria, forming a continous area. Link: Climatic conditions of the production area are favorable for abundant and high-quality fodder used to feed the dairy cows and for the development of the microbiological agents that give the organoleptic and color characteristics to the cheese. The cheese has achieved wide distribution and is used with tradtional cereal-based preparations typical of its area of origin.
Grana Padano PDO—Italy	Description: Half-fat cooked cow's milk cheese, cylindrical in shape, used as a table cheese or for grating. ["Grana" refers to the peculiar morphological characteristics of the curds, which are granular in texture.] Geographical area: The entire territory of the provinces of Alessandria, Asti, Cuneo, Novara, Turin, Vercelli, Bergamo, Brescia, Como, Cremona, Milan, Pavia, Sondrio, Varese, Trento, Padua, Rovigo, Treviso, Venice, Verona, Vicenza, Ferrara, Forli, Piacenza, Ravenna, and neighboring communes in the province of Mantua and Bologna, forming a continuous area. Link: The climatic conditions of the production area lead to abundant production and high-quality fodder for dairy cows. The intrinsic characteristics of the cheese have remained largely unchanged over time, because of the use of established techniques and the historical presence of highly specialized labor.

Product Name Designation—Country	Description/Geographical Area/Link[a]

Parmigiano Reggiano
PDO—Italy

Description: Half-fat, cooked cheese, slow maturing, and cylindrical in shape. Made from the milk of cows fed mainly on fodder from polyphite or lucerne meadows.

Geographical area: The entire territory of the provinces of Parma, Reggio Emilia, Modena, and neighboring communes in the provinces of Mantua and Bologna, forming a continuous area.

Link: The soil characteristics of the area, which runs from the ridge of the Appenines to the river Po, and the climatic conditions that affect both the natural flora and the particular fermentation characteristics of the product.

Pecorino Romano
PDO—Italy

Description: Hard, cooked cheese made from whole sheep's milk, either medium-mature or mature, depending on whether it is for table use or for grating.

Geographical area: The entire territory of the autonomous region of Sardinia and of the provinces of Rome, Frosinone, Latina, Viterbo, Rieti, and Grosseto, forming a single continental area.

Link: The particular characteristics of the areas used for rearing sheep, particularly with free grazing on natural pastureland, which is rich in natural essences that impart particular qualities to the milk. Apart from the historic economic importance, the sheep-rearing concerns involved are characterized by the sociological aspects connected with the presence of a rural population in so-called marginal areas, which otherwise would be completely abandoned.

Queso Manchego
PDO—Spain

Description: Full-fat, pressed cheese; matured, from half-cured to cured; cylindrical with noticeably flat faces; pale yellow, hard rind; weight from 2 kg to 3.5 kg.

Geographical area: Several municipalities in the provinces of Albacete, Ciudad Real, Cuenca, and Toledo, in the natural district of La Mancha.

Link: The area is marked by its extreme climate, with sparse rainfall, variable winds, and clear skies, which makes it an arid region. The terrain consists of flat, relatively treeless land, with abundant saline plants and a substrate rich in limestone and marls, which is highly suitable for sheep grazing. These factors provide high-quality raw material, the main basis for the production of a renowned traditional cheese.

Queijo Sao Jorge
PDO—Portugal

Description: Cured cheese, of firm consistency, yellowy, hard or semi-hard, with small and irregular holes spread over the whole mass, made from cow's milk.

Geographical area: Island of Sao Jorge.

Link: The handling and feeding of the cattle, based on natural pastures and the very special edaphological-climatic conditions, give unique and distinctive characteristics to this cheese.

Product Name
Designation—Country   Description/Geographical Area/Link[a]

Reblochon or **Reblochon de Savoie**; **Petit Reblochon** or **Petit Reblochon de Savoie** PDO—France	Description: Cheese made of whole, raw cow's milk with a pressed, uncooked paste. Presented as a flat cylinder weighing about 500 grams.

Geographical area: Approximately 200 communes spread across the dèpartments of Savoie and Haute-Savoie, France.

Link: The link to the origin lies in the conditions governing the milk production: using local breeds and feeding the cattle without using ensilaged crops, which reinforces the effect of the flora in the mountain pastures. The link also lies in the tradition and reputation of Reblochon, which has served as a catalyst in the development of agricultural activity in the mountainous areas where the cheese is produced. |
| **Roquefort** PDO—France | Description: Cheese with a veined paste made from raw whole ewe's milk, cylindrical in form.

Geographical area: Originally a vast area to the south of the Massif Central, possessing the same characteristics in terms of ovine breeds, vegetation and climate and characterized by an arid, wild landscape where sheep graze. Roquefort producers have encourage sheep breeding and milk production, so the milk used in the manufacture of Roquefort today mostly comes from the so-called "regional zone," which comprises most of Aveyron and part of the adjacent departments of Lozère, Gard, Hérault, and Tarn.

Link: The special quality of Roquefort is a product of intimate collaboration between man and nature. It derives on the one hand from the characteristics of the traditional breeds of ewe that are fed in accordance with local custom and on the other hand from the unique atmosphere of the natural cellars in caves entirely hewn out of the rocks at the foot of the limestone cliffs of the Combalou, where a miracle of nature takes place to give Roquefort its incomparable flavor. |