THE EUROPEAN UNION BANANA MARKET: DEMAND ESTIMATION AND EVALUATION OF THE NEW IMPORT REGIME

by

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AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2006

Abstract

The EU is one of the world's biggest importers of bananas and, as such, import policies enforced by this trade union are likely to have a great impact on major producers of bananas. Aiming to protect communitarian producers and exporters from selected ex-colonies of Africa, the Caribbean and Pacific and to honor previous agreements, the EU unified its import policy for bananas in 1993. This policy, known as the Common Market Organization for Bananas, generated one of the most controversial trade disputes in history. After several modifications of the original regime, in January 2006, the EU changed its import regime to satisfy a World Trade Organization mandate and to honor an agreement signed with the United States in 2000.

This dissertation reviews the history of the trade disputes in the EU banana market and analyzes the effects that the new import regime will have on major suppliers. To do this, a theoretically-consistent demand system is estimated and then the calculated parameters are used to model the effects of the tariff-only import system in the EU banana market. Based on the results, producers surplus are estimated and Monte Carlo simulations are performed to do a sensitivity analysis of the results.

In the demand estimation component, the EU market is modeled as a system containing four major suppliers using the Almost Ideal Demand System (AIDS). This estimation fills an important gap in literature regarding the lack of well-estimated demand elasticities of bananas in the EU.

The EU banana market is then modeled based on a equilibrium displacement model framework. Results of this analysis are then used to calculate point estimates of producer surplus changes as a measure of the impact of the new import policy on banana suppliers. Monte Carlo simulations are based on parameter estimates obtained from the AIDS model. These simulations allowed not only sensitivity analysis but also probabilistic inferences about the statistical significance of the estimates obtained in the previous components.

Results indicate that the hypothesis that the new import regime will not affect the major suppliers of the EU banana market cannot be rejected. This might indicate that the policy enforced by the Common Market Organization for Bananas and the current tariff-only import

regime are statistically equivalent. In other words, the EU expertly enacted a tariff level that will leave much as status quo.

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Acknowledgments

I would have never pursued this dream if it had not been for the help and support I received from many people during these years at Kansas State. I will always be thankful to Joaquín Arias for his inspirational lessons and his support to continue my studies. I also want to thank Dr. Bernardo for opening me the doors to Kansas State and his support at the beginning of my graduate studies. Thanks to Drs. Fox, Peterson and Hanawa-Peterson for their personal and financial support at the end of my studies. Special thanks to Maria, Christian and Eric for their friendship and help. My hearth is full of happy memories and gratitude for the moments we shared.

I want to especially thank Dr. Crespi. This journey would probably not have come to a happy end without his support and trust. His academic and professional advice and his support as a friend gave me strength during many weak moments. He trusted me when not even I was sure if I could keep going. Dr. Crespi has been and will always be a role model for me to follow as a professional and as person. Thanks forever.

There are not words to express my gratitude to my family, for their support, love and for making me the person I am today. Mom, thanks for teaching me the value of hard work and the art of never giving up. Dad, you always said I could be whatever I wanted to be and here I am. We did it! Luis, Sergio and Rober thanks for been the best brothers ever. Luis thanks for always reminding me where the real world is. Sergio, thanks for your company and serenity during hard times. Rober, thanks a lot for always been there. I never felt alone when you were around.

Finally, I am profoundly thankful to Mario, my teammate in life. Without him, I would not have even started this journey. Mario: thanks for your unconditional love and for giving me the strength to continue. I am always amazed by your ability of showing love and making sacrifices for us. Thanks for walking this road with me. And to you Marco thanks for coming to our lives and filling it with laughter and love. You are the most precious treasure I got from this journey.

Dedication

To my dear husband and son: Mario and Marco. To my parents: Lía and Luis Paulino and to my grandmothers Hilda and Anita. I would not be here without the love, understanding support and encouragement you all have given me throughout my entire life.

Love forever …

CHAPTER 1 - Introduction

The European Union (EU) banana market has been of enormous interest to researchers for more than a decade. Even prior to the policy unification brought by the Common Market Organization for bananas (CMOB) in 1993 many authors had studied the implications of the multi policy scheme. Between 1993 and 2000, researchers closely followed the many developments in this market, making it one of the world's most analyzed agricultural markets. The keen interest was due to the constant conflicts among different groups with competing interests. Evidence of this struggle is the several consultation processes and challenges brought to the World Trade Organization (WTO) that resulted in three major modifications of the CMOB between 1993 and 1999.

What made it so difficult for the EU to define an import system that pleased every party was the fact that national interests from at least three different regions were in play. On one hand, the EU wanted to maintain the preferred access its former colonies had historically received. The EU also wanted to protect its own producers, mainly from Spain, Greece, Portugal and France. On the other hand, WTO pressured the EU had to ensure certain market access and fairer treatment to Latin American producers. Fair access to the EU market for Latin American bananas was also in the interest of the United States, on behalf of its multinational fruit companies.

In 2001, the EU import system for bananas received attention when the United States (US) and the EU agreed to put an end to the so-called banana war. As part of the agreement, the EU made a commitment to eliminating its quota-tariff import regime by 2006 and replacing it with a tariff-only import system.

The controversy inspired authors to analyze the EU banana market extensively. However, besides the many times the EU banana market has been studied, there are still large gaps to fill in the literature. For example, measures of the economic impact of the CMOB differ substantially. Divergences in the results are found not only in the magnitude of the effects but also in the way the involved parties have been affected by the alternative import policies. One of the main reasons for those discrepancies is that for each evaluation, a different set of demand modeling techniques has been used. A common denominator to the estimations is that the general demand

restrictions necessary to make them consistent with economic theory have not been incorporated. Table 1.1 summarizes a few of the demand elasticity set-ups and the welfare effects that some authors have estimated for the EU banana market.

Welfare estimations are highly sensitive to the demand parameters used to parameterize the market. Now that a new banana import agreement has emerged in the EU, an adequate estimation of its import demand becomes relevant from a policy analysis perspective.

The objective of this project is to estimate a theoretically consistent demand system to generate reliable parameters to facilitate welfare analysis of the new EU import regime for bananas. Simulations, based on Monte Carlo analysis, to calculate welfare effects of the new import regime on major banana suppliers of this market are also performed.

The study is organized as follows. Chapter two gives a detailed background of the EU import banana market. Chapter three presents the methodology used to estimate the import demand system of bananas in the EU, discusses the data used and presents results. Chapter four details the equilibrium displacement model (EDM) used to estimate the welfare effects of the new EU import system. Chapter five presents the methodology used to estimate precision measures of welfare effects and discusses the results obtained. Chapter six concludes.

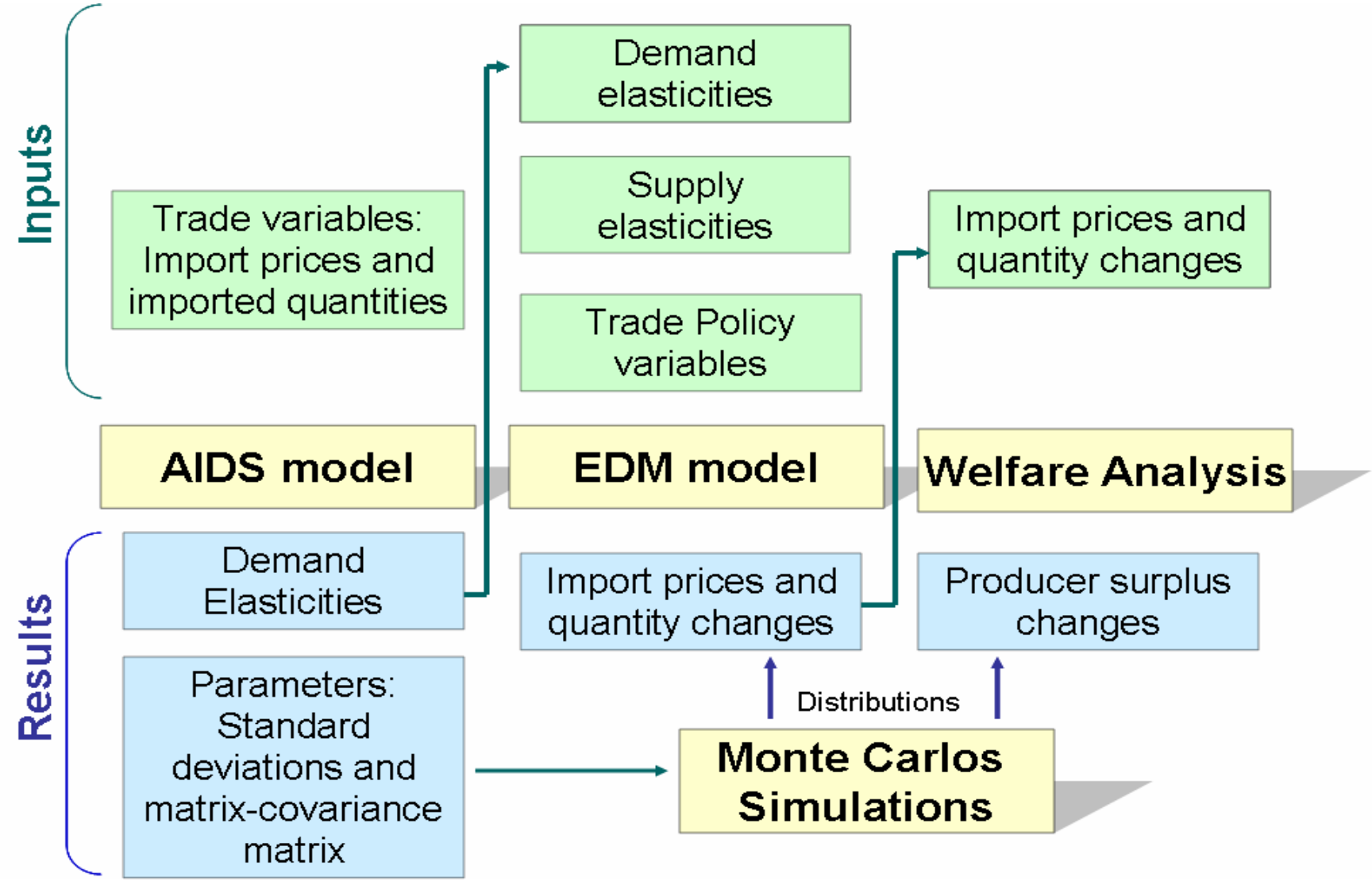
Figure 1.1 outlines the way four of the major components of this dissertation are related. Elasticity results from the Almost Ideal Demand System model (AIDS) are used to parameterize the equilibrium displacement model (EDM). Other parameter such as supply elasticities and trade policy variables are taken from existent literature and calculated based on assumptions about the two import regimes. Changes in prices and quantities obtained from solving the EDM model are used as inputs of the welfare analysis. Afterwards, Monte Carlo simulations are performed based on AIDS parameters and their standard deviations and variance-covariance matrix to generate new parameter distributions. Each of those set of parameters are used to solve for the AIDS and EDM models, which ultimately allows me to generate distributions of price, quantity and producer surplus changes.

Table 1-1 Summary of demand elasticities used in evaluations of the EU banana market

Source	Method for calculating Elasticities[(a)]	Comparison period	Welfare cost for EU consumers[(b)]
Borell and Yang (1990)	Elasticities assumed	Before 1993	693
Matthews (1992)	Elasticities assumed based on prior studies	Before 1993	579
Borell and Cuthbertson quoted in Matthews 1992	Elasticities assumed	Before 1993	1438
Borell and Yang (1992)	Elasticities assumed	Before 1993	1610
McInerney and Person (1992)		Before 1993	1600
Read (1994)	Unpublished	Before 1993	642
Borell (1994)	Elasticities assumed	After 1993	2300
Euro PA (1995)	Same as Borell	After 1993	800-1000

Source: H. Kox.
(a) Values not reported.
(b) Million US$

Figure 1-1 Structure of the analysis and relationship between each estimated component



CHAPTER 2 - A Historical Overview of the European Union Banana Import Policy

The economic importance of the EU banana market is evident in the history of trade disputes that have enveloped it for years. There is such a diversity of concerns at play that satisfying everybody's interests has been a nearly impossible task not only for the EU, but for the US, Latin America, Africa and the WTO. Even among the same interest groups there is often disagreement on the way import restrictions on this market should be administered. Consider, for example, Latin American producers who stand to gain the most from an open market. While Costa Rica advocates for a gradual elimination of the current import tariff to avoid an immediate overflow of the European market that would excessively decrease export prices, its neighbors believe that immediate deregulation of Europe is the sensible course of action (La Nación, 2006).

The purpose of this chapter is to summarize the main events that have characterized the conflict among the European Union, Latin American countries, African, Caribbean and Pacific nations and the United States regarding banana imports into the EU. It is organized as follows. Section 1 describes the EU policy structure prior to the establishment of the Common Market Organization for Bananas (CMOB) in 1993. Section 2 describes the CMOB as it was originally conceived. Section 3 discuses the various trade disputes held between 1993 and 2002 related to the import regime brought by the CMOB. Section 4 the EU's perspective of the so-called banana war. Finally, section 5 details the agreement reached between the EU and the US in 2002 and the eventual transition to the new import regime that came into effect in January of 2006.

EU import policy prior to 1993

The EU is primarily a customs union, which implies that each member nation must abide by a common set of import and export policies. Prior to 1993 however, bananas were exempt from the union. The 1993 policy to bring bananas under a unified tariff structure essentially lead to an amalgamation of the variety of prior banana import policies prevalent in member countries. Thus, in order to understand how the current regime exists, it is necessary to understand from whence it came.

Prior to 1993, there were three general agreements that ruled the European banana market: (i) a common external tariff of 20% applied to non-preferred suppliers; (ii) the Lomé Convention[1], that gave preferential treatment to the banana imports from former European colonies; and, (iii) the Treaty of Rome[2] that allowed France, Italy and the United Kingdom to protect their preferred suppliers. Additionally, a special protocol of the Treaty of Rome permitted Germany to import duty free bananas from any country (IICA, 1995). In addition to these stipulations, each country was allowed to define its own banana import policy. This explains the wide variety of import regimes among the EU prior the definition of the Common Market Organization.

From that variety of policies, it is possible to define three categories of countries within the policies. The first group includes the mostly closed markets that protected their traditional suppliers from the ACP region over non-preferred producers, mainly from Latin America (see Table 2.1). This group comprises Italy, Spain, Portugal, France and the United Kingdom. These countries conferred preferential treatment to other favored nations and granted a minimum price for their bananas. Additionally, they imposed a quota in order to limit imports from third countries (Borrel, 1992). The second group comprises those countries that only applied the 20% common tariff to non-preferred suppliers with the objective of protecting the ACP countries. The third category includes Germany, Austria, Sweden and Finland[3]. These nations advocated for free trade and gave boundless access to its market to all suppliers. For a summary of the prevalent national policies before 1993, see Table 2.2.

France constituted one of the most protective markets. It reserved around 2/3 of the market for its overseas departments (Martinique and Guadeloupe) and one third for French speaking African countries, mainly Cameroon, Côte d'Ivory, and Madagascar (IICA, 1995). It is

[1] The Lomé Convention is an agreement between the EU and 71 countries from Africa, The Caribbean, and Pacific first signed on February of 1975. It gives to these countries trade preferences for a group of commodities they are highly dependent on. Protocol number 5 of the Convention deals with the banana trade. It states that no ACP country will be made worse off in terms of its access to traditional markets and its preferred states. Specifically, this protocol allows ACP countries to export duty free bananas to the EU.

[2] The Banana Protocol of the Treaty of Rome (March 1957) allows the European Union Commission to concede permits to its members states to restrict banana imports from other nations. The protocol states two requirements for such a restriction: (i) the good must be produced in the other nation and; (ii) the restriction must safeguard any quotas the interested nation has.

[3] Austria, Finland and Sweden were not part of the EU at this time.

estimated that in the period 1985-1987, about 94% of the French market was reserved to its overseas territories and former colonies (Borrel, 1992). Imports from third countries were licensed and allowed only when import prices reached a minimum level. Latin American imports were limited to an annual 270,000 tons and were taxed with the 20% common tariff.

The United Kingdom granted free access to Commonwealth producers such as Jamaica, Dominica, Grenada, Saint Lucia, Saint Vincent, Suriname and Belize. Imports from other countries were subject to a license system and were only allowed when there existed a shortage in the favored supply. Additionally, the 20% common import tariff was applied to these imports. After 1989, a licensed minimum level of 30,000 tons was established for Latin American producers. Borrel estimated that three quarters of the market was granted to preferred suppliers (1992).

Italy allowed free access to imports from EC territories and ACP countries, Somalia being its traditional supplier. A 270,000-ton quota was established to limit imports from other nations in 1983. This regulation remained in place until the approval of the 1993 import regime.

Portugal and Spain restricted their banana imports to protect their own producers; Madeira, in the case of Portugal, and the Canary Islands, in the case of Spain. Both markets were closed to Latin American bananas other than in exceptional circumstances. Greece also limited access to its market in order to protect its domestic production setting a prohibitive import tax on bananas from other regions (Borrel, 1992).

Denmark, Ireland, Netherlands, Belgium and Luxemburg granted free market privileges to the traditional ACP suppliers. Although these countries did not have overseas banana producing territories, the benefits they conceded to the ACP nations were those regulated under the Lomé Convention.

The consequence of the EU policy structure, compared to a situation with free access for all producers, was reductions in overall banana imports, lower world prices but increased prices for EU consumers and preferred region producers. As a result, preferred region production increased, which further exacerbated the problems related to lower world prices in other regions, particularly Latin America. The way in which the EU import licenses were written generated rent seeking behavior on the part of banana importers (Borrell, 1997).

Import restrictions were calculated to cost European consumers $1.6 billion a year. Further, despite the fact that one justification of the import program was foreign aid, only $300

million (of the $1.6 billion) was paid to ACP producers. Additionally, it cost $100 million a year to other developing countries due to the lost export opportunities (Borrell, 1997).

The cost for society has not been calculated on a world scale. Clearly, however, the incentives encouraged less efficient producers to use resources in the production of bananas and reduced production in some of the more efficient regions[4]. Removing the pre-1993 EU policy structure would have led to welfare gains for the global economy.

The Common Market Organization for Bananas (CMOB)

The EU Common Market Organization for Bananas represented the consolidation of various efforts to regulate the market. The first attempt was in the mid seventies, when the main Latin American exporters argued for the necessity of organizing the market in order to overcome overproduction and low world prices. Although the implementation of a Common Market was seen as a reinforcement of customs union doctrine, (WTO, 1997), its main goal was to balance opposing interests of diverse groups affected by the hodgepodge of national-level import policies. With the implementation of the 1993 Agreement, free intra-EU movement of bananas was allowed, and the EU took a position of reaching three main importer-nation objectives (Patiño, 2000):

1. To assure overseas territories would get higher prices to compensate their more elevated production costs.
2. To fulfill the commitments with ACP countries made through the Lomé Convention.
3. To ensure consumers an adequate supply with good quality bananas from third countries (Borrell, 1997). Since prior to 1993, Latin American bananas represented 99.36% of non-preferred production, all the rules directed at this group referred essentially to Latin America or dollar bananas[5] (CORBANA, 1993).

[4] In 1998, it was estimated that a ton of bananas produced in Latinamerica cost on average $162. The production cost of a ton of bananas produced in overseas territories of the EU reached $500 (Cascavel, 1998).

[5] Since a large portion of the Latin American banana exports are dominated by US companies, bananas from this destination are also called dollar bananas.

During the Uruguay Round negotiations, Switzerland, Japan, Finland, Korea and New Zealand offered to liberalize their banana market. In opposition to these initiatives, the European Union decided not to include the banana trade in its negotiations. This position was evident with the ratification of the 1993 regulation, which further restricted the EU banana market. However, this new regime was not compatible with the WTO "most favored nation" clause since it conceded trade preferences to ACP nations over the suppliers (IICA, 1995).

The 1993 Agreement defined a specific set of importing guidelines for overseas territories and for how ACP and non-preferred suppliers would be allowed to export. A quota for each supplier category was set. Overseas territory and ACP exports were duty free up to the amount specified by the quota. An initial tariff of ECU 100 per ton was imposed on intra quota imports for third suppliers, mainly Latin America. The regime also allowed free movement of bananas among the European Union.

To protect production in overseas territories and ensure producers from those regions a minimum income, exports up to a maximum of 854,000 tons were eligible for deficiency payments[6]. The payment was defined as the difference between the market price and a reference price determined by the EU. Exports over these quantities were not covered by the compensation system. To guarantee that all countries benefited, a maximum import amount subject to compensation was assigned to each one. This maximum level was allocated based on the historical quantities exported by each country. However, the limits imposed were greater than the 1991 average export amount (see Table 2.3). Communitarian suppliers were also eligible for additional compensatory assistance. Producers who had to abandon banana production were subject to an indemnity. To qualify, they had to either cease all production if their plantation is less than five hectares or at least 50% if it was greater than eight hectares (CORBANA, 1993).

ACP countries were split into two groups: traditional and non-traditional suppliers. ACP traditional imports consisted of bananas exported by ACP countries in annual historic quantities. The non-traditional category incorporated imports from traditional ACP suppliers over the quantities habitually exported and imports from other ACP countries that did not produce bananas prior to 1993. Exports from this group were treated as if they were from non-preferred suppliers and taxed with a 750 ECU/ton tariff. Traditional ACP exporters enjoyed duty free access up to 857,700 tons as well as any other quantity imported when unfilled quotas occurred

[6] These payments were made by the EU.

from the non-preferred suppliers. The quota was split among the countries according to the traditional amount exported for each (Table 2.4).

This treatment of over-quota exports was the only modification traditional ACP exporters faced relative to their situation prior to 1993. Under the Lomé Convention Agreement, traditional ACP countries were not restricted at all in their duty-free imports. However, with the exception of Cameroon, the quotas imposed on each country did not limit their exports. As shown in Table 2.4, nearly all of the export levels of the ACP countries were below the maximum duty-free quantities allowed from 1994 to 2000. One exception was Cameroon, whose banana exports were greater than the duty free quota in 1999 and 2000.

For non-preferred exporters, the Common Market Organization introduced an aggregate tariff-quota of 2 million tons. These imports were charged a 100 ECU/T tariff (equivalent to a 20% ad-valorem tax). Over-quota imports were subject to a levy of 850 ECU/T (comparable to a 170% ad-valorem taxation CORBANA, 1993). The quota was subject to change depending on the projected market situation each year. This projection would be based on predicted European consumption and preferred supplier's production. Changes in Latin American production were not considered however, and Latin America was the only region whose allocation was smaller than the quantities it exported to the EU prior 1993 (see Table 2.5).

The new regime also created an import license system to distribute the non-preferred quota among importers. The allowance was split into three categories of operators on the basis of historical quantities imported. Category A comprised traditional banana importers from Latin America. They were allowed to import 66.5% of the 2 million tons quota. Category B corresponded to operators who traditionally imported bananas from preferred suppliers. They were authorized to import 30% of the quota assigned to Latin American producers. A category C was created to reserve import rights for new importers established in 1992. They got the last 3.5% of the import quota assigned to Latin American exporters.

Transference of import licenses was allowed between importers of the same category and among importers of categories A and B. It was not permissible to transfer licenses from or to category C. However, the principles that ruled the license transference were different for each category and harmed Latin American operators. For instance, if an importer of category A, sold its import license to a category-B operator, the seller lost its license for the next period.

However, if the transaction was in the opposite direction, from category B to A, this rule did not hold and the B operator was able to make use of its license the next period.

CMOB related events after its approval in 1993

The European policy has been extremely controversial since its creation in 1993. It faced numerous obstacles with most of the involved parts in the market, leading in most cases, to modifications of the original policy.

Although the Latin American countries, as a region, do not enjoy the same economic power as the European Union, they have been proactive with regard to modifications to the 1993 import system leading to three of the major adjustments. The United States, representing its multinational firms, also had an important role in the so called banana war challenging the EU import regime several times.

For exposition purposes, adjustments to the banana import policy are split into two chronological periods. The first covers changes that occurred between 1993 and the 1999 WTO declaration that the European import system was illegal. During this period, the 1993 regime was modified, but its main guidelines stayed the same. The second period covers changes after the WTO declaration in 1999 through 2001. The last WTO resolution urged the EU to modify its policy. In this sub-section, the failed attempts to define a new import policy to please everybody are presented. It also describes the background for the EU-US 2001 agreement.

The first adjustment to the regime was made in 1994 when Colombia, Costa Rica, Venezuela and Nicaragua reached an agreement with the EU in the context of the Uruguay Round Negotiations (GATT). In this occasion, the quota was raised to 2.1 million T. Then in 1995, with the conclusion of Uruguay Round negotiations, at the request of Costa Rica, Colombia, Ecuador and Panama, the quota was increased to 2.2 million tons and the in-quota tariff was reduced from 100 ECU to 75 ECU/T. Additionally, these countries negotiated a fixed participation in the quota applied to the Latin American exporters. Costa Rica and Colombia obtained the greater portion with 23.4% and 21% of the global quota respectively. Nicaragua got 3% and Venezuela 2% of the allowance. The parties were allowed to trade the import rights among themselves. However, the agreement was canceled in 1998, when Germany and Belgium requested an inquiry by the Justice Tribunal of the EU. The quota allocation was considered illegal, since the export rights discriminated among operators.

An additional modification to the quota to Latin American exporters was introduced in 1995. A temporary tariff quota of 353,000 tons was added when Austria, Finland and Sweden joined the European Union. Nonetheless, the increase in quota was not large enough to match the imports levels these countries had prior their accessing to the European Union. As shown in Table 2.6, total imports of this group during the period 1990-1994 were greater than the additional quota approved. Indeed, the growth tendency shown by these countries imports stopped once they joined the European Union. The additional allowance applied until 1997, when the third countries quota was set back at 2,200,000 tons.

It is interesting that the EU banana regime not only caused difficulties between the EU and the affected parties, but also divided the Latin American block. As a consequence of the quota allocation agreement negotiated by some nations, the Latin American unit split into two groups. One comprised those countries that accepted the new import regime: Costa Rica, Venezuela, Nicaragua and Colombia. The other comprised nations that advocated for an alternative system: Ecuador, México, Honduras, Guatemala and Panamá.

The US supported the later group claiming that its firms were harmed by the EU import regime. In fact, the US multinational firms felt more threatened when Colombia, Costa Rica, Nicaragua and Venezuela negotiated their allocations. The US firms argued that their economic interest would be harmed if the national quotas were executed because most of their production was not allocated in those countries.

Because of this discontent, the US government started an investigation process to determine if the actions taken by those countries truly harmed the US firms' interests. The US threatened to impose economic sanctions on the nations that accepted the import regime if the harm to its companies were proved. As a result, Nicaragua and Venezuela resigned the agreement and did not execute the allocated quotas assigned to them. On the other hand, Colombia and Costa Rica ratified the agreement.

The US government threatened Costa Rica and Colombia with suspending the commercial benefits these countries enjoy as part of the Caribbean Basin Initiative (CBI). This is a unilateral preferential treatment between the United Stares and countries from the Caribbean Area. It allows duty free entrance to exports from the benefited countries to the United States territory, including the Virgin Islands and Puerto Rico. The final resolution was on favor of

Costa Rica and Colombia. The US government understood they acted in defense of their interest, considering the high dependence of these countries' economies to the banana activity.

In 1997, the United States, Guatemala, Honduras and Mexico requested a hearing of the Dispute Settlement Body (DSB) of the World Trade Organizations against the EU (Ecuador and Panama supported the action but did not take part since they were not being WTO members at that time). This group argued that the EU's import policy harmed their interests and favored ACP suppliers.

The WTO's resolution partially favored the EU. The Dispute Settlement Body determined that based on the Lomé Convention, the EU was right to concede preferences to the ACP nations. However, some effects of the new import system were found to be in opposition to WTO rules, the Agreement on Import and Licenses Procedures, and the General Agreement on Trade and Services. The WTO affirmed that this system unfairly discriminated against some importing and marketing firms in Latin America. As a result, the EU adopted a modified set of import policies that entered into force in January 1999. Three principal changes were introduced:

a) The four "substantial suppliers" of the EC (Ecuador, Costa Rica, Colombia and Panama) were allocated specific shares of tariff-quotas A and B on the basis of the 1994-1996 period.
b) The country-specific sub-quotas within the quota for countries of Africa, the Caribbean and the Pacific (ACP countries) were abolished.
c) The complex system of import license allocation was simplified by reducing the number of market operator types from 7 to 2 (traditional and newcomer operators).

These adjustments came in the context of a greater liberalization of the EU's agriculture sector and its commitment with the WTO. The adapted import system safeguarded the commitment the EU had with the traditional ACP suppliers and, at the same time, the EU could meet its obligations with the WTO.

In 1999, Ecuador and the US confronted the European policy again and brought another demand to the WTO. These countries were not pleased with the modifications enforced in 1999 by the EU. This time, the case was resolved in favor of Ecuador and the US. The resolution imposed an important precedent in the WTO since it was the first time a developing country was authorized to execute economic sanctions on a developed block. The same resolution applied to

the US[7]. Additionally, the EU was asked to make further changes to its banana import regime, in order to make it compatible with the WTO specifications.

After the WTO declared the European banana import system illegal in 2000, the European Union Commission started a consultation process with the involved parts. Its goal was to define a new WTO compatible policy generally accepted by the parties. By the end of 1999, the Commission proposed a "tariff only" system that would be introduced in 2006. Meanwhile, it suggested adopting a transitional tariff quota system with preferential access for ACP producers. The proposal suggested maintaining type A and B quotas during the transitional period. The first staying on its previous 2.2 million tons charged with a EUR75/ton. The type B quota would be autonomous and for an amount of 353,000 tons for which the EUR75/ton tariff would also apply. Additionally, it considered the creation of a new autonomous quota (type C) of 850.000 tons. ACP exports would enter duty free under any quota category.

None of the parties expressed any kind of disagreement with this component of the proposal. The conflict with the parties started when the Commission communicated its intention of conceding the import licenses on a historical basis. A new period of consultation started.

After seven months of discussion with the parties, the Commission announced a new import license distribution system. It was based on its initial proposal of license concessions based on a historical reference period but also considered a proposal made by the Caribbean countries and redefined the operators that would have access to the quotas.

The proposal was not accepted by the US operators nor by some Latin American producers. The US opposition held even though the Commission estimated that US operators would fall into the new definition and therefore would increase their market share. A new dialogue process started with the objective of reaching an agreement about the historical reference period for the license allocation. Once again, the process did not yield any agreement between the parts (Commission of the European Communities. October, 2000).

At this point, the Commission initiated an evaluation of a quota system based on the "first come, first served" system. It was considered the last option to define an import policy compatible with the WTO rules and that would please the involved parts. The EU recognized

[7] The US increased by 100%the import tariff on European products such as textiles, cheese, jam and cookies. The sanctions affected all Communitarian countries but Netherlands and Denmark. The US government claimed this tax would compensate for the estimated $520 million losses US firms have had as a result of the EU import banana policy (La Nación, 1999)

many advantages in the "first come, first served" system. First, it was a WTO compatible import structure. In fact, the WTO defined it as a "well-suited" system for the management of tariff quotas in its resolution of the Ecuador panel in 1999. Specifically, it represented the solution to the quota management problem for it would imply the elimination of national quota allocations and definition of operators. The distinction between traditional and newcomer operators would disappear. In addition, the rent shifting originated by the trade in license would be overcome (Commission of the European Communities. October, 2000).

However, there were some weaknesses attached to the system that required an adequate solution by the EU. For example, the perishable character of bananas requires the period between transportation from the production center and the arrival of the fruit to be limited. The proposed system could delay the process. Moreover, there was the possibility of technical difficulties in the ports because of a larger number of shipments that may congestion them. Additionally, there were also budgetary implications for the EU. Under the new import structure, the banana supply would increase in the market driving the price down. This would have raised the compensatory payments to community producers (Commission of the European Communities. October, 2000).

Not surprisingly, each party claimed some kind of modification to the proposal that would fit their interests. Some of them even advocated for a different system. For example, most operators favored an import regime based on historical references. Their main argument was that the proposed system would reinforce the large operators' position to the detriment of the small and medium sized ones. They claimed that the larger operators were more capable of negotiating shipping arrangements (Commission of the European Communities. October, 2000).

European community producers were indifferent to the system since the compensatory payments would have covered any decrease in their incomes. On the contrary, the ACP producers favored the maintenance of the quota system as long as possible. However, even though the new system did not perfectly fit their interests, the foreseen increase in the tariff preference in one of the quotas was on their benefit (Commission of the European Communities. October, 2000).

The system never came into effect however, primarily because of US opposition. At this point the EU started the bilateral negotiations with the US that brought the EU-US agreement in 2001 discussed in the next section. But, before moving on to this, it is important to mention the economics impacts some authors have estimated the CMOB had on the involved parts.

The 1993 policy resulted in higher priced bananas for EU consumers. Many studies have been conducted since the introduction of this policy to determine it's effects on European countries' welfare. All of them agree that German consumers were the most affected. Imports to this country were estimated to decrease by 250 thousand tons compared to the initial free market situation. German consumer's welfare lost was calculated at $50 million (Kersten, 1995). On the other hand, consumers in countries that had restrictive import policies, such as France and UK, were made better off. In those countries, real import price of bananas decreased with the introduction of the new regime. A similar situation occurred in Spain, Portugal, and Greece (Kox, 1998).

However, despite the gains for some countries, total consumer welfare decreased in the European market. Consumer's losses for the EU (excluding Germany) were calculated at approximately $640 million compared to the market situation that prevailed before 1993 (Kersten, 1995 and Borrel, 1997).

Additionally, the goal of protecting developing countries was inefficiently, and just partially, reached. The 1993 regime imposed costly resource transference from one group of underdeveloped nations to another. It is estimated that Latin American nations incurred a cost of $0.32 ($98 million a year) for every dollar of aid reaching preferred suppliers (Kersten, 1995 and Borrel, 1997).

EU perspective on the CMOB and the banana war

In addition to the viewpoint of the third parties affected, it is important to consider the European perception and justification for the banana regime. One of the main reasons it was justified was the need to fulfill the requirements established by the European Single Market (ESM). This policy intended to increase welfare through a higher level of competition and efficiency. Therefore, defenders of the CMOB argue that this policy had a justifiable goal: to benefit domestic producers and consumers of bananas within the EU border. Furthermore, there is sufficiently proof that the European Single Market was indeed successful at enhancing global welfare when considering the policy as a whole (Allen, C., M. Gasiorek and A. Smith, 1998). Therefore, it would be valid to claim that the CMOB is an exception to the success the more global policy had.

As a second goal, the policy was meant to protect the economies of the ACP nations. These countries are alleged to be highly dependent on the banana sector and any sudden adjustment in their productive structure would have had devastating social consequences[8]. However, when analyzing the economic structure of both groups of countries, the levels of development and the dependency on the banana sector are not valid arguments to justify the EU policy. As discussed earlier, the 1993 regimen imposed extremely high costs for Latin American countries, also developing nations.

Many of the ACP countries have income levels comparable or higher than European countries as Poland, Bulgaria, Romania and most former states of the Soviet Union. Based on their Human Development index most of them are considered among the medium developed nations[9]. On the other hand, with some exceptions, most of the Latin American countries are doing very poorly in development related matters. Large parts of these countries populations remain in extreme poverty (see Table 2.7).

Evaluating dependency on the sector, a study performed by Kox in 1998 found that banana exports to the EU represent only three to seven percent of total export earnings for the poorest ACP countries. Meanwhile, banana exports contribute to domestic income in Honduras, Costa Rica, Ecuador and Panama three to eight times more than in most ACP countries.

In addition to the economic justification of the CMOB, there are also political reasons that, under the European point of view, made the adopted system preferable to a free trade alternative. One of the stronger arguments is that under free trade, the EU would have had to make direct payments to the communitarian and ACP producers. These payments would have compensated the losses that those producers had faced for the cancellation of their preferred treatment. The EU claimed they did not have the resources necessary to make the required direct transference. Even if they had had the budget, none of the benefited parties felt comfortable with the idea of getting resources in such a fashion. Additionally and maybe more important, both the EU and the ACP nations worried about the social consequences that adjustment in their productive structure would have (Tangermann, 1997).

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[8] For example, 70% Saint Vincent population's revenue depends directly and indirectly on the banana sector. One of every three people in Saint Lucia depends on this activity. Finally, 60% of the revenue perceived by the four EU overseas territories comes from banana production.

[9] Cameroon and Cote d'Ivory constitutes the exceptions.

Another argument used by the CMOB defenders is that this policy was not as costly as has been estimated. Most studies make their welfare estimations based on the situation prevalent in 1991 and 1992, i.e. Borrel. However, this period is alleged not to be representative of the real tendency in the market because the Latin American exporters increased their shipments forecasting a change in the policy (Tangermann, 1997). However, defenders of this idea left an important question unanswered: how were the Latin American exporters able to increase their shipments if most of the European market was protected under the multi-policy situation prior to 1993? Furthermore, even if the estimated welfare effects of the 1993 policy were overestimated, nobody can claim that the transference system imposed by this policy was highly inefficient. European Union consumers and producers from developing countries were taxed in order to transfer resources to another group.

Agreement between the US and the EU

After eight years of controversy (1993-2000), the European Union negotiated a settlement that would put an end to the CMOB. It involved in addition to the traditional nations implicated in the banana dispute, the US in representation of its multinational fruit companies operating in Latin America. Both the United States and the European Union agreed to modify their commercial policy related to the banana dispute.

The agreement was conceived in two stages. The first phase came into effect in July 2001. It established a temporary elimination of a 100% ad valorem tariff the US had imposed on imports of certain European goods. This tariff was applied by the US as a sanction to the EU for the banana dispute held with the Latin American countries. Additionally, the U.S. agreed to drop its hold to the Lomé Convention, allowing the waiver to Article I of the GATT to pass. The European Union agreed to allocate two more 100,000 ton quotas for Latin American bananas and to eliminate a third quota for the ACP countries. The distribution of quotas was based on historical allocations of import licenses using the years 1994-1996 as the reference period[10].

The second stage started in July 2002, when the European Parliament had to amend the existent banana legislation. A difference of this phase respect to the first stage of the agreement was that it did not have a definitive schedule for its implementation. However, it was established

[10] This time was selected in response to the availability of data.

that for the elimination of US sanction imposed on the EU to be definitive, this phase had to be fully implemented.

It was not until 2006 that the EU import regime was substituted by a tariff-only import system. Under this regime, protected and non-preferred exporters are solely competing on the basis of tariff differences. Quotas on Latin American bananas were eliminated and are taxed at 176 Euros per ton rate[11]. ACP imports are allowed duty free up to a quota level of 775.000 tons. Imports exciding this contingent must pay the non-preferred tariff level.

Defining a tariff level was a long process for the EU and it involved two disputes brought to the WTO by Latin American providers. The initial requisite imposed by the WTO to the EU was that the tariff level had to ensure Latin American suppliers at least the same market access they had enjoyed under the previous import regime. In January 2005, the EU announced that after several months of consultation with ACP countries, they hade defined a tariff level of 230 Euros per ton to imports from non-preferred suppliers. The ACP acquiesced to his tax believing it would let them compete against Latin American bananas. Considering this tariff level prohibitively high, a group of Latin American exporters requested arbitration with the WTO under the Doha Ministerial Decision. The arbitration panel determined the proposed tariff did not grant Latin American suppliers the same market-access they had previously enjoyed.

Afterwards, the EU proposed a lower tariff of 187 Euros per ton, which still did not please non-preferred suppliers. On this occasion, the EU requested a second arbitration to determine whether this new tax level was satisfactory. However, the report made by the WTO ruled out this tariff level under arguing that it still did not provide Latin American access to the EU banana market. Finally, the EU set a tariff of 176 Euros per ton to imports from this region.

[11] Compared to a 75 Euros per ton tariff under the precious import regime.

Table 2-1 EU Banana Exporter Categories Prior to 1993

Preferred suppliers		Non preferred suppliers:	
African, Caribbean and Pacific (ACPs) countries	**EU overseas territories**	**Latin American producers and others**	**Non-traditional ACP**
Belize [(a)]	Crete	Brazil	Belize [(b)]
Cameroon [(a)]	Guadeloupe	Colombia	Cameroon [(b)]
Cape Verde	Martinique	Costa Rica	Dominican Republic
Dominica	Madeira	Ecuador	Ghana
Grenada	The Canary Islands	Guatemala	Ivory Coast [(b)]
Ivory Coast [(a)]		Honduras	Other ACP
Jamaica		Mexico	
Madagascar		Nicaragua	
Saint Lucia		Panama	
Saint Vincent		Philippines	
Somalia		Others no identified	
Suriname			
Windward Islands			

Sources: Borrell, B. EU Bananarama III, 1994 and "Patiño, Maria I., M. Andrea. El régimen de acceso al mercado de la Unión Europea".
(a) Traditional quantities.
(b) Above traditional preferred quantities.

Table 2-2 Summary of national import policies prior to the CMOB

Group 1 *(Wanted to protect former colonies)*			
Country	**Tariff**	**Quota**	**Other restrictions**
France	20%	270,000 tons	Closed to third countries exports but when exceptional conditions
United Kingdom	20%	30,000 tons	Licensed and allowed only when there existed a shortage in the favored supply.
Italy	20%	270,000	None
Portugal, Spain and Greece	20%	0	Greece imposed a prohibitive tariff on imports from third countries.
Group 2 *(Wanted to protect ACP countries under the Lomé Convention)*			
Country	**Tariff**	**Quota**	**Other restrictions**
Denmark	20%	None	None
Ireland	20%	None	None
Netherlands	20%	None	None
Belgium	20%	None	None
Luxemburg	20%	None	None
Group 3 *(Advocated for free trade)*			
Country	**Tariff**	**Quota**	**Other restrictions**
Germany	No	None	None
Austria [(1)]	No	None	None
Finland [(1)]	No	None	None
Sweden [(1)]	No	None	None

[(1)] This countries were not part of the EU when the CMOB came into effect.

Table 2-3 Overseas territories' production subject to price compensation

Overseas territory	Maximum Production subject to compensation	1991 production	Excess (%)
Canary Islands	420,000	339,450	23.73
Guadeloupe	150,000	116,124	29.17
Martinique	219,000	181,069	20.94
Madeira	50,000	N.A	N.A
Crete	15,000	N.A	N.A
Total	854,000	636,643	24.00

Source: "Patiño, Maria I., M. Andrea. El régimen de acceso al mercado de la Unión Europea".

Table 2-4 Duty free import quantity limits for ACP suppliers and export levels in the period 1994-2000

Country	*Duty free quota (Tons)*	*Actual imports (Tons)*						
		1994	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Cote d'Ivoire [2]	155,000	-	-	13,684	122,045	114,664	141,924	140,916
Cameroon	155,000			148,921	113,121	109,978	170,734	191,925
Suriname[2]	38,000	27,861	33,438	22,227	24,162	17,853	28,467	28,064
Somalia [2]	60,000	-	-	13,540	13,457	4,551	0	0
Jamaica [2]	105,000	75,595	82,832	66,858	67,999	55,588	41,428	30,973
Saint Lucia [2]	127,000	-	-	79,877	52,602	56,861	53,579	47,692
Saint Vincent/ Grenadine	82,000	-	-					
Dominica [2]	71,000	-	-	27,260	27,053	22,543	22,755	18,058
Belize [1] [2]	40,000	-		34,409	35,027	27,613	36,979	37,826
Cape Verde	4,800							
Grenada	14,000	4,504	4,695	1,451	59	47	501	507
Madagascar	5,900	-	-	-	-			
Total	857,700	107,960	120,965	408,227	455,525	409,698	496,367	495,961

Source: CORBANA, 1993 and United Nations Statistics.

(1) Remember that just part of Belize's exports enjoys preferred treatment in the EU.

(2) Exports estimated from banana imports reported by the EU.

Table 2-5 Annual average exports of main Latin American banana suppliers to the EU (1980-1999)

Country	*Total Exports*	*Exports to the EU*	*Share of imports to the EU*	*Share into EU total imports*
Colombia	10,719.1	4,290.4	40.03	15.5
Costa Rica	13,034.4	5,730.7	43.97	20.7
Ecuador	17,567.3	3,931.9	22.38	14.2
Guatemala	4,025.6	497.1	12.35	1.8
Honduras	9,953.9	2,162.9	21.73	7.8
Nicaragua	845.0	259.0	30.65	0.9
Mexico	778.0	0.0	0.00	0.0
Panama	7,766.8	4,701.2	60.53	17.0
Dominican Republic	70.6	8.5	12.04	0.0
Total Latin America	71,951.6	27,734.4	38.55	100.0

(1) Hundred of tons.
Source: United Nations. Comisión Económica para América Latina y El Caribe. Tendencias y Perspectivas de las Exportaciones de Banano de América Latina y El Caribe. 1993

Table 2-6 Austria, Finland and Sweden average banana imports (1990-2000)

Country	***1990***	***1991***	***1992***	***1993***	***1994***	***1995***	***1996***	***1997***	***1998***	***1999***	***2000***
Austria	144	154	150	146	144	111	96	94	88	102	93
Finland	70	73	86	96	169	66	58	60	58	64	62
Sweden	143	160	162	153	154	147	149	159	175	185	187
Total	*357*	*387*	*398*	*395*	*466*	*324*	*303*	*313*	*321*	*351*	*341*
Difference respect to quota	-4	-34	-45	-42	-113	29	50	40	32	2	12

Hundred of tons.
Source: FAO Statistics

Table 2-7 Human Development Index (HDI) of the EU banana suppliers

Country	*Region*	*Human development index*	*Rank (1999)*	*GDP per capita ($US)* [1]
Dominica*	ACP	0.873	-	3778
Grenada*	ACP	0.843	-	3295
Saint Lucia*	ACP	0.838	-	4505
Saint Vincent and the Granadillas [(a)]	ACP	0.836	-	3018
Costa Rica	LA	0.821	41	2942
Mexico	LA	0.790	51	5036
Panama	LA	0.784	52	3397
Belize	ACP	0.776	54	3045
Colombia	LA	0.765	62	2093
Suriname	ACP	0.758	64	1657
Brazil	LA	0.750	69	3525
Philippines	Others	0.749	70	1032
Jamaica	ACP	0.738	78	1487
Ecuador	LA	0.726	84	1109
Cape Verde	ACP	0.708	91	1400
El Salvador	LA	0.701	95	2007
Nicaragua	LA	0.635	106	459
Honduras	LA	0.634	107	856
Guatemala	LA	0.626	108	1637
Madagascar	ACP	0.462	135	239
Ivory Coast	ACP	0.426	144	808

Source: Human Development Reports. 1999
The HDI combines the real purchasing power per capita, life expectancy at birth, education in terms of adult literacy and school enrollment.
* The index was not reported for these countries in 1999. The value shown corresponds to 1994.

CHAPTER 3 - Import demand for bananas in the European Union

There has been some controversy regarding whether an inverse demand system would be more appropriate for analyzing the EU banana market than a quantity dependent demand system. Supporters of the inverse demand base their hypothesis on the fact that banana imports in the EU had historically been regulated by quotas on non-preferred suppliers. Therefore, quantities have been predetermined by the quota level and prices adjusted to them. A regular demand system assumes that quantities are determined based on the price level prevalent in the EU.

Nevertheless, two arguments can be used to justify the use of a regular demand system to analyze the EU banana market. First, only imports from Latin America were limited by the established quotas in the EU banana market. Consequently, only imports from this region might be better explained by an inverse demand equation. Domestic and import demands from ACP are properly explained based on the assumption that quantities adjust to price changes. Second, the quota-tariff system has been substituted by a tariff-only import regime. This implies that inverse demand equations are no longer adequate descriptions of banana demand in the EU. Since one of the goals of this thesis is to provide policy makers with a well defined set of demand parameters to be used on subsequent welfare and market analysis, the relevant model, the one that best describes the most current market structure is a regular demand system.

However, following the idea that at least the demand equation for Latin America should be inversely specified (prices adjusting to quantities), a regular and an inverse demand system are estimated. The first corresponds to the almost ideal demand system (AIDS) and the second to the inverse almost ideal demand system (IAIDS). The goal of estimating both models is to determine whether the parameter estimates obtained from both of them are consistent in terms of the way consumers in the EU consider bananas from different regions substitutes or complementary goods.

The rest of this chapter is organized in three sections. The next one describes the theoretical aspects of both demand systems estimated. The other details the data used on the estimation and the last one presents and discusses the results obtained form the model estimation.

The Almost Ideal Demand System

The Almost Ideal Demand System (AIDS) proposed by Deaton and Muellabauer in 1980 has been widely used to estimate systems of import demand equations. Two of its desirable characteristics are that it exactly satisfies the axioms of choice and allows testing for homogeneity and symmetry of the parameters (Deaton and Muellabauer). Those two conditions ensure the estimation of a theoretically justifiable import demand system. The system is derived from an indirect utility function, V(*p*,*m*), of the form shown in equation (1):

$$V(p,M) = \frac{\ln(M) - \ln a(p)}{\ln b(p)} \tag{1}$$

Where

$$\ln a(p) = \alpha_0 + \sum_{i=1}^{4} \alpha_i \ln(p) + 0.5 \sum_{i=1}^{4} \sum_{j=1}^{4} \gamma_{ij} \ln p_i \ln p_j \tag{2}$$

$$\ln b(p) = \beta_0 \prod p_j^{\beta_j} \tag{3}$$

For the purpose of this study, *i* and *j* represent four different exporting regions. The first corresponds to Latin America, the main supplier of the EU. The second is composed of the countries from Africa, the Caribbean and Pacific that have traditionally enjoyed preferred access to the EU market. The third region comprises the communitarian countries, which are mainly overseas territories of Greece, Spain, France and Portugal. The last exporting region comprises the rest of the world thus $i, j = 1, \ldots, 4$ and $i \neq j$. *p* is a price vector containing import prices from each exporting region *i*; *M* is total expenditure in bananas in the EU, and α_0, α_i, γ_{ij} and β_i are the parameters to be estimated.

By solving equation (1) for *M,* the expenditure function can be recovered as shown in equation (4):

$$E(p,u) = b(p)^U a(p) \tag{4}$$

Where *b*(*p*) and *a*(*p*) correspond to the definitions previously given and *U* is utility level. By Shephard's lemma, differentiating the log of this function with respect to the log of each price, a set of compensated share equations (w_i^c) is obtained. These equations represent the share of each exporting region into total EU imports and are of the form shown in equation (5):

$$w_i^c = \alpha_i + \sum_{i=1}^{n} \gamma_{ij} \ln p_j + \beta_i U \beta_0 \prod p_i^{\beta_i} \quad (5)$$

After solving equation 5 for *U* and substituting the solution back into the compensated share equation, uncompensated share equations are obtained:

$$w_i = \alpha_i + \sum_{i=1}^{n} \gamma_{ij} \ln p_j + \beta_i (\ln M - \ln a(p)) \quad (6)$$

By estimating three of these equations simultaneously (one must be dropped to avoid singularity of the variance-covariance matrix), a set of parameters specific for the EU banana market are derived. To be consistent with the general demand restrictions, adding up, homogeneity and symmetry were imposed on the system as shown in equations (7) to (9).

Adding up $\sum_{j}^{n} \gamma_{ij} = 0 \sum_{i=1}^{n} \alpha_i = 1, \quad \sum_{i=1}^{n} \beta_i = 0, \quad \sum_{i}^{n} \gamma_{ij} = 0$

(7)

Homogeneity $\sum_{j}^{n} \gamma_{ij} = 0$

(8)

Symmetry $\gamma_{ij} = \gamma_{ji}$

(9)

Price (ε_{ij}) and income (ε_{im}) elastiticies can be calculated by deriving the uncompensated share equations with respect to the appropriate variable as depicted in equations (10) and (11) respectively.

$$\varepsilon_{ij} = \frac{\gamma_{ij} - \beta_i (\alpha_i + \sum_{i=1}^{n} \gamma_{ij} \ln p_j)}{w_i} - \delta_{ij} \quad (10)$$

$$\varepsilon_{iM} = \frac{\beta_i}{w_i} - 1 \quad (11)$$

Where δ_{ij} is the Kronecker delta, taking a value of 1 when *i=j* and zero otherwise. Compensated elasticities are derived from the above elasticities using the following relationship, derived from the Slutsky identity.

$$\varepsilon_{ij}^c = \varepsilon_{ij} - w_j \varepsilon_{iM} \quad (12)$$

These elasticities are meaningful since they are a representation of the substitution relationships between exporting regions, allowing us to exactly determine whether imports from the different regions are either complements or substitutes.

Data

The complete data set consists of annual observations on per-capita quantity imported and import prices in the EU by exporting region for the period 1964 to 2004. These variables were constructed from trade flows, consumer price indices, and population statistics obtained from the following sources.

Trade flows were obtained from the *World Trade Annual Report* of the United Nations. Statistics on commodity price indices (CPI) and population are from the *International Financial Statistics* of the International Monetary Fund. Domestic prices for bananas in France, Italy and Greece are from the Food and Agricultural Organization (FAO) web site.

Original trade data included import flows for each EU country member and all their trade partners during the analyzed period. Imports by country were grouped according to their corresponding exporting region (i.e. Latin America, ACP, EU and rest of the world). Afterwards, nominal imported value for each EU country was deflated using the corresponding national consumer price index to obtain real imported values at 2004 US $. Next, quantity imported and import values from each region were aggregated along all communitarian countries to obtain total imports of the EU. Import prices were obtained as the ratio between 2004 real import values and their corresponding imported quantities. Total expenditure was calculated as the sum of import value from each exporting region. Each region's share was obtained as the ratio between the corresponding real import value and total expenditure. Finally, per capita imports were calculated by dividing total quantity imported from each exporting region by total population.

Some limitations of the data set are as follows. Because of the way trade data are reported, it was not possible to determine whether reported exports from EU countries corresponded to actual domestic production (Portugal, Spain, Greece and France) or to re-exports of bananas imported from other regions. As a result, import statistics from the EU might be over estimated. Additionally, new members added to the EU in 2004 were not included in the estimation due to limited data availability.

Descriptive statistics for the data are shown in Table 3.1. Notice that Latin America is the main supplier of bananas to the EU. Per capita imports from this region averaged 4 kg a year during the period 1964 – 2004. However, imports from this region were the most variable, likely the result of the varied import regimes that have ruled the EU banana market during the analyzed period. Average per-capita imports from ACP and the EU are very similar. Nevertheless, exports from the ACP are more stable over time.

Bananas from Latin America are the cheapest at the border (without accounting for tariffs) and prices from this region are less variable than import prices from other regions. Bananas from communitarian countries are the most expensive, followed by the ACP. Import prices from other suppliers are lower than from those two regions but still are not competitive with respect to Latin America.

Results from the demand systems estimation

Table 3.2 presents the parameter estimates obtained from the two AIDS models estimated. The first, and the one used for further analysis, includes the four exporting regions. The second one excludes rest of the world from the estimation. The objective of estimating this second model was to determine how sensitive elasticitites were to the inclusion of the ROW as a region because of its low share in the EU banana market.

In the case of the four-region model, direct estimation yielded thirteen parameters while the other six were recovered from the theoretical restrictions imposed on the model. Eighteen out of nineteen coefficients are significantly different from zero at the 5% confidence level and the other at the 10%. Hence elasticitites, calculated as a function of the parameters, are likely quite robust.

Demand elasticities obtained are shown in Table 3.3. They were calculated at each data point and then averaged over time to obtain a single parameter value. The numbers in parentheses are approximate t-values obtained by dividing the average elasticity by its corresponding standard deviation.

The four own price elasticities have the expected negative sign and are significantly different from zero at the 10% level. Import demand for bananas in the EU from all regions but the rest of the world (ROW) is relatively inelastic. Demand for domestic product is the least sensitive to own price changes (-0.23), followed by ACP (-0. 41) and Latin America (-0.97). On

the other hand, import demand from ROW is relatively elastic and therefore more sensitive to own price changes (-1.66).

Expenditure elasticities indicate that bananas from the EU, ACP and Latin America are normal goods. However, demand for bananas from the EU and ACP vary proportionately less than expenditure changes. The opposite occurs to import demand from Latin America which is relatively more sensitive to expenditure changes. The coefficients for these three regions are significant at the 5% level. Contrary to this, income elasticity estimated for the rest of the world is negative and not significantly different from zero. This result will be discussed in more detail when the three-region model's results are presented.

Compensated price elasticities are also shown and used to determine whether bananas from the four different sources are complements or substitutes. The advantage of this procedure is that the income (expenditure) effect is eliminated, letting us analyze the pure price effect and categorize the goods as q-net complements or q-net substitutes. As expected, bananas from Latin American and the other regions are substitutes. Nevertheless only parameters for ACP and ROW are significant. Domestic and ACP bananas are also substitutes as expected but cross price elasticities for these two regions are not significantly different from zero. Results obtained for the ROW indicate that imports from this region are considered complementary to bananas supplied by ACP and the EU. Even though this result is only significant for the case of the ACP, it is worthwhile to expand on the reasons that may explain this result.

While the objective is to estimate a demand system at the consumer level, the data used is at the wholesale level. It would be expected then that a fraction of total imports are for industrial or processing uses, which might deviate from the consumer demand relations found in the data. Additionally, the inclusion of ROW as a fourth region in the demand system might affect the results because of the low share it has in the EU banana market.

This share has also decreased over time. For example, imports from this region accounted for 12% of the total imported value in 1964 by the EU but only 0.33% in 2004. On average, imports from this region accounted for just 2% of total banana imports in the EU during the analyzed period. This and the questionable elasticity values obtained for this region justified the estimation of another demand model excluding this region.

Parameter estimates are presented in Table 3.2. A total of thirteen parameters were obtained in this case, eight of them directly from the model estimation and five more were

recovered from the theoretical restriction imposed on the model before its estimation. All parameters are significant.

Conclusions drawn from own-price and expenditure elasticities are similar to those obtained from the four-region model. Demand for bananas from Latin America is the most price sensitive, followed by ACP and demand for communitarian bananas. Expenditure elasticities have the same signs and are very close in value. Indeed they are the same for Latin America and the EU. Compensated elasticities are not as robust as those obtained in the previous model. However, some conclusions are comparable to it. For example, bananas from Latin America and all other regions are substitutes and demands from the EU and ACP are complements. In this case the result is significant while in the previous model it was not.

Because there are no evident gains in excluding ROW from the demand estimation, all subsequent analysis are based on the four-region model. Nevertheless it is important to keep in mind some of the limitations of the results, notably negative expenditure elasticity for ROW and some questionable complementary relations in the demand for bananas from different regions.

Table 3-1 Descriptive statistics of trade data used in demand estimation

Variable	Mean	St. Deviation	Minimum	Maximum
Quantities (kg per capita)				
Latin America	4.07	2.59	0.87	8.46
EU	1.38	0.57	0.62	2.83
ACP	1.55	0.34	0.95	2.16
Others	0.16	0.22	0.01	0.71
Prices (real 2004 $/ton)				
Latin America	217.17	194.51	16.073	847.28
EU	279.14	222.53	18.012	802.89
ACP	261.81	213.72	12.314	776.33
Others	227.03	221.56	7.4721	862.38
Expenditure (real $ per capita)	2.24	2.51	0.06	9.66

The data set contains 42 observations.

Table 3-2 Parameters estimated from the AIDS model

AIDS (4 regions)		AIDS (3 regions)	
Parameter	**Coefficient**	**Parameter**	**Coefficient**
α_0	96.66** (96.57)	α_0	155.210* (2.673)
α_1	17.44** (19.408)	α_1	27.280* (3.517)
α_2	-3.32** (-3.8925)	α_2	-4.527* (-2.405)
α_3	-10.21** (-13.485)	α_3	-21.753* (6.618)
α_4	-2.91** (-4.321)	n/a	n/a
β_1	0.17** (18.539)	β_1	0.167* (9.940)
β_2	-0.03** (-4.1714)	β_2	-0.029* (-2.854)
β_3	-0.1** (-13.693)	β_3	-0.137* (-11.067)
β_4	-0.04** (-6.025)	n/a	n/a
γ_{11}	2.76** (9.023)	γ_{11}	4.428* (-4.223)
γ_{12}	-0.57** (-3.622)	γ_{12}	-0.885* (-2.847)
γ_{13}	-1.75** (-9.2364)	γ_{13}	-3.543* (-4.090)
γ_{14}	-0.44** (-3.2157)	n/a	n/a
γ_{22}	0.13** (1.8371)	γ_{22}	0.325* (-2.847)
γ_{23}	0.34** (4.2922)	γ_{23}	0.560* (2.438)

Table continues…

Table continued…

AIDS (4 regions)		AIDS (3 regions)	
Parameter	**Coefficient**	**Parameter**	**Coefficient**
γ_{24}	0.1** (-2.9189)	n/a	n/a
γ_{33}	1.14** (-7.244)	γ_{33}	2.982* (3.900)
γ_{34}	0.27** (-3.5116)	n/a	n/a
γ_{44}	0.07* (-1.618)	n/a	n/a

* Indicates significant values at the 5% level

Table 3-3 Elasticities from the 4-region AIDS model

Price/Quantity	Uncompensated elasticities			
	Latin America	***EU***	***ACP***	***ROW***
Latin America	-0.97**	-0.40**	0.09	11.18
	(-6.31)	(-4.28)	(0.50)	(1.06)
EU	-0.32**	-0.23*	-0.10**	-1.21
	(-5.57)	(-1.53)	(-2.19)	(-1.04)
ACP	-0.15*	-0.18**	-0.41**	-4.00
	(-1.63)	(-3.40)	(-2.00)	(-1.01)
Rest of the World	0.08**	-0.05**	-0.10**	-1.66**
	(2.68)	(-4.09)	(-3.142)	(-2.51)
Expenditure elasticity	1.36**	0.86**	0.52**	-0.21
	(18.06)	(30.52)	(4.04)	(-0.88)
Price/Quantity	**Compensated elasticities**			
	Latin America	***EU***	***ACP***	***ROW***
Latin America	-0.31*	0.02	0.33**	8.98
	(-1.48)	(0.25)	(2.03)	(1.08)
EU	0.01	-0.02	0.03	-2.26
	(0.29)	(-0.20)	(0.392)	(-0.94)
ACP	0.19*	0.03	-0.27*	-5.04
	(1.41)	(0.41)	(-1.69)	(-0.96)
Rest of the World	0.11*	-0.03	-0.09**	-1.67**
	(1.43)	(-1.02)	(-2.34)	(-2.45)

* Indicates significant at the 10% level
** Indicates significant at the 5% level

Table 3-4 Elasticities from the 3-region AIDS model

Price/Quantity	**Uncompensated elasticities**		
	Latin America	***EU***	***ACP***
Latin America	-1.081**	-0.418**	0.519
	(-2.514)	(-2.871)	(0.922)
EU	-0.323**	-0.171	-0.178*
	(-4.491)	(-1.045)	(-1.580)
ACP	0.048	-0.286**	-0.755*
	(0.137)	(-2.324)	(-1.692)
Expenditure elasticity	1.356*	0.875*	0.413*
	(18.302)	(34.890)	(2.662)
Price/Quantity	**Compensated elasticities**		
	Latin America	***EU***	***ACP***
Latin America	-0.391**	0.015	0.674**
	(-4.006)	(0.196)	(11.646)
EU	0.029**	0.027	-0.062*
	(0.425)	(0.641)	(-1.3723)
ACP	0.360**	-0.061	-0.664**
	(3.973)	(-1.197)	(-11.838)

* Indicates significant at the 10% level
** Indicates significant at the 5% level

CHAPTER 4 - Economic effects of the new import policy

Modeling of the import policy

As explained in Chapter 2, prior to January 2006 the EU banana market was regulated by a tariff-quota system designed to protect EU communitarian and ACP producers. Under this scheme, imports from ACP countries enjoyed duty free access up to 750,000 tons. Above this quota, imports were taxed at a 380 Euros/ton rate (approximately US $373). Additionally, imports from non-preferred suppliers were subject to a tariff of 75 Euros/ton (approximately US $93) within a 2,750,000 ton quota. Out-of-quota imports paid a tariff of 680 Euros/ton (approximately 2004 US $845). This quota was increased by 100,000 tons in 2002, as part of the second stage of an agreement signed between the EU and the US.

To summarize Chapter 2, recall that the EU defined a new import system to replace the existing tariff-quota scheme. The new regime came into effect in January of 2006 and required the removal of all quotas but also a higher tariff level for non-preferred suppliers. The duty-free quota for ACP was increased to 775,000 tons in an attempt to continue to safeguard this region's access to the EU market. However, ACP's exports above this quota level must abide by the same regulations imposed on non-preferred suppliers.

The effect of the transition from one import regime to another on the major banana suppliers of the EU is what is evaluated in the following two chapters. To model this transition it was necessary to convert the Latin American quota level to what I refer to as an "equivalent tariff" to avoid several complications related to the use of a non-continuous supply function as implied by a tariff-quota situation. The tariff-quota supply equation would be as shown in equation (13).

$$s_i = Min\left[s_i(p_i^p, \tau_i), quota_i\right] \tag{13}$$

This specification indicates that export supply of region *i* (s_i) is given by the minimum quantity between the quota imposed on the specific region ($quota_i$) and a quantity that depends on a export price (p_i^p) and region-specific tariff level (τ_i).

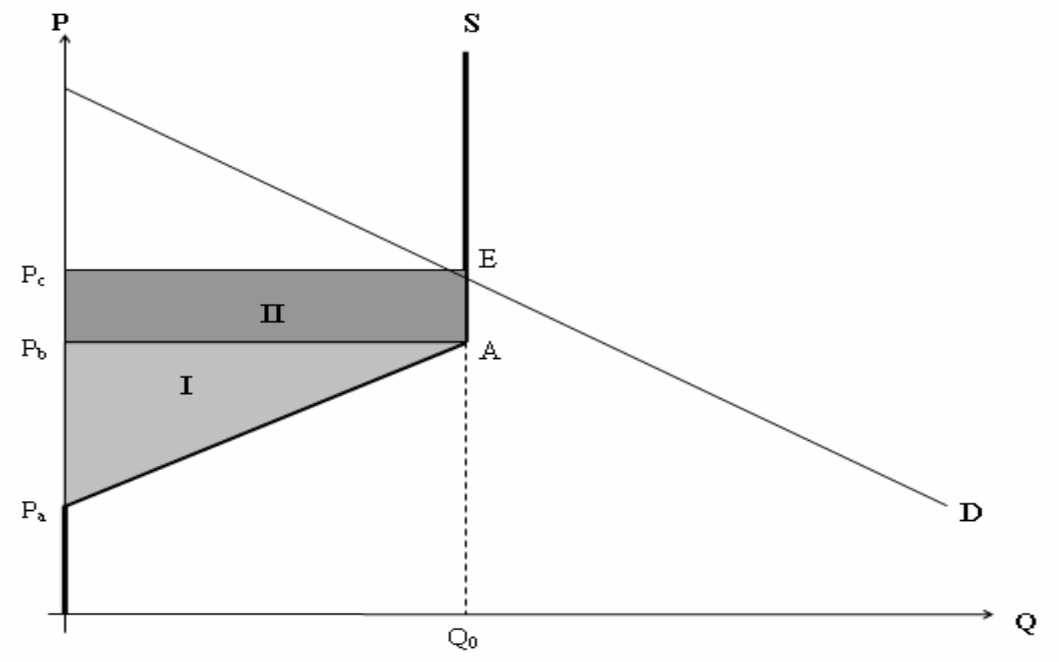
The obvious drawback of working with this supply specification is that it is not a continuous function, making it cumbersome to convert it to its total differential form.

Additionally, the modeling issue in the simulations would have required estimation of the elasticity of supply with respect to the quota; information that is not only unavailable, but questionable as to its meaning as well. Estimating an equivalent tariff allow one to subsume the quota component in the supply equation. Supply can then be solely expressed as a function of import prices and tariff levels.

Using as a base case a pre-2006 producer surplus measure, one can calculate the tariff level that would have made Latin American producers as well off as the quota. This equivalent tariff was calculated as the difference between the actual price received by producers and a hypothetical price under which they would be willing to supply a quantity equal to the quota level, subject to achieving the same producer surplus as under the quota restriction.

Figure 4.1 represents the pre-2006 market equilibrium for Latin America. Here, Q_0 and P_c are the equilibrium quantity and price respectively. D is the demand curve faced by this region and the line P_aAS represents the supply curve that would prevail under the import quota situation. P_a is the minimum price producers are willing to export to the EU market and A marks the minimum price at which producers are willing to export Q_0 based upon the upward-sloping portion of the supply curve.

Figure 4-1 Pre-2006 equilibrium in the Latin American banana market

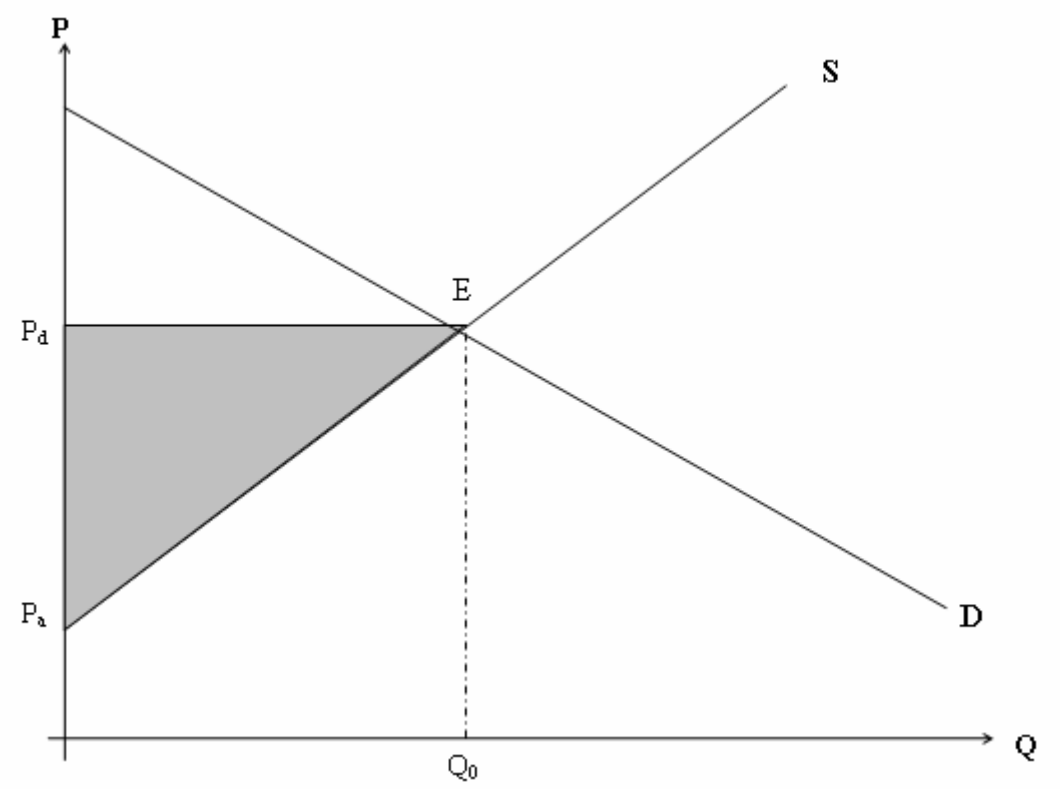


Under this scenario, producer surplus is given by the shaded area under the equilibrium price (P_c) and above the supply curve. Geometrically for ease of estimation, this area can be divided in two parts, one given by the rectangle formed by points P_bAEP_c and the other by the triangle P_aAP_b. Producer surplus can then be estimated as the sum of those two areas as shown in equations (14) and (15).

$$PS = (P_c - P_b) * Q_0 + 0.5 * (P_b - P_a) * Q_0 \quad (14)$$

$$\text{or } PS = (P_c - 0.5P_b - 0.5P_a) * Q_0 \quad (15)$$

Figure 4-2 Pre-2006 LAT simulated equilibrium under the absence of import quotas



The calculated producer surplus was then used to simulate an equivalent new market equilibrium under a non-quota scenario, as the one depicted in Figure 4.2. The shaded area represents producer surplus and is equal to the producer surplus previously estimated under the quota scenario. What is needed is the hypothetical price (P_d) that would make producers as well off as under the quota while supplying quantity Q_0. This price can be obtained from the producer surplus equation for the non-quota scenario (*PS*).

$$PS = 0.5 * (Pd - Pa) * Q_0 \quad (16)$$

Since the values of producer surplus (PS), P_a and Q_0 are known, P_d can be obtained by solving for P_d directly from equation (16).

$$P_d = \frac{2PS}{Q_0} + P_a \tag{17}$$

And the equivalent tariff is determined as the difference between P_d and the actual price received by Latin American producers (P_c in Figure 4.1).

Before presenting results of the previous simulation, let's take a look at how prices P_a, P_b, and P_c are determined. Various choices for P_a could be used, including zero. Fortunately as long as the same P_a is used in the reference or base model and the counterfactual model, the choice of P_a is innocuous. For example, I chose to calculate P_a as an average price paid to producers plus a percentage added by exporters to cover transport and insurance costs[12]. However, because of the way the base and counterfactual producer surpluses were calculated, this variable cancels out. Therefore inclusion of an incorrect P_a into the calculations of the reference producer surplus, will have no effect on the hypothetical price estimated (P_d) for the non-quota scenario.[13]

P_b is obtained from a Cobb Douglas supply equation of the form:

$$S = AP^{\alpha} \tag{18}$$

Where S is quantity supplied and P and α are price and elasticity vectors respectively. This equation was calibrated for the constant term A trade data for the period 1999 to 2004 and elasticity values from existent literature as shown in (19).

$$A_0 = \frac{S}{P^{\alpha}} \tag{19}$$

Once the value of A_0 was determined, it was possible to solve for the minimum price at which suppliers are willing to export the complete quota quantity during the years analyzed as indicated in equation (20).

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[12] This assumption is reasonable because multinational firms, which are mostly in charge of the export activity, buy a considerable proportion of their export supply from national producers. Therefore, prices paid for those bananas are good proxies of what can be consider the production cost of these firms' export supply.

[13] Combining equations (17) and (15), P_d can be expressed as:
$P_d = \frac{2}{Q_0} * [Q_0 (P_c - .5P_b - .5P_a)] + P_a$, which can be simplified to:
$P_d = 2P_c - P_b$

$$P_b = \left(\frac{Q_0}{A_0} \right)^{1/\alpha} \tag{20}$$

Where A_0 is the calibrated constant term from equation (23) and Q_0 is the quota level applied to Latin American countries in the period 1999 to 2004. Results of this calculation are presented in Table 4.1 for two alternative short-run elasticity values (0.75 and 1.5) based on the values reported by FAO (2005).

Table 4.2 presents the equivalent per unit tariff for the previous two elasticity scenarios. Notice that as expected the more elastic the supply is, the less "penalized" Latin American producers are from the quota imposed on their exports to the EU banana market. These values were used for calibrating the equilibrium displacement model presented in the next section.

Equilibrium displacement model

To simulate the effects of the new EU import regime of bananas on the major producer regions, an equilibrium displacement model (EDM) was used. The EU banana market was decomposed, following the same criteria used for demand estimation, into four regions or markets defined by Latin America; the African, Caribbean, Pacific countries (ACP); the EU (representing local production) and rest of the world (ROW).

The use of this model, instead of a partial equilibrium framework, takes into account not only the direct effects of the new import regime in the entire EU market but also the indirect effects from the interrelations among the different exporting regions. As shown by the cross price elasticities obtained from the AIDS model, the four exporting regions are related on the demand side.

In this way, if the import price from a certain region changes as a result of the new import regime, not only that region's quantities demanded and supplied will react, but also demand and supply from other regions. Ultimately, all import prices will react to those quantity variations, which will have an impact on the equilibrium prices and quantities of the other markets. This chain of events will continue until a new equilibrium has been simultaneously reached in all markets. The model that follows presents these interactions.

The general model is initially described by the following set of equations:

$$d_i = d_i(\mathbf{p}^c, M, z_i) \qquad \textit{Demand for bananas from region } i \tag{21}$$

$s_i = s_i(p_i^p, \tau_i)$ *Supply of bananas from region i* (22)

$d_i = s_i$ *Market clearing condition for quantities* (23)

$p_i^c - p_i^p = \tau_i$ *Market clearing condition for prices* (24)

Where *i* refers to each exporting region (i.e. Latin America, ACP, EU and others); *M* is total annual expenditure in bananas in the EU; z_i represents a vector of *n* demand shifters for region *i*'s demand; $\mathbf{p^c}$ is a vector of consumer prices; p_i^p is producer price in region *i*; and, τ_i represents per-unit import tax for region *i*. Prices and quantities are endogenous in the model while shift variables, expenditure, and import tariffs were exogenously determined outside the model.

The system is then converted to its log differential form following the steps described below. First, total differential of equations (21) to (24) were taken, which transformed the previous set of equations to a system of the form:

$$\Delta d_i = \sum_{j=1}^{4} \frac{\partial d_i}{\partial p_j^c} \Delta p_j^c + \frac{\partial d_i}{\partial M} \Delta M + \sum_{n=1}^{N} \frac{\partial d_i}{\partial z_i} \Delta z_{in} \quad (25)$$

$$\Delta s_i = \sum_{j=1}^{4} \frac{\partial s_i}{\partial p_j^p} \Delta p_j^p + \frac{\partial s_i}{\partial \tau_i} \Delta \tau_i \quad (26)$$

$$\Delta d_i = \Delta s_i \quad (27)$$

$$\Delta p_i^c - \Delta p_i^p = \Delta \tau_i \quad (28)$$

where Δ indicates absolute change (i.e. $\Delta d_i = d_i^1 - d_i^0$) with upper indexes 1 and 0 referring to after the shock and initial values of the variable respectively. Next, equations (25) to (28) were rearranged to express them in terms of elasticities and log differentials. Starting with expression (25), both sides of the equation were multiplied by $1/d_i$ to yield:

$$\frac{\Delta d_i}{d_i} = \sum_{j=1}^{4} \frac{\partial d_i}{\partial p_j^c} \frac{\Delta p_j^c}{d_i} + \frac{\partial d_i}{\partial M} \frac{\Delta M}{d_i} + \sum_{n=1}^{N} \frac{\partial d_i}{\partial z_i} \frac{\Delta z_{in}}{d_i};$$

Then, the terms on the right hand side (RHS) were multiplied by $\frac{p_j}{p_j}$, $\frac{M}{M}$ and $\frac{z_i}{z_i}$ respectively to derive the following equation:

$$\frac{\Delta d_i}{d_i} = \sum_{j=1}^{4} \frac{\partial d_i}{\partial p_j^c} \frac{p_j^c}{d_i} \frac{\Delta p_j^c}{p_j^c} + \frac{\partial d_i}{\partial M} \frac{M}{d_i} \frac{\Delta M}{M} + \sum_{n=1}^{N} \frac{\partial d_i}{\partial z_{in}} \frac{z_{in}}{d_{in}} \frac{\Delta z_{in}}{z_{in}};$$

Finally, terms were combined together to express this equation in terms of elasticities and proportional changes as shown by (25').

$$\tilde{d}_i = \sum_{i=1}^{4} \varepsilon_{ij} \tilde{p}_j^c + \mu_i \tilde{M}_i + \sum_{n=1}^{N} \zeta_{in} \tilde{z}_{in} \qquad (25')$$

Where ε_{ij} represents elasticity of demand *i* with respect to price *j*; μ_i is expenditure elasticity of demand *i*; ζ_{in} is the elasticity of demand *i* with respect to variable z_{in}; and $\tilde{x}_i$ symbolizes the proportional change of variable x (i.e. $\frac{x_i^1 - x_i^0}{x_i^0}$).

A similar procedure was used to transform the three other equations of the system. For example, the supply equation was first multiplied by $1/s_i$ and then each resulting term of the RHS was multiplied by $\frac{p_j^p}{p_j^p}$ and $\frac{\tau_i}{\tau_i}$ respectively, to obtain the following expression:

$$\frac{\Delta s_i}{s_i} = \sum_{j=1}^{4} \frac{\partial s_i}{\partial p_j^p} \frac{p_j^p}{s_i} \frac{\Delta p_j^p}{p_j^p} + \frac{\partial s_i}{\partial \tau_i} \frac{\tau_i}{s_i} \frac{\Delta \tau_i}{\tau_i};$$

Which after grouping and re-ordering of terms can be expressed as:

$$\tilde{s}_i = \sum_{j=1}^{4} \eta_{ij} \tilde{p}_j^p + \upsilon_i \tilde{\tau}_i \qquad (26')$$

Where η_{ij} is the elasticity of supply *i* with respect to price *j* and υ_i is the elasticity of supply *i* with respect to its tariff.

The following expression was derived from equation (23) after taking the total differential and multiplying each side by $1/q_i$:

$$\frac{\Delta s_i}{q_i} = \frac{\Delta d_i}{q_i}$$

Making use of the fact that quantity demanded and supplied must change in the same proportion for the market to be in equilibrium, the following identity must hold: $q_i = d_i = s_i$ this equation (23) is equivalent to:

$$\tilde{s}_i = \tilde{d}_i \tag{27'}$$

To convert the price clearing condition (24) into relative change form, each term of the original equation was multiplied by $\frac{p_i^c}{p_i^c}, \frac{\tau_i}{\tau_i}$ and $\frac{p_i^d}{p_i^d}$ respectively to obtain:

$$\Delta p_i^c \frac{p_i^c}{p_i^c} - \Delta \tau_i \frac{\tau_i}{\tau_i} = \Delta p_i^p \frac{p_i^p}{p_i^p}$$

$$\Rightarrow \tilde{p}_i^c \; p_i^c - \tilde{\tau}_i \; \tau_i = \tilde{p}_i^p \; p_i^p$$

Then, by multiplying both sides by $\frac{1}{p_i^p}$ and re-arranging terms, equation (24) becomes:

$$\tilde{p}_i^c \frac{p_i^c}{p_i^p} - \tilde{\tau}_i \frac{\tau_i}{p_i^p} = \tilde{p}_i^p$$

$$\Rightarrow \tilde{p}_i^c (1 + \pi_i) - \tilde{\tau}_i \pi_i = \tilde{p}_i^p \tag{28'}$$

Where π_i indicates the percentage tariff on imports from region *i* and is calculated as the ratio between per-unit tariff and producer price[14].

To summarize, the equilibrium displacement model of the EU banana market is described by the following set of equations:

$$\tilde{d}_i = \sum_{i=1}^{4} \varepsilon_{ij} \; \tilde{p}_j + \mu \tilde{M}_i + \sum_{n=1}^{N} \zeta_{in} \; \tilde{z}_{in} \tag{25'}$$

$$\tilde{s}_i = \sum_{j=1}^{4} \eta_{ij} \; \tilde{p}_j^p + \upsilon_i \; \tilde{\tau}_i \tag{26'}$$

$$\tilde{d}_i = \tilde{s}_i \tag{27'}$$

$$\tilde{p}_i^c (1 + \pi_i) - \tilde{\tau}_i \pi_i = \tilde{p}_i^p \tag{28'}$$

The system was reduced by substituting equation (28') into (26') as follows:

$$\tilde{s}_i = \sum_{j=1}^{4} \eta_{ij} \left[\tilde{p}_i^c (1 + \pi_i) - \tilde{\tau}_i \pi_i \right] + \upsilon_i \tilde{\tau}_i \tag{34''}$$

---

[14] From (20), $p_i^c = \tau_i + p_i^p$. So, $\frac{p_i^c}{p_i^c} = \frac{\tau_i}{p_i^c} + 1$

By doing so, the model was solely expressed in terms of endogenous changes in quantities (supplied and demanded) and consumer prices (p_j^c). Grouping these endogenous variables in the RHS and assuming that changes in all exogenous variables but the tariff level are zero[15], the following system of three equations was obtained:

$$\tilde{d}_i - \sum_{j=1}^{4} \varepsilon_{ij}\, \tilde{p}_j^c = 0 \tag{29}$$

$$\tilde{s}_i - \sum_{j=1}^{4} \eta_{ij}(1+\pi_i)\, \tilde{p}_i^c = \left(\upsilon_i - \sum_{j=1}^{4} \tilde{\eta}_{ij}\, \pi_i \right) \tilde{\tau}_i \tag{30}$$

$$\tilde{s}_i - \tilde{d}_i = 0 \tag{31}$$

Equations (29) to (31) can be expressed in matrix form as **M X** = **Y.** Where **M** contains all relevant price elasticities, **X** embodies price and quantity changes and **Y** comprises information on exogenous variable changes. These matrices are defined as:

$$M = \begin{bmatrix} \mathbf{I} & \mathbf{0} & -\boldsymbol{\varepsilon} \\ \mathbf{0} & \mathbf{I} & -\boldsymbol{\eta}' \\ -\mathbf{I} & \mathbf{I} & \mathbf{0} \end{bmatrix},\ X = \begin{bmatrix} \tilde{\mathbf{d}}_\mathbf{i} & \tilde{\mathbf{s}}_\mathbf{i} & \tilde{\mathbf{p}}_\mathbf{i} \end{bmatrix} \text{ and, } Y = \begin{bmatrix} \mathbf{0^B} \\ \mathbf{v}' \tilde{\boldsymbol{\tau}} \\ \mathbf{0^B} \end{bmatrix}$$

Where:

I	4 x 4 identity matrix
0	4 x 4 null matrix
ε	4 x 4 matrix of demand elasticities with elements ε_{ij}
-η'	4 x 4 matrix with elements $\eta_{ij}(1+\pi_i)$
η	4 x 4 matrix of supply elasticities with elements η_{ij}
v'	4 x 1 vector with elements $v_i - \sum_{j=1}^{4} \eta_{ij}\pi_i$
$\tilde{\mathbf{v}}$	1 x 4 vector of tariff level changes
$\mathbf{0^B}$	4 x 1 null vector

[15] Under this assumption, terms $\mu \tilde{M}_i$ and $\sum_{n=1}^{N} \zeta_{in}\, \tilde{z}_{in}$ become zero.

Specifically **M**, **X** and **Y** contain elements as follows.

$$X = \begin{bmatrix} \tilde{d}_1 & \tilde{d}_2 & \tilde{d}_3 & \tilde{d}_4 & \tilde{s}_1 & \tilde{s}_2 & \tilde{s}_3 & \tilde{s}_4 & \tilde{p}_1 & \tilde{p}_2 & \tilde{p}_3 & \tilde{p}_4 \end{bmatrix}$$

$$M = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\varepsilon_{11} & -\varepsilon_{12} & -\varepsilon_{13} & -\varepsilon_{14} \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & -\varepsilon_{21} & -\varepsilon_{22} & -\varepsilon_{23} & -\varepsilon_{24} \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & -\varepsilon_{31} & -\varepsilon_{32} & -\varepsilon_{33} & -\varepsilon_{34} \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & -\varepsilon_{41} & -\varepsilon_{42} & -\varepsilon_{43} & -\varepsilon_{44} \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & -\eta_{11}(1+\tau_1) & -\eta_{12}(1+\tau_1) & -\eta_{13}(1+\tau_1) & -\eta_{14}(1+\tau_1) \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & -\eta_{21}(1+\tau_2) & -\eta_{22}(1+\tau_2) & -\eta_{23}(1+\tau_2) & -\eta_{24}(1+\tau_2) \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & -\eta_{31}(1+\tau_3) & -\eta_{32}(1+\tau_3) & -\eta_{33}(1+\tau_3) & -\eta_{34}(1+\tau_3) \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & -\eta_{41}(1+\tau_4) & -\eta_{42}(1+\tau_4) & -\eta_{43}(1+\tau_4) & -\eta_{44}(1+\tau_4) \\ 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$Y = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ [\nu_1 - \pi_1(\eta_{11} + \eta_{12} + \eta_{13} + \eta_{14})]\tilde{\tau}_1 \\ [\nu_2 - \pi_2(\eta_{21} + \eta_{22} + \eta_{23} + \eta_{24})]\tilde{\tau}_2 \\ [\nu_3 - \pi_3(\eta_{31} + \eta_{32} + \eta_{33} + \eta_{34})]\tilde{\tau}_3 \\ [\nu_4 - \pi_4(\eta_{41} + \eta_{42} + \eta_{43} + \eta_{44})]\tilde{\tau}_4 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

The twelve equation system was solved for proportional consumer price and quantity changes as $\mathbf{X} = \mathbf{M}^{-1}\,\mathbf{Y}$. Producer prices were recovered from identity (28'). Those proportional changes were then used to calculate the welfare impact on the major producing regions from the new EU import regime for bananas.

Calibration of the equilibrium displacement model

As shown by equations (29) to (31), supply and demand elasticities as well as policy variables were needed to calibrate the equilibrium displacement model. Demand parameters were obtained from the estimation of the Almost Ideal Demand System. Supply elasticities were taken from existent literature and corresponded to the same values used to calculate the equivalent tariff for Latin America.

To model policy changes from one import regime to the other, it was assumed that only the quota imposed on Latin American imports was binding. This assumption is justified based on the quota realities (see Chapter 2). Since this quota was converted to its equivalent tariff, only data on tariff levels and tariff changes for all regions were required. The elasticity of supply with respect to the tariff level (υ) was approximated by the own price supply elasticity as an increase in the tariff level would have the same impact as a decrease in the prices paid to exporters. Finally, the percentage tariff (π) was calculated as the ratio between total tariff revenue received by the EU from each region and total value exported by the respective region.

Results of the equilibrium displacement model

Table 4.3 shows the results of the equilibrium displacement model for two different scenarios corresponding to the same elasticity values used in the equivalent tariff calculation. It is important to mention that the results discussed in this section are based on Monte Carlo simulations as will be explained in more detail in the following chapter. Briefly, the use of Monte Carlo analysis allows bounds to be placed on the calculated point estimates of price and quantity changes in each market in order to make probabilistic inferences about the possible changes in the EU banana market as a means of providing a sensitive analysis.

Results indicate that under the new import regime, prices are likely to increase in all markets. In the first scenario, where Latin American supply is relatively inelastic ($\eta = 0.75$), there is an 88% chance that the import price for this region will increase. Price is also likely to rise in the rest of the world, ACP and the EU. However, the probability of communitarian producers obtaining a higher price is lower than for ROW and ACP suppliers whose probability of a price increase is around 61% and 63% respectively versus a 54% chance for EU producers.

Quantity exported by each region on the other hand is likely to be less affected by the import regime change. Again, Latin American exports have the greatest possibility of increasing (77% probability). The probability of imports from the EU growing is 54% and contrary to what happened to price increases, the chances of the ACP and ROW of augmenting their sales to the EU market are low respect to the EU. ACP producers face the lowest odds of increasing their export level with just a 7% chance whereas there is 31% probability that shipments from ROW increase in the short run.

Finally, from the results it was also possible to determine the chances each region has of increasing their share in the EU banana market. As expected by the previous results, Latin American producers are the ones with the greatest opportunity for increasing their market share (74% probability), followed by the EU (24%), the ACP and ROW (with 15% and 14% respectively).

Information on the new average price and quantities are also included in Table 4.3. These values are the average new price and quantity in each market and can be compared to their initial levels under the previous quota-tariff import regime.

Notice that results are very stable across the two Latin American-supply scenarios. The chance of a price increase in both cases is the same while the probabilities of quantity increases are just slightly higher for the EU, ACP and ROW and lower for Latin America under the second scenario. The same happens to the possibility of each region increasing its market share. However, results still support the idea that Latin American producers are the most likely to increase their presence in the EU banana market.

Table 4-1 Results of supply equation calibration

Period	Import Price	Quota level	LAT Export Supply Elasticity = 0.75			LAT Export Supply Elasticity = 1.50	
			Estimated constant (A_0)[1]	P_b[2]		*Estimated constant (A_0)*	P_b
1999	416.43	2,750,000	34225.39	346.72		371.27	379.98
2000	361.61	2,750,000	38636.37	294.97		465.92	326.60
2001	391.72	2,750,000	36202.08	321.71		411.15	354.99
2002	436.38	2,750,000	35250.82	333.34		369.21	381.39
2003	627.36	2,850,000	27121.63	495.87		216.36	557.76
2004	820.96	2,850,000	22895.93	621.51		149.28	714.31
Average[3]	509.08	2,783,333	32205.00	406.32		326.74	457.29

(1) A_0 corresponds to the constant term of the export supply curve of Latin America.
(2) P_b represents the minimum price Latin American producers are willing to supply the quota level.
(3) Aerage value was used to calculate the equivalent tariff under the two export supply elasticity scenarios.

Table 4-2 Latin American banana supply: equivalent tariff calculation

LAT Export Supply Elasticity = 0.75						
Period	**Import price (p_c)[1]**	**P_b[2]**	**P_a[3]**	**Producer surplus [4]**	**Implicit price (p_d)[5]**	**Equivalent tariff**
1999	416.43	346.72	310.61	241,352,300	486.14	69.71
2000	361.61	294.97	302.89	172,376,276	428.25	66.64
2001	391.72	321.71	292.73	232,356,968	461.72	70.01
2002	436.38	333.34	302.27	326,074,811	539.41	103.04
2003	627.36	495.87	296.45	658,914,924	758.84	131.48
2004	820.96	621.51	317.58	1,001,540,150	1,020.42	199.45
Average equivalent tariff						***106.72***
LAT Export Supply Elasticity = 1.50						
Period	**Import price (p_c)**	**P_b**	**P_a**	**Producer surplus**	**Implicit price (p_d)**	**Equivalent tariff**
1999	416.43	379.98	310.61	195,621,089	452.88	36.45
2000	361.61	326.60	302.89	128,892,291	396.63	35.02
2001	391.72	354.99	292.73	186,595,251	428.44	36.72
2002	436.38	381.39	302.27	259,998,783	491.36	54.98
2003	627.36	557.76	296.45	570,734,215	696.96	69.60
2004	820.96	714.31	317.58	869,301,901	927.62	106.65
Average equivalent tariff						***56.57***

(1) Actual import price in constant 2004 US $.
(2) Minimum price Latin American producers are willing to supply the quota level (from Table 4.1).
(3) Vertical intercept of Latin America export supply curve.
(4) In constant 2004 US $.
(5) Simulated price that would make producers as well of as the quota.

Table 4-3 New equilibrium and relative changes in import price and quantity by region

	Scenario 1 (η = 0.75)					Scenario 5 (η = 1.50)			
Probability of:[1]	***Latin America***	***EU***	***ACP***	***ROW***		***Latin America***	***EU***	***ACP***	***ROW***
Price increase	0.88	0.54	0.61	0.63		0.83	0.53	0.59	0.60
Quantity increase	0.77	0.54	0.07	0.31		0.83	0.53	0.07	0.33
Market share increase	0.78	0.24	0.15	0.14		0.79	0.22	0.15	0.13
Average changes in:									
Share	0.09	-0.13	-0.25	-0.17		0.10	-0.14	-0.25	-0.18
Quantity	0.09	-0.08	-0.27	0.02		0.15	-0.09	-0.27	0.03
Price	0.18	-0.20	0.39	0.08		0.14	-0.22	0.39	0.08
Average new:									
Share	0.73	0.15	0.12	0.00		0.74	0.14	0.12	0.00
Quantity	3,688,923	799,935	587,873	8,184		3,900,313	794,574	587,538	8,212
Price	838	550	988	1017		810	539	988	1019
Initial:									
Share	0.69	0.15	0.14	0.02					
Quantity	3,399,798	870,014	805,945	7,985		3,399,798	870,014	805,945	7,985
Price	709	688	709	941		709	688	709	941

(1) Probability of decrease can be obtained as 1 minus the probability of increase reported here.

CHAPTER 5 - Welfare analysis of the import-only regime

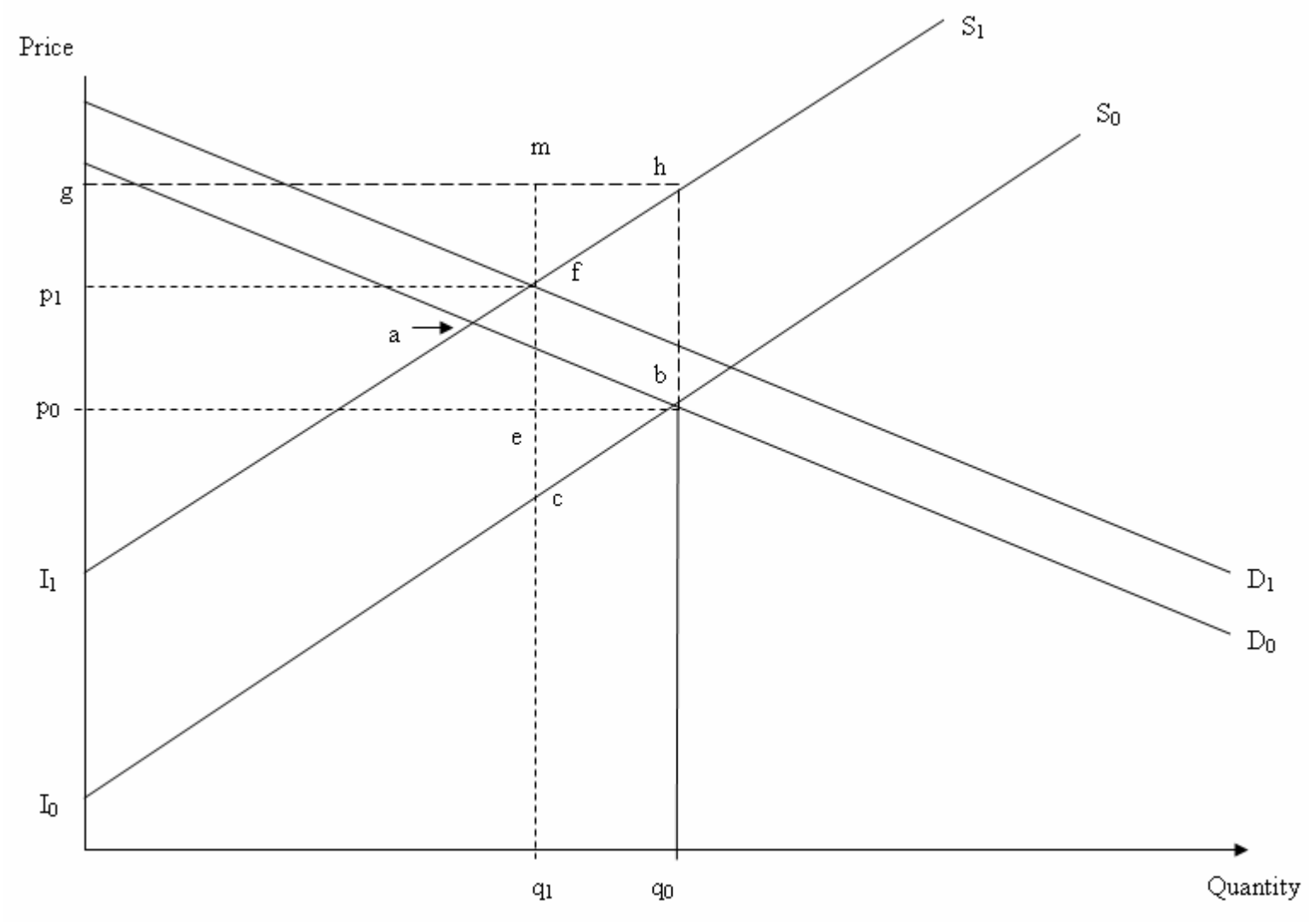
As has been previously stressed, the goal of this study is to determine the effect of the new import regime on banana producers. Although consumer welfare is also important, banana producers are more vulnerable to market changes. Whereas expenditure on bananas does not represent a significant share of a consumer's total expenditure, for producers, a small decrease in their market share might imply important losses and may even force them out of the market. Therefore, this section focuses on the estimation of the economic impact of the new import policy on banana producers from all regions but mainly those on Latin America and the ACP. Welfare changes are measured as the change in producer surplus as detailed in the following section.

Producer surplus

Because each region's market equilibrium not only depends on own price but also on the price of bananas from the competing regions, a price change in one region would affect demand and supply in each market. The EU market and that of its suppliers is depicted in Figure 5.1 Even though prior to 2006, the Latin American market behaved differently than the other three regions due to the existence of a binding quota, the calculation of the equivalent tariff explained in the previous section, enabled to analyze all four markets under the same scheme.

In the diagram, S_0 and D_0 represent the initial supply and demand curves respectively (here, we have used linear curves for simple explanation). Initial market equilibrium is given by price level p_0 and quantity q_0. Due to the enforcement of a new import policy, supply and demand changes can be expected in all regions. Demand changes will be determined mostly by the substitution or complementary relationship between the bananas from different origins. For example, as demand for ACP and Latin America are substitutes, an increase in the price of Latin American bananas will increase the demand for ACP produce. Changes in the supply will be determined by how sensitive the supply from each region is to its own price changes.

Figure 5-1 Equilibrium of major supplier regions in the EU banana market



The new equilibrium will be given at a new point such as *f*, with p_1 and q_1 being the new price and quantity levels. Whether these variables are higher or lower than their initial values can not be determined *a priori*. The place of the new equilibrium depends on the combined effect of the supply and demand curve movements, which ultimately depends on the cross-price demand and own-price supply elasticities in each region.

For expositional purposes a hypothetical scenario is depicted where initial producer surplus is given by the triangle p_0bI_0 and then changes to p_1fI_1 due to the new import regime. The difference between those two areas is a measure of the change in producer surplus (ΔPS_i), which can be expressed as:

$$\Delta PS_i = p_0 bI_0 - p_1 fI_1 \tag{32}$$

Defining *g* as the shift in the supply equation and assuming that supply and demand shifts are parallel, the triangle ghI_1 is equivalent to p_0bI_0. So, changes in producer surplus for each region can be expressed as:

$$\Delta PS_i = ghI_1 - p_1 fI_1 \tag{33}$$

This difference is equal to the area $ghfp_1$, which can be decomposed into two smaller areas: the rectangle $gmfp_1$ and the triangle mfh. Those areas can be calculated respectively as:

$$\text{dmfp}_1 = (g - p_1)q_1 \tag{34-a}$$

$$\text{mfh} = 0.5(g - p_1)(q_1 - q_0) \tag{34-b}$$

Therefore, the change in producer surplus for each region *i* (ΔPS_i) is given by:

$$\Delta PS_i = (g_i - p_i^1)q_i^1 + 0.5(d_i - p_i^1)(q_i^1 - q_i^0) \tag{35}$$

Where g_i is the shift of region *i*'s supply, p_i^0 and p_i^1 are initial and new equilibrium prices in region *i* respectively and q_i^0 and q_i^1 are initial and new equilibrium quantities.

In share form (35) can be expressed as:

$$\Delta PS_i = \Delta w_i q_i^1 + 0.5\Delta w_i \Delta q_i \tag{36}$$

Where Δw_i and Δq_i represent changes in region *i*'s share and in quantity supplied, respectively.

Multiplying the first and second terms of the RHS of equation (44) by $\frac{w_i}{w_i}$ and $\frac{w_i}{w_i}\frac{s_i}{s_i}$ respectively, the change in producer surplus can be expressed in terms of relative changes as shown by (37).

$$\Delta PS_i = \frac{\Delta w_i}{w_i} w_i s_i + \tfrac{1}{2}\frac{\Delta w_i}{w_i}\frac{\Delta s_i}{s_i} w_i s_i$$

$$\Rightarrow \Delta PS_i = \mathrm{w}_i s_i \widetilde{w}_i \left[1 + \tfrac{1}{2}\widetilde{s}_i\right] \tag{37}$$

Total change in producer surplus for the EU market is given by the sum of the changes in producer surplus in each region:

$$\Delta PS_{EU} = \sum_{i=1}^{4} \Delta PS_i \tag{38}$$

Precision Measures of the Welfare Estimates

As discussed earlier, the equilibrium displacement model that solves for the parameters necessary to calculate welfare effects of the new import regime was parameterized based, on among other variables, demand elasticities of the EU market. These elasticities were calculated as non-linear functions of parameters estimated from the Almost Ideal Demand System (AIDS). Therefore, for each different set of parameters there exist a new set of elasticities that differ from the others depending on the magnitude of the difference among the parameter sets and the way those parameters are related within each set. Likewise, there is a solution for the EDM model and new welfare estimations for each parameter set. Making use of these relationships, Monte Carlo simulations based on the demand parameters obtained from the AIDS model were used to derive measures of precision for the producer surplus estimates.

To do this, I started with the fact that each parameter obtained from the AIDS model is characterized by its point estimate and its standard deviation. Additionally, the complete parameter set is also described by a variance-covariance matrix that depicts the degree of correlation between each parameter. Ignoring this correlation between coefficients would not generate samples with exactly the same characteristic as the original multiple-variable population (Fan *et al.* 2002).

Assuming normality of all parameters, imposing the population correlation pattern on a sample data set was done by decomposing the covariance matrix using the procedure proposed by Fan *et .al* (2002). First, to define the structure of the relationship between the demand parameters in a way that could be imposed on the sample data, the variance-covariance matrix generated when solving the AIDS model was decomposed using the principal component factor extraction method. In general, this procedure generates new variables, also known as factors that are linear combinations of the variables analyzed.

In this case, decomposition of the AIDS parameter variance-covariance matrix generated a new pattern matrix of dimension 13 X 13 because the procedure was performed on the 13 coefficients directly generated by the demand model. The information generated here was used to simulate coefficient values of the other six parameters that were not directly estimated by the AIDS model but that were recovered from the economic restrictions imposed before the demand system instead. The SAS code for this step is provided in Appendix B.

In a second step, *k* random variables were generated and then multiplied by the factor pattern matrix to impose the population correlation and generate a sample of correlated variables of size *k*. Finally, using data on parameters means and standard deviations in a Monte Carlo framework, a distribution of demand parameters was generated, which enabled me to build distributions of elasticities and hence, distributions of the solutions to the EDM and, thus, of producer surplus.

To ensure the analysis is based on reliable coefficients, once the parameter distribution was obtained, elasticities were calculated at each data point and then tested to ensure that each elasticity set conformed to economic theory. In other words, each elasticity set was tested for negativity (negative own price elasticities) and curvature[16] (negative semi-definite Hessian of compensated elasticities). If any given parameter set did not conform to any of these two restrictions, the data point was eliminated. The goal is to obtain what is termed "truncated distribution" of elasticities in order to perform the requisite simulations. Even with the faster computer, the simulations are nonetheless very time consuming. When the process was terminated, I had obtained a truncated distribution with 267 observations that was compliant with all theoretical economic restrictions. Descriptive statistics of this parameter distribution and estimated market shares are shown in Table 5.1.

[16] Adding up, homogeneity and symmetry were imposed when calculating the AIDS model.

Notice that on average the parameter values of the truncated distribution are almost the same as the point estimates of the original data set obtained from the AIDS model. However, the truncated distribution presents lower variability, measured as the standard deviation of the parameters. This was a result of imposing restrictions on the parameters, which eliminated extreme data points that did not conform to economic theory. Average market shares simulated at each data point for the four regions are also very close to their real values in 2003, the base year used in the calculations.

Results

Table 5.2 shows producer surplus changes that result from the EU switching to a new import regime under two alternative supply elasticity values. It also includes information on price, quantity and share changes (solution of the EDM) as well as the new equilibrium levels of those variables for each producing region.

The difference between the two scenarios is the value of Latin American supply elasticity, which in the first case is less elastic simulating a shorter time horizon ($\eta = 0.75$). The second scenario models a more elastic supply for Latin America and can be viewed as a larger time horizon where producers had more flexibility in responding to market changes by adjusting their production levels and changing their marketing practices. For both scenarios, own price supply elasticities for the other regions are 0.4 in the case of the European Union, 0.5 for ACP's and 0.8 for the rest of the world (ROW). These values are based on the estimates by Arias (2006).

From the first scenario, based on the average changes in producer surplus, it can be concluded that Latin American and EU producers gain from the new import regime, while ACP suppliers are harmed and exporters from the rest of the world are not affected. However, additional information generated from the parameter distribution, instead of just point estimates, indicates that these results are not certain.

For example, even though mean changes in producer surplus for Latin America and the EU are positive, the probability of producers from Latin America gaining from the new regime is 79%. This means that there is a 21% chance that producers from this region might be harmed by

the tariff-only import regime. This is also evident when considering the 90% confidence interval of the producer surplus for Latin America, which ranges between -$368,247 and $816,005. [17]

What is perhaps more interesting is that such high variability might be an indication that the tariff-only import regime is statistically no different from the import policy enforced by the Common Market Organization for bananas (CMOB). If this were the case, one could conclude that EU has been successful in adopting an alternative import system that is consistent with WTO regulations and at the same time maintains Latin American access to its market, at least in the short run.

A similar analysis can be done for the EU. Simulation results indicate that producers from this region gained an average of $57,868 as result of the new import regime. However, the chance of producers being positively affected is only 28%. In other words, there is a probability of 78% that suppliers from this region lose due to the import regime change. Changes in producer surplus for this region vary between -$34,595 and $400,326, thus, again, one might conclude that the new regime leads to no change, at least not a statistically significant one.

Additionally, even though it seems that producers from the ACP region are the net losers from an import system change, statistics of the estimated producer surplus changes indicate that this measure is not significantly different from zero. That is, on average producers from this region are not really harmed by the new import system. The same result was obtained for the rest of the world, where point estimates indicate that producers from this region gained $1 from the import system switch. It can be concluded therefore that the tariff-only and the CMOB import regimes are equivalent from the perspective of these two regions.

When analyzing price and quantity changes, all regions face the possibility of obtaining a higher price for their product, with Latin America having the better odds of increasing their equilibrium price, followed by the rest of the world, ACP and the EU in that order. Results are not as promising for quantity increases. For example, the probability for Latin American and EU producers of increasing their quantity supplied is 77% and 54% respectively. Meanwhile, the rest of the world faces a probability of 31% of increasing their quantity exported to the EU while this possibility is just 7% for the ACP region.

These results comply with the ones obtained from analyzing producer surplus changes. Latin America has the greatest possibility of increasing its market share in the EU banana market

[17] Surplus is measured in constant 2004 US $.

(78%), followed by the EU (24%), ACP (15%) and the ROW (14%). [18] However, there is not certainty that any region will gain or lose from the new import regime.

For the second scenario, average gains are higher for Latin America, the EU and the ROW and average losses are lower for the ACP. If we maintain the assumption that this scenario models a larger time horizon (in the form of a more elastic supply for the EU), results fit the idea that producers are less affected because they had more time to adjust to the new market conditions in the EU banana market.

Even though Latin America still gains on average, producer surplus changes are lower under this scenario. Additionally, changes in the producer surplus for the other regions are not significantly different from zero. Probabilities of gaining from the switch to a tariff-only import system are about the same for Latin America and the EU but a little bit more promising for ACP and ROW suppliers.

Tables 5.3 to 5.5 show different scenarios maintaining the same supply elasticities used for scenarios 1 and 2, but varying the tariff level imposed by the EU. Three alternative tariff levels were analyzed. The first corresponds to the initial tariff proposed by the EU of 230 Euros/ton and that was ruled out by a WTO panel. The second is the lower tariff suggested by the EU after the WTO resolution (176 Euros/ton) and the third corresponds to the tariff level requested by the Latin American region at the beginning of the consultation process with the WTO (75 Euros/ton).

Contrary to what one might think, a higher tariff does not harm Latin American producers as much as it does ACP suppliers. This is most evident from scenario 3, in which a higher tariff level (230 Euros/ton) implies a higher average producer surplus for Latin America and higher average losses for the ACP region compared to the base scenario. This indicates that the duty free quota conceded to producers from this region is in fact binding and that their ability of overcoming the effects of an import tariff is limited. This result is not surprising as this has been the argument used by ACP producers and EU policy makers to protect this region against competition from lower cost Latin American producers.

[18] The higher possibility of the ACP gaining market share with respect to the ROW derives from the higher average change in price that the first region might face.

The better gains for Latin America derive from a greater quantity increase. Under the 230 Euros/ton tariff scenario the new average quantity would have been around 200 thousand tons higher than under the base scenario. ACP exported quantity is on the other hand lower.

As happened in the previous cases however, there is no certainty that Latin America would have benefited from the adoption by the EU of such a tariff level and again, even though changes in producer surplus for ACP are negative on average, there is no statistical evidence that those changes are different from zero. That is, one cannot conclude that ACP producers would have been made worse off if the EU had set its tariff level at this level.

Results from scenario 4 are qualitatively equal to the previous one. The difference is in the magnitude of the welfare effects, especially for Latin America and the ACP. Here, a lower tariff translates into lower average losses for the ACP and lower average gains for Latin America. Results suggest correlation between the magnitudes of gains for Latin America and losses for the ACP region. This idea is sustained by results from the last scenario, which analyzed the effects of imposing a tariff of just 75 Euros/ton. Under such market conditions, ACP average welfare reduction and Latin American gains would have been the lowest of all possible scenarios.

Interestingly, conclusions drawn from simulations under alternative tariff levels are opposite to the ideas expressed by most exporters and EU policy makers when trying to negotiate the tariff level. That is, it has been shown here that the lower the tariff the less benefited Latin America producers would have been because it would have enabled ACP producers to compete under more favorable conditions against Latin American exports.

Final remarks

Even though it is still early for exporters to determine whether they will be harmed or helped by the import regime, as it has only been in effect for less than a year, some Latin American countries such as Costa Rica and Panama have admitted that their exports have not decreased as a result of the new import policy. This position is in contrast with that maintained

by other exporting countries, especially Ecuador, who argues that the 176 Euros/ton tariff level is prohibitive.[19]

As discussed, results from the simulation analysis show that a null hypothesis of no change for producers from the new import policy cannot be rejected. However, this does not mean that the tariff-only import system will affect all countries in the same way. This is especially true when considering the differences in production costs prevalent among producer countries within a region. As Chacon (2004) showed in an analysis of the effect of the first stage of the US-EU agreement in the main Latin American producers, even though the quota level for these countries increased, only Costa Rican and Colombian producers benefited from it. Ecuador and the rest of the producers from this region were made worse off by the new import policy scheme.

This situation might be repeated again and results from the analysis are consistent with such a prognosis. For example, it is not certain that Latin America will gain from the new import regime. The possible losses reported by the simulation exercises might correspond to losses faced by countries such as Ecuador. Additionally, the fact that the simulations suggest the possibility that the old and new import regimes are equivalent, is in line with Costa Rica and Panama confessing that during the present year their exports to the EU have not importantly changed as a result of the import regime changing.

Finally, results are in line with some conclusions reached by other authors. Guyomard (2004) for example indicated that ACP producers are the most vulnerable to the new import regime and that they will be negatively affected unless they are compensated and their banana production becomes more competitive. This situation is likewise reflected in our results.

Anania (2006) concluded that the 176 Euros/ton tariff is not high enough to maintain Latin American access to the EU banana market. She showed that the new import regime benefits non-preferred suppliers. Our results show that on average and in probabilistic terms this a plausible outcome of the EU switching regimes.

[19] Ecuador proposed for Latin American producers to call another WTO panel to ask for a reduction of the 176 Euros/ton tariff to their bananas. Costa Rica did not support this position as they support a gradual decrease of the quota to avoid an overflow of the market. (La Nación. August 15 and October 20, 2006)

Table 5-1 Comparison of simulated distribution and descriptive statistics of the demand parameter set

Simulated distribution N=267				***Point Estimates from AIDS***		
Parameter	***Mean***	***St. Deviation***		***Parameter***	***Mean***	***St. Deviation***
α_1	17.44	0.66		α_1	17.42	0.90
γ_{12}	-0.57	0.18		γ_{12}	-0.58	0.16
γ_{13}	-1.75	0.18		γ_{13}	-1.73	0.19
γ_{14}	-0.44	0.14		γ_{14}	-0.43	0.13
β_1	0.17	0.01		β_1	0.17	0.01
α_0	96.66	0.99		α_0	96.58	1.00
α_2	-3.32	0.57		α_2	-3.28	0.84
α_3	-10.21	0.42		α_3	-10.18	0.75
γ_{23}	0.34	0.08		γ_{23}	0.34	0.08
γ_{24}	0.10	0.03		γ_{24}	0.10	0.03
γ_{34}	0.27	0.07		γ_{34}	0.27	0.08
β_2	-0.03	0.01		β_2	-0.03	0.01
β_3	-0.10	0.00		β_3	-0.10	0.01
Simulated market shares				***2003 market shares***		
Region	***Average***	***St. Deviation***		***Region***	***Average***	***St. Deviation***
Latin America	0.66	0.12		Latin America	0.69	n/a
EU	0.15	0.08		EU	0.15	n/a
ACP	0.15	0.09		ACP	0.14	n/a
ROW	0.03	0.02		ROW	0.02	n/a

Table 5-2 Welfare and market effects of the tariff-only import regime

Variable	Scenario 1 (η = 0.75)				Scenario 2 (η = 1.50)			
	Lat	**EU**	**ACP**	**ROW**	**Lat**	**EU**	**ACP**	**ROW**
Mean change in producer surplus [(1)]	816,005	57,868	-3,611,442	1	391,305	19,407	-520,812	17
90% confidence interval								
Min	-368,247	-34,595	-23,568	-4	-328,089	-35,394	-23,786	-4
Max	1,326,103	401,326	222,083	5	1,265,397	303,252	334,425	6
Probability of increase in:								
Producer surplus	0.79	0.28	0.15	0.15	0.78	0.28	0.18	0.16
Price	0.88	0.54	0.61	0.63	0.88	0.54	0.61	0.61
Quantity	0.77	0.54	0.07	0.31	0.75	0.54	0.08	0.30
Market share	0.78	0.24	0.15	0.14	0.77	0.25	0.16	0.15
Average new:								
Share	0.73	0.15	0.12	0.00	0.72	0.15	0.13	0.00
Quantity	3,688,923	799,935	587,873	8,184	3,879,885	865,463	486,967	7,935
Price	838	550	988	1017	828	679	819	966

(1) Measured n 2004 US$.

Table 5-3 Welfare and market effects of three alternative tariff levels in the EU banana market

Variable	Scenario 3 (τ = 230 Euros/ton)				Scenario 4 (τ = 187 Euros/ton)				Scenario 5 (τ = 75 Euros/ton)			
	Lat	EU	ACP	ROW	Lat	EU	ACP	ROW	Lat	EU	ACP	ROW
Mean change in producer surplus	823,844	57,236	-3,679,865	1	731,943*	64,678	-3,015,875	2	391,305*	19,407	-520,812	17
90% confidence interval												
Min	-358,406	-34,634	-23,581	-4	-303,605	-34,531	-23,535	-4	-328,089	-35,394	-23,786	-4
Max	1,318,597	396,765	225,856	5	1,252,070	379,093	193,657	5	1,265,397	303,252	334,425	6
Probability of increase in:												
Producer surplus	0.79	0.28	0.15	0.15	0.79	0.31	0.15	0.17	0.78	0.28	0.18	0.16
Price	0.87	0.54	0.61	0.63	0.91	0.55	0.62	0.66	0.88	0.54	0.61	0.61
Quantity	0.79	0.54	0.07	0.32	0.54	0.55	0.07	0.28	0.75	0.54	0.08	0.30
Market share	0.78	0.24	0.15	0.14	0.78	0.27	0.15	0.16	0.77	0.25	0.16	0.15
Average new:												
Share	0.73	0.14	0.12	0.00	0.72	0.15	0.12	0.00	0.72	0.15	0.13	0.00
Quantity	3,731,984	798,843	587,805	8,190	3,293,545	809,961	588,500	8,132	3,879,885	865,463	486,967	7,935
Price	832	547	988	1,018	889	569	990	1,014	828	679	819	966

CHAPTER 6 - Summary and conclusions

The EU is one of the world's biggest importers of bananas and, as such import policies enforced by this trade union are likely to have a great impact on the major producers of bananas. Aiming to protect communitarian producers and exporters from selected ex-colonies of Africa, the Caribbean and Pacific and to honor previous agreements, the EU unified its import policy for bananas in 1993. This policy, known as the Common Market Organization for Bananas, generated one of the most controversial trade disputes in history. After several modifications of the original regime, in January 2006, the EU changed its import regime to satisfy a World Trade Organization mandate and to honor an agreement signed with the United States in 2000.

The controversy generated during and after the enforcement of both import regimes has inspired authors to analyze this market extensively. However, there are still many gaps to fill in the literature that are addressed in this study, especially the lack of adequate estimation of demand parameters and of statistical simulation analysis to test for the significance of the results obtained from the analysis.

The objectives of this project were to provide a detailed overview of the history of the trade dispute, to estimate a theoretically consistent demand system to generate reliable parameters and then to use these parameters in a system-wide welfare analysis of the EU banana market. The latter focused on the impact of the new import policy in the major producing areas as these are the agents that are most likely to be affected by the new import regime. Additionally, Monte Carlo analysis was used to derive sensitivity measures of the welfare and market change estimates.

Analysis of results indicates that on average Latin American and EU communitarian producers benefit from the new regime while ACP exporters will be harmed. However, the sensitivity analysis, which allowed making probabilistic inferences about the statistical significance of these point estimates, indicates that those results are not certain. The hypothesis that the new import regime will not affect the major suppliers of the EU banana market was not rejected. This might indicate that the policy enforced by the Common Market Organization for Bananas and the current tariff-only import regime are statistically equivalent. In other words, the EU expertly forced a tariff level that will leave much as status quo.

Another interesting result is that the duty –free quota allowed to ACP producers is not enough to safeguard the market interests of this region. A higher tariff level, such as that initially proposed by the EU, will no better protect ACP exporters from Latin American competition. Indeed, higher import taxes benefit the through market share losses of the ACP region in the EU banana market.

Based on opinions recently expressed by some Latin American countries regarding their support of the new import regime and on conclusions drawn from the simulation analysis, it seems likely that not all countries will be affected in the same way by the change in import regimes. It would be important for future analysis to determine country-specific effects of the new import regime. This can be achieved by estimating a demand system disaggregated by country to generate country-specific demand elasticitites. This would enable solving a modified equilibrium displacement model where markets are defined as individual countries and not as regions as was done here. Finally, results of the equilibrium displacement model indicate that EU consumers are likely to lose from the new regime due to higher prices and lower quantities. So, future research should also address this issue.

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Appendix A - Variable definition and description

Table A-7-1 Observed variables in Chapter 3 (EU import demand for bananas)

Variable	Name	Description	Unit / base year	Source
i, j	Producing regions	Latin America (Lat) European Union (EU) Africa, the Caribbean and the Pacific (ACP) Rest of the world (ROW)	N/A	N/A
p	Price vector	Annual price vector containing annual import prices from each exporting region *i*	2004 US $ per ton	Computed as the ratio between real import value and quantity imported from each region *i*.
M	Expenditure	Annual total expenditure in bananas in the EU	2004 US $	Computed as the sum of import value from each region

Table continues…

Table continued…

Variable	Name	Description	Unit / base year	Source
w_i	Uncompensated share equation	Share equation for each region *i* estimated based on observed shares, total expenditure *M*, price vector *p* and estimated coefficients.	Percentage	Observed shared computed as the ratio between region's *i* imported value and total expenditure *M*.
ε_{ij}	Uncompensated own price and cross price elasticities	Measure of the sensibility of demand of bananas from region *i* to price changes of bananas from region *j*	Percentage	Computed from the AIDS model parameter estimates
ε_{im}	Expenditure elasticity	Measure of the sensibility of demand of bananas from region *i* to changes in total expenditure *M*	Percentage	Computed from the AIDS model parameter estimates
ε_{ij}^{c}	Compensated own price and cross price elasticities	Measure of the sensibility of demand of bananas from region *i* to price changes of bananas from region *j* isolated of the income effect.	Percentage	Computed from observed shares, uncompensated price and income elasticities
q	Quantity vector	Vector containing imported quantity from each region *i*.	Tons / year	World Trade Annual Report of the United Nations.
f_{ij}	Flexibility	Measure of the sensibility of region *i*'s import price from to imported quantity changes from region *j*.	Percentage	Computed from the IAIDS model parameter estimates.

Table A-7-2 Theoretical variables in Chapter 3 (EU import demand for bananas)

Variable	Name	Description
$V(p,M)$	Indirect utility function	Indicates the maximum utility level that EU consumers can achieved from consuming bananas when spending M dollars given prices p.
$E(p,u)$	Expenditure function	Represent the minimum expenditure necessary to achieve utility level U given the price vector p
w_i^c	Compensated share equation	Share equation obtained from the expenditure function using Shepard's lemma. (Holds utility level constant)
U	Direct utility function	Consumer' s utility derived from the consumption of bananas from all regions

Table A-7-3 Variables used in Chapter 4 (Equilibrium Displacement Model)

Variable	Name	Description	Unit / base year	Source
d_i	EU demand for bananas from each region *i*	Accounts for the quantity imported by the EU from each region *i*.	Tons / year	World Trade Annual Report of the United Nations.
τ_i	Per unit tariff for region i	Import tax paid by each region *i* to enter the EU market.	Euros / ton 2004 US $ / ton	Various
p^p	Vector of producer or exporter prices	Prices of bananas from region *i* at the exporter level.	2004 US $ per ton	Computed as the ratio between real import value and quantity imported from each region *i*.
p^c	Vector of consumer prices	Prices of bananas from region *i* at the consumer level.	2004 US $ per ton	Computed as producer price plus per unit tariff τ_i .
z_i	Vector of *n* demand shifters for demand from region i	Takes into account variables other then prices and expenditure that have an affect on EU the import demand of bananas. AIDS model no shifters	Annual	N/A

Table continues…

Table continued…

Variable	Name	Description	Unit / base year	Source
Δx_i	Total differential of a given variable x_i	Indicates absolute changes in the equilibrium value of the variables that define the EU banana market model (i.e. quantities, prices and policy variables).		$\Delta x_i = x_i^1 - x_i^0$
$\tilde{x}_i$	Proportional change in variable x_i	Change in variable x_i expressed in relative terms.	Percentage	$\frac{x_i^1 - x_i^0}{x_i^0}$
ε_{ij}	Elasticity of demand *i* with respect to changes in price *j*	Measure of the sensibility of demand of bananas from region *i* to price changes of bananas from region *j*	Percentage	From the AIDS and GAIDS models.
μ_i	Expenditure elasticity of demand for region *i*	Measure of the sensibility of demand of bananas from region *i* to changes in total expenditure *M*	Percentage	From the AIDS model.
ζ_{in}	Elasticity of demand *i* with respect to a change in variable $z_{in.}$	Measure of the sensibility of demand of bananas from region *i* to changes in shifter variable z_{in}.	Percentage	From the GAIDS model.

Table continues…

Table continued…

Variable	Name	Description	Unit / base year	Source
η_{ij}	Elasticity of supply *i* with respect to price *j*	Measure of the sensibility of region *i*'s export supply to changes in region *j*;s export price.	Percentage	B. Borrell and Hanslow K.
υ_i	Elasticity of supply i with respect to its tariff	Measure of the sensibility of region *i*'s export supply to changes in its own import quota τ_i .	Percentage	
π_i	Percentage tariff on imports from *i*	Region i's per unit import tariff expressed as a percentage of consumer price.	Percentage	Calculated as the ratio between consumer and producer prices $\frac{p_i^c}{p_i^p}$
M	Parameter matrix	Includes elasticity and policy variables the parameterize the EDM.	Various	Various
X	Endogenous variables	Relative changes in price and quantity for each producing region under the new import regime.	Percentage	Obtained after solving the EDM model.
Y	Market shifters	Policy variables that changed with adoption of the new import system	Various	Change in tariff and equivalent tariff from one import system to the other.

Table A-7-4 Variables used in Chapter 5 (Welfare Analysis)

Variable	Name	Description	Unit / base year	Source, computation
ΔPS_i	Change in producer surplus	How much producer surplus for region *i* changes as result of the new import regime.	2004 US $	Calculated from Equation X (Chapter 5)
q_0	Initial equilibrium quantity in region *i*	Initial equilibrium quantity imported by the EU from region *i* under the old import regime	Tons	World Trade Annual Report of the United Nations.
q_1	New equilibrium quantity in region *i*	New equilibrium quantity imported by the EU from region *i* under the new import regime	Tons	Calculated from the EDM model.
p_0	Initial equilibrium price in region *i*	Initial equilibrium import price from region *i* under the old import regime.	2004 US $ / ton	World Trade Annual Report of the United Nations.
p_1	New equilibrium price in region *i*	New equilibrium import price from region *i* under the new import regime	2004 US $ / ton	Calculated from the EDM model.

Appendix B - Factor pattern SAS code to impose population correlation on Monte Carlo simulated parameters

```
      data A (type=corr);_type_='corr';
            input A1 G12 G13 G14 B1 A0 A2 A3 G23 G24 G34 B2 B3;
      cards;
1     .     .     .     .     .     .     .     .     .     .     .
-6.66E-02   1     .     .     .     .     .     .     .     .     .
-0.1264     -1.76E-03   1     .     .     .     .     .     .     .
-7.72E-02   -6.62E-04   1.02E-02    1     .     .     .     .     .
 7.92E-03   -6.59E-04   -1.27E-03   -7.73E-04   1     .     .     .
-4.45E-03   5.33E-03    1.66E-02    7.88E-03    -1.68E-03   1     .
-0.22786    0.12898     -3.55E-02   -2.11E-02   -2.22E-03   -3.53E-03   1
      .
-0.26809    -4.65E-02   0.1252      1.07E-02    -2.62E-03   -7.04E-03   -0.3191
      .     .
 3.23E-02   -1.13E-02   -1.23E-03   1.72E-03    3.21E-04    -3.00E-03   -5.94E-02   1.17E-02
      .     .     .
 1.82E-02   -3.67E-03   -8.53E-05   -2.67E-03   1.81E-04    -1.52E-03   -1.67E-02   1.01E-02    1.22E-03
      1     .     .     .
 3.97E-02   3.35E-03    -7.89E-03   -9.49E-03   3.98E-04    -4.51E-03   2.79E-02    -2.00E-02   -1.95E-03
      8.11E-04    1     .     .
-2.24E-03   1.27E-03    -3.44E-04   -2.05E-04   -2.24E-05   3.04E-04    6.96E-03    -3.14E-03   -5.85E-04
      -1.64E-04   2.72E-04    1     .
-2.64E-03   -4.53E-04   1.25E-03    1.12E-04    -2.74E-05   9.37E-04    -3.14E-03   5.60E-03    1.13E-04
      9.78E-05    -2.01E-04   -3.06E-05   1
;
proc factor n=13 outstat=facout;/*Stores the factor pattern data into the file facout*/
DATA PATTERN; SET FACOUT;
 IF _TYPE_='PATTERN';
 DROP _TYPE__NAME_;
RUN;
```