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An analysis of the impact of the EU sugar policy reform on ACP countries: a quota market framework

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AN ANALYSIS OF THE IMPACT OF THE EU SUGAR POLICY REFORM ON ACP COUNTRIES: A QUOTA MARKET FRAMEWORK

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ABSTRACT

The pressures for reform within the World Trade Organization have led to the European Union (EU) reforming its sugar policy with a price cut phased from 2006 and scheduled to end in 2009. The reform will have an impact on the sugar protocol African Caribbean and Pacific (ACP) countries that have a preferential market access to the European Union with a protected price. This study investigates the effect of EU sugar policy reform has on these ACP sugar countries.

First, it examines how the protocol countries' sugar supply and demand determinants. While the determinants of supply in some countries performed as expected, others did not show sign of an improvement due to the sugar protocol. On the demand side we found that in some countries price does not affect the decision of the consumer.

Second it explores the protocol countries transfer benefits before and after the reform. Before the reform, the countries were enjoying substantial transfer benefits. After the reform, there are some countries that will no longer be able to make profits by selling to the European Union.

Finally, we develop a quota market analysis to examine negotiated transfer quota outcomes between ACP countries. We allow for the countries that can no longer make a profit to sell their quota rights to the countries that can still make a profit. We assumed equal bargaining powers and unequal bargaining powers. In the equal bargaining power case, total profit is equally divided between seller and buyer. In the unequal bargaining power case, we consider two scenarios. The first scenario where the world sugar price is not affected by EU sugar policy reform revealed that the sellers would have greater bargaining power and a larger share of the profit. The second scenario where the world sugar price is increased by thirty percent revealed that the buyer would exercise superior bargaining power relative to the seller and would have a

larger share of the profit. Buyers can expand their production and sellers can use the revenues to diversify away from sugar.

CHAPTER 1. INTRODUCTION

1.1 General Background

The world sugar market is one of the most heavily protected markets with most producers benefiting from a variety of programs, such as production quotas, supply controls, market sharing, sales quotas, import quotas, imports tariffs, exports subsidies. The European Union is both one of the world's largest exporters and importers of sugar; but it is also one of the world's most heavily protected markets. The EU sugar industry has existed for many years as has the tradition of protection for that industry. Despite changes that have occurred in many EU agricultural sectors due to the Common Agricultural Policy (CAP) reforms, the sugar sector has hardly been touched since its inception in 1968.

Although the European Union remains one of the world's leading sugar producers, it is also a major importer of sugar. Nearly all EU sugar imports occur under special preferential arrangements (Sergey, Lindsay and Donald). This includes the African, Caribbean and Pacific (ACP) sugar group which supplies the largest volume of sugar to the European Union. There are 19 former European colonies (Barbados, Belize, Congo, Fiji, Guyana, Ivory Coast, Jamaica, Kenya, Madagascar, Malawi, Mauritius, Saint Kitts and Nevis, Suriname, Swaziland, Trinidad and Tobago, Tanzania, Uganda, Zambia, and Zimbabwe) that produce sugar and receive preferential access to EU markets. Under the sugar protocol these countries are able to export approximately 1.3 MMT of sugar per year to the European Union at a guaranteed minimum price that is substantially above the world sugar price. This acts to transfer resources from the European Union to ACP countries. The European Union essentially applies its internal sugar policy, consisting of production quotas and guaranteed prices, to the African, Caribbean and Pacific (ACP) sugar group (Herrmann and Weiss 1995).

After being criticized for many years, EU sugar policy faced a ruling in 2004, handed down by the World Trade Organization (WTO), claiming that the European Union's support policy allows European countries to illegally export sugar. The ruling was the result of an investigation motivated by complaints from Brazil, Thailand and Australia, three major sugar producers, who claimed that EU sugar policy was highly trade distorting and would have to be reevaluated if freer trade were to be achieved. In order to comply with the requirement of the WTO panel and to make the EU sugar sector more compatible with the rest of the world, the EU Council reformed its' sugar sector in 2005. This reform involved a progressive reduction in export subsidies and a large cut in the intervention price starting in 2006. The implications of an EU sugar regime adjustment have been projected to be a reduction in the quantity of sugar exported and a fall in the European domestic price of sugar by 36% over a four-year period (20% cut in 2006, 25% in 2007, 30% in 2008 and a 36% cut in 2009).

Reforming EU sugar policy will mean that ACP suppliers will receive the same price cut on exports to the European Union as do EU sugar growers. It is projected, as a result, that ACP suppliers will experience revenue losses.

1.2 ACP Sugar Protocol

The European Union occupies an important place in the world sugar market as both a major exporter (in 2002 the EU was the third largest sugar manufacturer after Brazil and India) and importer. Although tariffs on many agricultural imports are high, the European Union grants preferences to developing countries under a variety of schemes. Currently all EU sugar imports come under special preferential arrangements. These preferential trade arrangements, which are primarily for developing countries, are a key feature of the EU import regime and represent a crucial aspect of the economies of the beneficiaries (Sergey, Lindsay and Donald). Furthermore,

there exist historic ties between certain EU Member States and their former colonies. Since 1975, these arrangements have been incorporated into the Sugar Protocol, agreed between certain developing countries and the EU alongside the wider EU-ACP Partnership Agreement.

The EU sugar regime allows for duty free or for reduced duty imports of both raw and white sugar from these countries (Sergey, Lindsay and Donald). The EU-ACP cooperation can be traced back to the Treaty of Rome that was signed in 1957 and guaranteed to contribute to the growth of the countries with historical connections with EU member states. As part of the UK's accession arrangements, a preferential sugar import program was agreed to with the traditional developing country suppliers. The ACP protocol effectively translated a United Kingdom commitment to the commonwealth into an EU (at the time EEC) commitment to the ACP. The preferential access was reduced from about 2 million tons imported by the UK refineries under the old agreement to 1.3 million tons of raw sugar (Sergey, Lindsay and Donald). The sugar protocol was embodied in the Lomé Convention of 1975. The sugar protocol and a parallel agreement with India allow for the import of 1.3 million tons of raw sugar, white value a year. This tonnage is not subject to import duties and is purchased at the level of the EU support price for raw sugar. In 2000 the Cotonou agreement replaced the Lomé Convention, but sugar arrangements remained practically unchanged (Sergey, Lindsay and Donald).

1.3 Problem Statement

The African, Caribbean and Pacific (ACP) countries and the European Union have mutually benefited from a long and profitable partnership in the sugar sector under the terms of the ACP/EU Sugar Protocol. This agreement, which came into force in 1975, guarantees access to the EU market for fixed quantities of ACP sugar at preferential prices over an indefinite period of time. It is a legally binding, intergovernmental agreement between ACP signatory States and

the European Union with obligations to be met by all contracting parties. The Sugar Protocol is acknowledged by the recipients as a model for cooperation development because, according to involved parties, it has brought significant benefits to the economies of small and vulnerable countries (African Caribbean and Pacific Sugar Group).

Given the WTO ruling and the European Union's intent to reduce both domestic production and exports in order to fulfill its commitments, the guaranteed price that the ACP sugar group will receive will be reduced by 36% as of 2009. In addition to the direct impact on EU sugar farmers and producers, the reform will affect all countries presently benefiting from preferential access, such as the sugar protocol countries. Though the total sugar protocol quota will remain constant at 1.3 million tons, the price cut applies to their exports to the European Union too and will be reflected in reduced export revenues.

Many ACP countries do not have a resilient socio-economic infrastructure capable of absorbing the consequences resulting from such price reductions as do EU member states. The reliance upon sugar in these countries is markedly different from that of producers within the European Union. ACP sugar industries typically comprise a large percentage of Gross Domestic Product while both the employment and social benefits provided by the industries are central to the social cohesion of ACP communities. The dominance of the sugar industry has meant that it is the focal point around which many social services and infrastructure developments have evolved. The most serious impact of the reform may be the loss of health and educational services funded in part by the sugar industry. In summary, there is a serious risk of economic devastation and irreparable damage to the ACP and other less developed sugar countries if the European Union reforms of the sugar sector are implemented. it is important to identify a response to the reform that will limit losses. This analysis looks at how best to ensure the future

well being of ACP sugar suppliers in the new environment arising from EU sugar policy reform.

1.4 Justification

The lack of extensive country specific research on the impact of EU sugar policy reform on ACP has served to stimulate this study. It is important to know the outcome effect on these countries and recommend a judicious solution to deal with the situation, since all are less developed economies. Because the sugar industry is a vital source of jobs and government revenue in most ACP countries, it is important to identify strategies that will further protect the development of their economies and families. The success of these industries is influenced by the trade agreements between the European Union and the ACP countries that have been ongoing since 1975. With EU sugar policy reform, ACP economies will be affected, thus the need to formulate optimal strategies that are not only be consistent with the ruling of the WTO but will also preserve the best interest of the ACP economies is of paramount interest.

This study investigates the effect of the EU sugar policy reform on the ACP sugar group. This is of special relevance, since ACP countries and the European Union have a special trade preference in the form of the sugar protocol. On the other hand, a reform of EU sugar policy will reduce the ACP preferential price and hence, affect revenue transfers that ACP countries were getting. The work is meaningful in that it will identify a possible response to the EU sugar policy reform for ACP countries. Moreover, it will identify the strategy that optimally distributes the benefits of the ACP countries through the utilization of their profit functions.

Despite the fact that the impact of EU sugar policy reform has been a principal concern as of late, not all relevant aspects of the topic have been considered. For instance, the redistribution of quota rights amongst ACP countries has not been studied in detail. Many of the studies have focused on the assessment of revenue losses and identifying potential winners and losers from

the new policy. This paper contributes to the limited literature by extending the work on the implications to explore the effect of a market for the sugar import quota among the ACP countries. A quota market in the ACP sugar producing group would have the advantage of restructuring the quota distribution from being relatively arbitrary to a greater concentration in low cost ACP countries. This would lead to sugar preferences being redirected to more competitive countries. Moreover, high cost producing countries can use the revenues from quota sales to invest in research and production of other enterprises which can lead to those countries becoming more competitive in other activities.

1.5 Objectives

The main objective of this study is to investigate the impact of EU sugar policy reform on revenue transfers to ACP sugar producing countries and to suggest a mechanism for dealing with the situation. The specific objectives are as follows:

1.) To estimate the determinants of the sugar industries in all ACP countries. The structure of each country's model includes behavioral equations for area harvested, yield, and production for sugar cane on the supply side, and per capita consumption and ending stocks on the demand side.

2.) To determine and measure production and transportation costs of sugar for each ACP country. This will be used to evaluate the transfer of profits before the reform and the projected revenue transfer after the entire price cut comes into effect. We will then explore how protocol countries are going to be affected by the reform and determine which countries will likely discontinue their sugar exports to the EU.

3.) To construct a quota market model based on bilateral monopoly theory where countries whose sugar industry cannot survive the EU sugar policy reform sell their quota rights to countries that are more efficient. We apply the model to determine quota allocation, bargaining

powers and the price each country will pay. Using the outcome of the bilateral monopoly model, we will then calculate the profit yielded by each country and contrast it with the reform case in order to show the improvement that the mechanism is going to generate.

1.6 Literature Review

A rich body of literature regarding the ACP-EU sugar protocol has emerged in recent years. All of the studies recognize that the sugar protocol has provided some economic benefits to the ACP countries. Herrmann and Weiss (1995) provided an economic evaluation of the sugar protocol by elaborating on the impacts on prices, trade, export earnings and economic welfare. Using the Newbery and Stiglitz approach, Hermann and Weiss jointly evaluate the sugar protocol's impact on the level and instability of sugar export earnings and computed transfer and risk benefits. Their major conclusion is that the policy has to be evaluated differently from the donor's and the recipient's respective points of view. Focusing on the recipient country's point of view, they found that there is a revenue raising or stabilizing effect created by the sugar protocol. In addition they pointed out that the instability of sugar export earnings was lowered in all but one ACP country. Their third finding was that, in addition to the transfer benefits that ACP countries were receiving, there was a significant portion of the welfare gains that were realized could be attributed to risk benefits.

McDonald (1996) extended the work on the EU sugar policy to explore the implications of a reform for African, Caribbean and Pacific countries. He showed that there are significant reductions in income transfers and that the Caribbean countries plus Fiji and Mauritius bear the heaviest loss. In a similar manner, Milner, Morgan and Zgovu (2004) explored the way in which a reform will affect the transfers of welfare to the ACP countries. The authors take into account the fact that OECD sugar reform can affect both domestic and world prices. They concluded that

while some countries would lose due to decreased transfers, others may gain due to the impact that sugar reform has on world prices. They argue that the differences are due to the uneven allocation of preferential quotas across protocol countries and the highly differential dependence of the countries on EU and non-EU export markets.

The practice of quota leasing has been studied for various commodities. Bureau, Guyomard, Morin and Requillard (1997) develop an analytical framework for evaluating the consequences of a market for quota rights in the EU sugar sector. The theoretical framework they use is based on duality theory and employs the concept of the virtual or shadow price of a rationed good. They show that the equilibrium of the market for a quota is a function of the level of the world price of sugar and that different cases have to be distinguished when analyzing the comparative statics of such a market. They use a simulation to show that marketable quota rights would benefit farmers. Butcher and Heady studied probable quota exchange within a small Iowa area and found that there are some possibilities for income gains (cost savings) by redistributing quotas. They argue that permitting quotas to be traded in a "quota market" would appear to be an expeditious way for allocating quotas so that the efficiency of production will be greater than with ordinary mandatory controls. Babcock and Foster (1992) explain the distribution of economic rents between owners of quota rights and renters under mandatory supply controls and examine how this distribution changes with increases in marginal costs.

There are several variants of the bilateral monopoly model based on a variety of assumptions regarding both institutional setting and bargaining procedure (Truett and Truett). An extensive discussion of bilateral monopoly can be found in the works of. Bowley (1928), Fellner (1947), and Machlup and Taber (1960). These authors describe a solution based on joint profit maximization that would lead to a determinate quantity traded of the intermediate product but

not a determinate intermediate product price. Recently, Blair, Kaserman, and Romano (1989) have reiterated the joint profit maximizing solution. Like earlier writers, they argue that the quantity traded of the intermediate good will be determinate, while its price will be indeterminate. Truett and Truett (1993) use a contract curve approach to establish that the equilibrium price of the intermediate product is determined through a bargaining process between the seller and the buyer and that the optimal solution calls for a joint profit maximization by both the seller and the buyer. Devadoss and Cooper (2000) use an optimal control, dynamic optimization model to simultaneously determine the price and quantity of the intermediate product in a joint profit maximizing bilateral monopoly with equal bargaining power. Dasgupta and Devadoss (2002) also applied a game theoretic model to derive the equilibrium price and quantity of the intermediate product when buyer and seller have unequal bargaining power. Their game theoretic model specifies multi-period contracts with threats and punishments that induce Nash equilibrium for a jointly negotiated price and quantity.

1.7 Dissertation Outline

This dissertation will be organized into five chapters. Chapter 1 has presented the background, research problem statement, justification of the research, objectives of the study and a review of the literature. Chapter 2 will examine the ACP sugar economies. The theoretical framework for the econometric estimation, the transfer benefits determination, and the bilateral monopoly approach will be discussed in Chapter 3. The empirical approach will be conducted to determine bargaining power, prices and quantities traded between the countries, and the results will be discussed in Chapter 4. The summary, conclusions, and suggestions for further research will be included in Chapter 5.

CHAPTER 2. STRUCTURE OF THE EUROPEAN UNION AND ACP COUNTRIES' SUGAR ECONOMIES

2.1. EU Sugar Policy

The European Union's sugar policy uses production quotas, import controls, and export refunds (subsidies) to support producer prices at levels which are well above international prices. The program is financed primarily by EU consumers who pay higher prices than world market prices. The sugar policy began in 1965, as part of the Common Agricultural Policy (CAP) which dates to 1958. Two institutional support prices, "the intervention price" (a floor price) and the "threshold price" (a minimum import price) form a band within which the domestic EU market price moves. The threshold price is meant to ensure that domestic market prices can rise toward a target price without being undercut by third-country imports. If prices fall below this intervention price, then the European Union buys the commodity and stores it until the Commission decides to sell it domestically or export it. These prices vary by country to allow for transportation costs between surplus and deficit areas. Intervention sugar prices have been constant in nominal terms since 1984/85 and have been more than double world market prices during most of the past 20 years. Some countries (e.g., Italy, Portugal, and Spain) have also been allowed to pay national aid to sugar producers which has, in turn, encouraged further production (F.O. Licht, p.518). Import duties are used to prevent lower priced imports from the world market, and export refunds are paid to exporters so as to cover the gap between the EU price and the generally lower world market prices when commodities are sold from intervention stocks. The basic market support system for sugar remains virtually unchanged in the current day as it was initially designed in 1968, despite reforms to the CAP.

2.2. EU Sugar Consumption, Production and Trade

Sugar production, consumption, and trade in the European Union have been highly influenced by

government programs through the Common Agricultural Policy (CAP). Sugar is produced from either sugar cane (2 percent) or beets (98 percent) in almost all of the EU's 25 member states, (with the exception of Luxembourg, Estonia, Cyprus, and Malta). Major sugar producing states are France and Germany, with about 50 percent of total production, followed by Poland, Italy, and the United Kingdom (European Commission, 2004 (b)). Both production and domestic use have significantly increased over time (ERS-USDA, PS&D Tables). Total sugar production and consumption in 1961 was 5,474,000 and 6,312,000 MT, respectively; in 2004, production and consumption totaled 14,358,000 and 17,132,000 MT, respectively. Despite this significant change from 1960 levels, production has remained relatively stable since 1992 and domestic consumption has been nearly constant since the beginning of the 1990s (Figure 2.1). From 1961 to 1981, total exports of refined sugar increased (Figure 2.2). From 1961 to 2004, total exports grew from 1,040,000 to 7,130,000 MT. Exports have exceeded imports since 1977. Imports increased substantially from 1961 to 1974; since 1978, they have been relatively stable and significantly below the volume of sugar exports (Figure 2.2). Total imports, mostly in raw sugar, were 1,900,000 MT in 2004. In general, the EU is a net exporter; however, because of the difference between the high price paid for imports relative to the low price received for exports, a negative trade balance in terms of value has existed since 2002 (European Commission, 2004 (b)).

2.3. Source of Reform

The European Union was pressured by external sources to reform its sugar regime. These pressures were associated with how other trading countries on the world sugar market are affected by the trade distorting effects of EU sugar policy. The major external agent for reform of sugar policies lies in multilateral trade negotiations conducted under the auspices of the WTO.

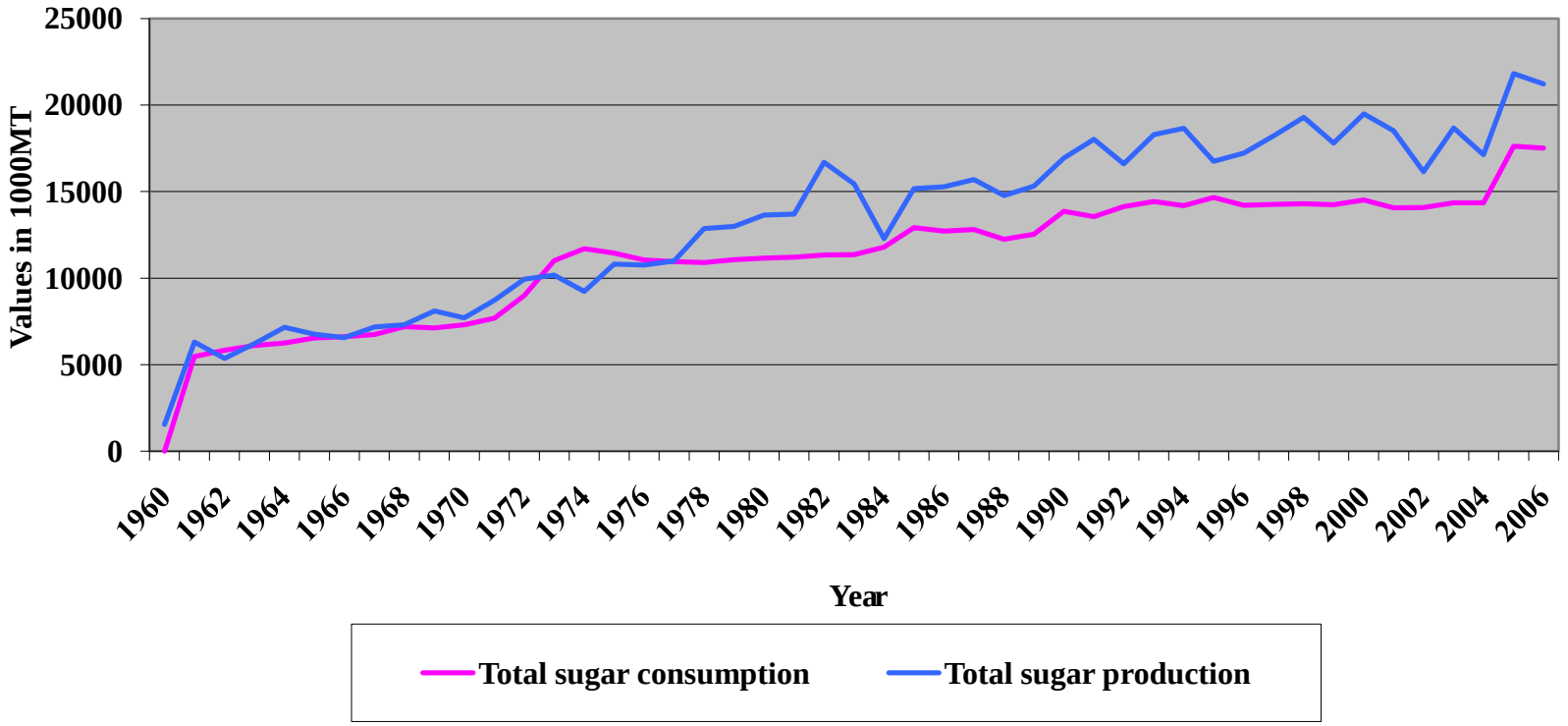

Figure2.1.: EU sugar total production and total consumption 1960-2006

Source: USDA PS&D data

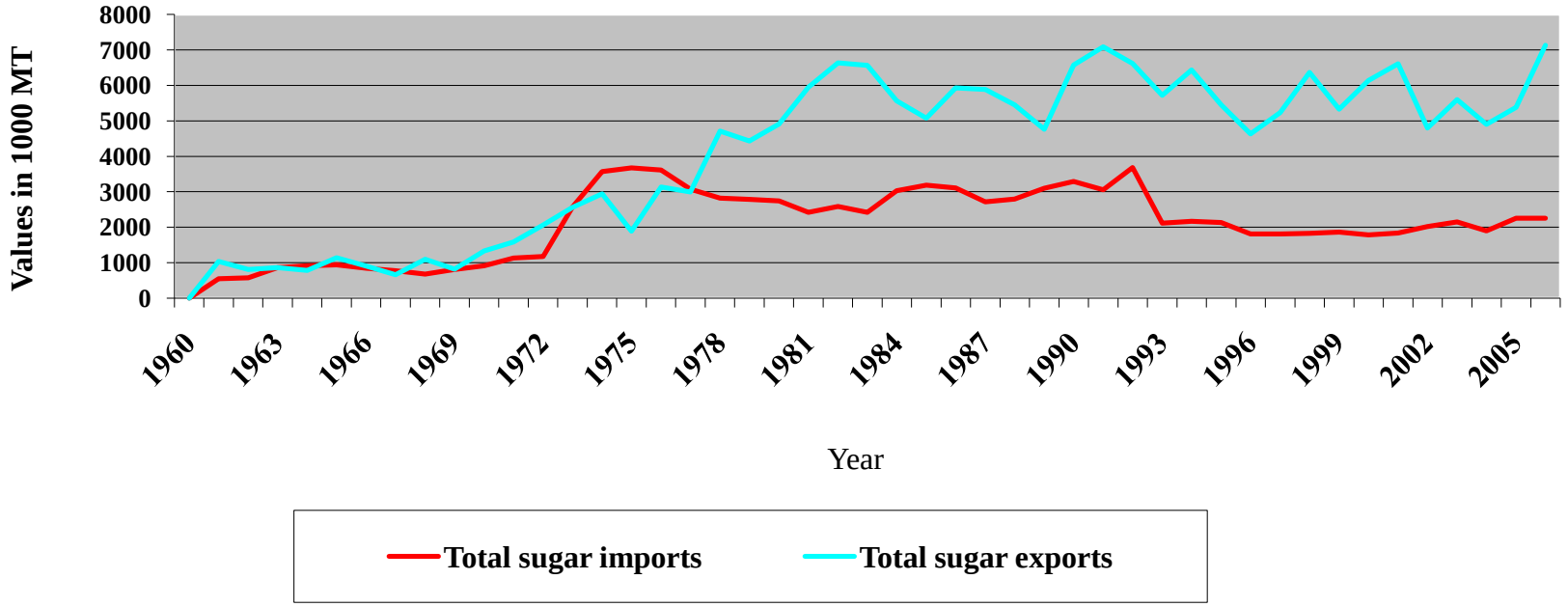

Figure 2.2.: EU total sugar imports and exports 1960-2006

Source: USDA PS&D data

In September 2002, Australia and Brazil filed complaints and requests for consultations with the European Union through the World Trade Organization, concerning the nature of the EU's sugar market. The complaint was that the volume of EU subsidized exports of sugar exceeded the levels the European Union had committed itself to under the World Trade Organization and that this was causing harm by reducing world prices. In 2004, the World Trade Organization, after an investigation, acknowledged the claims made by the three countries and urged the European Union to reform its sugar policy. As expected, therefore, that same year the European Commission considered plans for a radical reform of the sugar regime. It proposed to cut back sugar exports and export refunds substantially, reduce intervention, reduce EU production and the internal sugar price, and grant de-coupled payments to sugar beet farmers. These reforms were to be phased in from 2006 over a period of four years.

The reform is expected to enhance the competitiveness and market-orientation of the EU sugar sector, guarantee it a viable long-term future and strengthen the EU's negotiating position in the current round of world trade talks. In addition, it will bring a system, which has remained largely unchanged for almost 40 years, into line with the rest of the reformed Common Agricultural Policy. The guaranteed price for white sugar will be cut by 36 percent over four years. Other details of the reform are that farmers will be compensated for, on average, 64.2 percent of the price cut through a decoupled payment; countries which give up more than half of their production quota will be entitled to pay an additional coupled payment of 30 percent of the income loss for a temporary period of five years; a generous voluntary restructuring scheme will be established to provide incentives for less competitive producers to leave the sector; and intervention buying of surplus production will be phased out after four years (EUROPA press release, February 2006).

Within these proposals, the commission takes it as granted that the provisions of the ACP sugar protocol continue to commit the European Union to buying the annually agreed quantity of sugar from protocol countries. However, the commission also recognizes that the proposed reforms mean that the commitment would have to be fulfilled at a lower guaranteed price (i.e., the new lower EU intervention price.)

2.4. ACP Sugar Protocol Quota Allocation

Currently, 18 ACP countries plus India participate in the sugar protocol. The core of the agreement is the European Union's obligation to import specific quantities of sugar from these countries' at guaranteed prices derived from the internal EU price and are supposed to equal the price range obtained in the European Union. The protocol also obliges ACP countries to deliver the agreed quantity; failure to deliver for reasons other than "force majeure" leads to a quota loss of the same amount. Sugar represents a high proportion of total agricultural products and is the primary agricultural export of these ACP countries. The European Union is a major outlet for ACP sugar. Quota allocations have remained nearly constant since 1975 for most countries except for Zimbabwe and Ivory Coast which joined the protocol in early 1980.

Table 2.1 and the Charts below present the distribution of the quota and their share of production and export quantities before the price cut came into effect. The sugar protocol is a way by which the European Union provides transfer assistance to its old colonies.

Sugar protocol countries are a rather heterogeneous group with diverging production levels and different degrees of dependency on the EU market. Figure 2.3 shows that there are five countries that receive the majority of the quota. Mauritius receives by far the largest delivery rights with nearly forty per cent of total quota, followed by Fiji, Guyana, Jamaica and Swaziland. Together, these five countries capture almost eighty per cent of the total quota, whereas

Table 2.1. : ACP Sugar Protocol quota distribution

Countries	Quota	Production 05	Exports 05	Share of total quota	Share of 05 production	Share of 04 exports
Barbados	50312.00	40000	35872	3.8	125.8	140.3
Belize	40349.00	105000	95007	3.0	38.4	42.5
Congo	10186.00	75000	51624	0.8	13.6	19.7
Ivory Coast	10186.00	140000	28924	0.8	7.3	35.2
Fiji	165348.00	330000	303039	12.4	50.1	54.6
Guyana	159410.00	270000	209043	12.0	59.0	76.3
Jamaica	118696.00	184000	118905	8.9	64.5	99.8
Kenya	10000.00	489000	21760	0.8	2.0	46.0
Madagascar	10760.00	26000	8852	0.8	41.4	121.6
Malawi	20824.00	260000	104166	1.6	8.0	20.0
Mauritius	491031.00	600000	539457	36.9	81.8	91.0
St. Kitts	15591.00	15000	11478	1.2	103.9	135.8
Swaziland	117845.00	598000	538887	8.8	19.7	21.9
Tanzania	10186.00	255000	20149	0.8	4.0	50.6
Trinidad	43751.00	35000	35201	3.3	125.0	124.3
Zambia	26987	250000	153487	2.0	10.8	17.6
Zimbabwe	30225	525000	149458	2.3	5.8	20.2
Total	1331687.00					

Source: ACP Sugar Website, FAS PS&D data and own computation

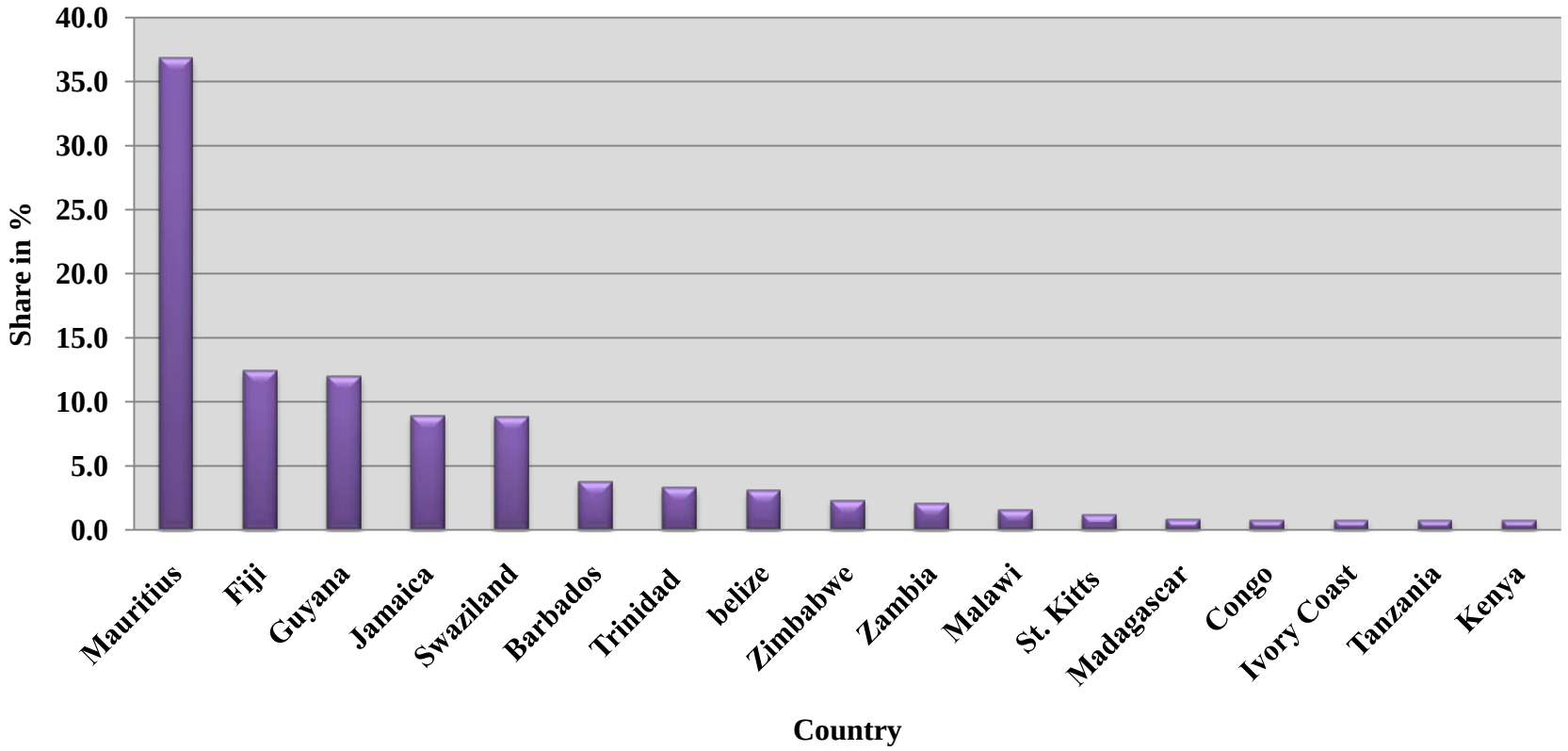

Figure 2.3.: ACP sugar quota share of total quota 2005

Source: ACP Sugar Web Site

the remaining ten ACP countries receive less than five per cent of the quota.

Figure 2.4 shows that countries such as Barbados, Trinidad, and St. Kitts, saw their 2005 production fall short of the quota that they were allocated (their sugar quota amount was more than 2005's total production). Other countries for which their quota accounts for a major proportion of their sugar production are Mauritius (81.9%), Jamaica (64.5%), Guyana (59%), Fiji (50.1%), Madagascar (41.4%), and Belize (38.4%). These proportions suggest that these countries will have a high dependency on the sugar protocol. The other countries will be less dependent on the sugar protocol.

Information on the quota share of 2005 exports for each country is also provided in Figure 2.5 above. Linking the two figures, the dependency of the countries on the Sugar Protocol can be seen. Countries like Mauritius and Jamaica, for example, export almost all their sugar to the European Union, since EU prices are above world market prices and their quotas are relatively high. Other sugar protocol countries, such as Swaziland, Zambia, or Zimbabwe, which are important sugar producers as well, have much lower quotas and thus a lower dependency on EU markets. Nevertheless, the sugar protocol offers most ACP countries an interesting marketing alternative with favorable conditions that plays a substantial role in their economies. Some ACP countries such as Congo, Cote d'Ivoire and Tanzania produce more than their quota but their exports show that they did not fulfill their quota quantity for that year. There is an uneven allocation of the preferential quotas across protocol countries. That is reflected in the fact that the distribution is not proportional to the production capacity of each country. However it can be seen that, for the most part, the quota accounts for a significant share of the exports for these countries. This supports the statement that the sugar protocol is a large source of revenue for these countries.

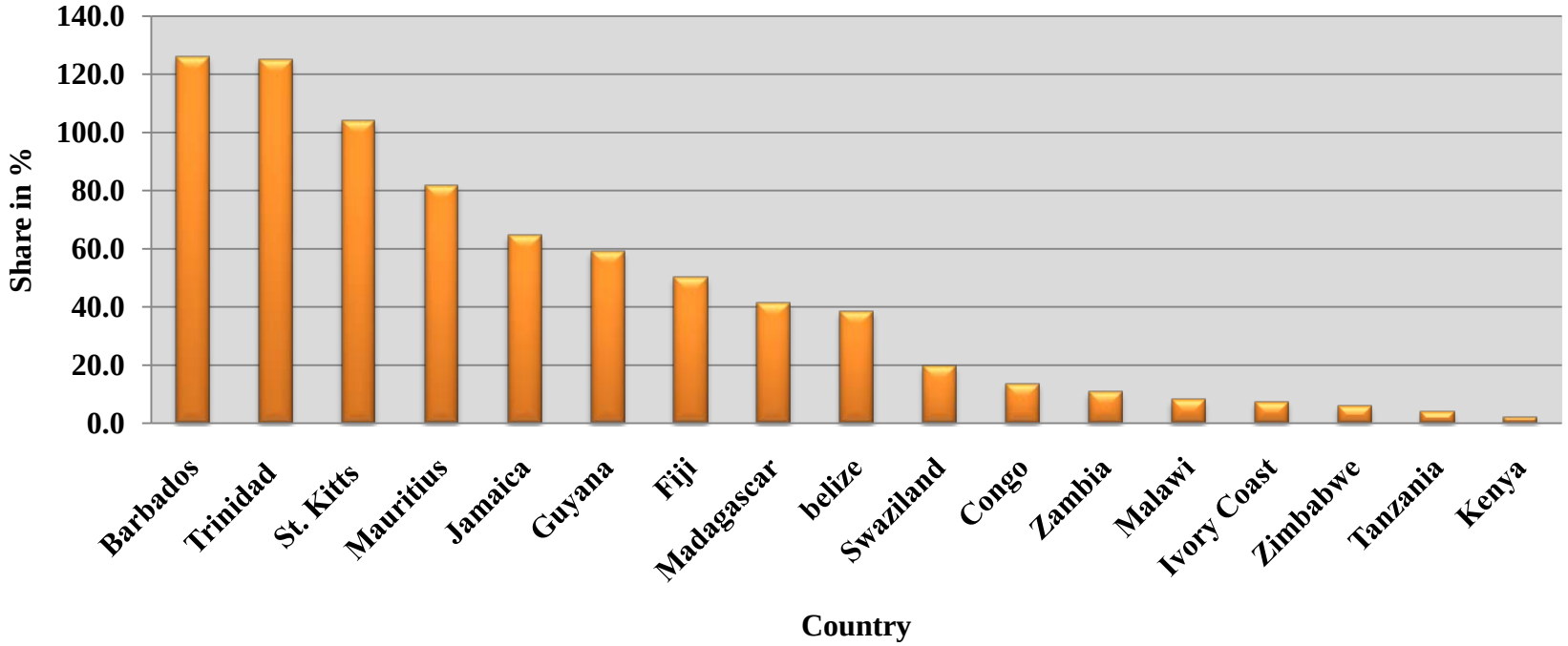

Figure 2.4.: ACP sugar quota share of 2005 production

Source: ACP Sugar Web Site and USDA/FAS PS&D Data

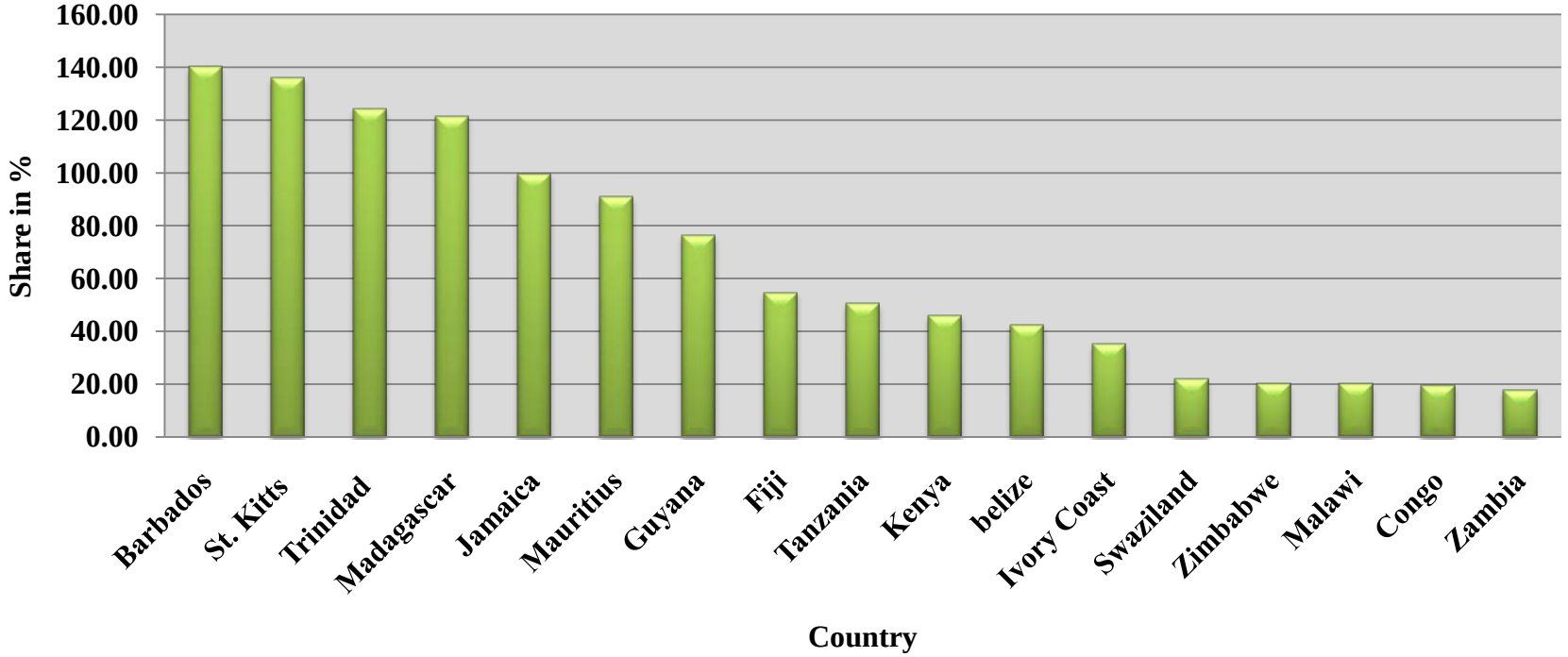

Figure 2.5.: ACP sugar quota share of 2005 sugar exports

Source: ACP Sugar Web Site and USDA/FAS PS&D Data

2.5. ACP Sugar Industry Cost Structure

Cost estimates are important in understanding the dynamics of sugar markets and for assessing the competitiveness of sugar producing countries. In our analysis, we use these estimates as benchmarks to gain insight into the vulnerability and resilience of the sugar producing countries at alternative price levels. In analyzing cost, we considered both transportation and production cost. It was difficult to construct a complete data set on transportation and production cost for the ACP countries. Estimation was not possible because a time series data set of the variables that needed to be used was not available. As a result, we had to settle for data based on these computations. Two sources were used in computing the cost data set. For production costs, we used the USDA attaché reports and for transportation costs we used a data set that LMC International was willing to share. LMC International is a British consultancy that is internationally recognized for its expertise on sugar. It works on cost of production issues and regularly updates variable costs for a wide variety of producers worldwide; however most of the figures are not published. What we did was to use the available data and the determinants of each variable to use as proxies for specific countries for which we could not obtain the data.

2.5.1. Transportation Costs

2.5.1.1. Freight Rates

Freight is represented by the average cost of sea freight to EU ports in the first half of 2007. Out of the seventeen countries, data was obtained for ten. LMC reports that all southern African countries ship from either the ports of Maputo or Beira in Mozambique and therefore have the same or similar rates. Following this rationale, freight rates are derived for the remaining seven countries based on the assumption that countries from the same region are shipping from the same port, and hence, all have the same rates. Table 2.4 shows the detailed computation.

2.5.1.2. Fobbing Costs

'Fobbing' refers to the cost of taking raw sugar from the mill to a free on board (f.o.b) basis (i.e. loaded on a vessel in the port of origin). Here, again, we were given the fobbing rates for the same ten countries as with the freight rates. Using those rates in association with the factors that explain differences in transport costs we were able to derive the fobbing rates for the remaining seven countries. The first and most studied determinant that we considered is distance (Table 2.2). Many studies have explored the relationship between geographical distance and transport costs and most conclude that there is a positive link between the two variables. The greater the distance between two locations, the higher the expected transport cost. The second factor considered is country characteristics, which relates to geographical and infrastructure measures (Table 2.3). For geographical measures, we consider whether the country of origin is landlocked or whether it is an island. In the case of the infrastructure measure, we look at the density of the road network, the paved road network, and the number of per capita telephone main lines in order to measure the cost of travel in and through a country. The next factor that we consider is whether the countries involved share a common border. Following Limão and Venables, we consider that neighboring countries have more integrated transport networks that should reduce the number of transshipments (from rail to road or across different types of rail gauge). Also, neighboring countries are more likely to have transit and customs agreements that reduce transit times and translate into lower shipping and insurance costs. Finally, the higher volume of trade between neighbor countries should dramatically increase the possibilities for backhauling allowing for the sharing of fixed costs over two trips. Details of the fobbing data are presented in Table 2.4.

2.5.2. Production Costs

Production costs were derived using the USDA/ERS sugar and sweetener situation outlook reports and data from the World Bank (International Development Magazine (IDM)). Both sources used the estimates published by LMC International but did not report detailed results for specific countries. According to the USDA ERS report, LMC considers three different stages in the estimation of the sugar cane cost of production. The first comprises field costs. It covers land preparation before planting to the delivery of cane to the processing mill. Estimates are made for labor, capital, and all fuel, chemicals, and fertilizers used in the field. The second stage is the factory costs. For sugarcane, this covers all costs from the initial arrival to the delivery of raw sugar into bulk storage at the mill. In addition, all byproduct credits are applied against factory costs. As with field costs, estimates are divided into their respective labor, capital, fuel and chemical components. The third stage represents administrative and overhead costs that cannot be adequately included solely as a field or factory expense. The results that the USDA reported show the average cost of producing raw cane sugar for the groups of countries. In the September 2001 sugar and sweetener situation and outlook (USDA, ERS), it was reported that Zambia and Zimbabwe are among the lowest cost sugar producers with an average cost of just 7.81 cents per pound (172.18$/Ton) for the years 1994-1999 . Another report from the same source shows that Belize and Guyana are in the medium to high cost group with an average of 16.54 cents per pound (364.64$/Ton). The same report puts Barbados, Jamaica, St Kitts and Nevis and Trinidad and Tobago in the high cost group with an average of 23.56 cents per pound (519.41$/Ton). Using pertinent information obtained from the World Bank, we were able to determine a grouping of the countries based on their average raw sugar production costs.

Low cost producers: Zimbabwe, Malawi, Zambia, Swaziland

Medium to High cost producers: Fiji, Guyana, Mauritius, Belize, Congo, and Tanzania

High cost producers: Ivory Coast, St. Kitts and Nevis, Barbados, Jamaica, Kenya, Madagascar, Trinidad and Tobago.

A detailed computation is shown in Table 2.4 and Figure 2.6 below.

2.5.3. Summary

The production cost of sugar in the ACP countries ranged from 673 $/T to 263 $/T in 2005. These costs are low to slightly high when compared to many other sugar producing countries in the world. Countries like Trinidad and Tobago, Madagascar, Kenya, Jamaica, Barbados, St. Kitts and Nevis, Ivory Coast, were already struggling to produce sugar at a competitive price. These production costs are very important because they will be used to assess the profitability of the sugar production in each country. For simplicity, we assume that these values will be the same when the final price cut is implemented. The break-even, before and after the reform, were also reported in Table 2.2. Based on these results, we can see that, before the reform, all ACP countries could profitably export to the European Union. Although some countries are not as profitable as others (the break-even for Trinidad is 7.1$/T while Zimbabwe is making a profit of 417$/T), it is clear that the sugar protocol played a significant role in the economies of the ACP countries. After the final price cut, the EU price will be reduced by 36%. The computation of the resulting break-even prices is summarized in Table 2.2. Estimates show some concerning results as all ACP countries will suffer a loss. Moreover, out of the seventeen countries, only seven are able to obtain a positive profit with their transfer expected to decrease substantially. The heaviest losses will occur in those ACP countries that had a large share of the quota but were high cost producers (i.e., those that were more dependent on the Sugar Protocol).

Table 2.2. Geographical distance

Country	Capital	Distance (mile)
Congo	Brazzaville	1813.31
Mozambique	Maputo	0
Madagascar	Antananarivo	1068.55
Uganda	Kampala	1731.85
Kenya	Nairobi	1659.03
Trinidad	Port of Spain	379.96
Guyana	Georgetown	0
Barbados	Bridgetown	479.54
St. Kitts an	Basseterre	831.83

Source LSU AgCenter GIS Lab

Table 2.3. ACP countries Geographical and infrastructures measures

Country	Geographical	Paved (Km)	unpaved (Km)	Total/ rank (Km)	Main line/rank
Barbados	Island	1,600		1600 (177)	134900 (133)
Belize	Port	575	2,432	3007 (167)	33900 (176)
Congo	Landlocked	2,794	150,703	153497 (34)	9700 (205)
Fiji	Island	1,692	1,748	3440 (164)	108400 (139)
Guyana	Port	590	7,380	7970 (142)	110100 (138)
Ivory Coast	Port	6,500	73,500	80000 (60)	730000 (89)
Jamaica	Island	15,937	5,615	21552 (109)	342000 (113)
Kenya	Port	8,933	54,332	63265 (74)	264800 (119)
Madagascar	Island	7,617	58,046	65663 (70)	133900 (134)
Malawi	Landlocked	6,956	8,495	15451 (123)	175200 (127)
Mauritius	Island	2,028		2028 (173)	357300 (106)
St. Kitts & Nevis	Island	163	220	383 (198)	25000 (182)
Swaziland	Port	1,078	2,516	3594 (161)	44000 (165)
Tanzania	Port	6,808	72,083	78891 (61)	165013 (128)
Trinidad & Tobago	Island	4,252	4,068	8320 (140)	323800 (115)
Zambia	Landlocked	20,117	71,323	91440 (55)	91800 (146)
Zimbabwe	Landlocked	18,481	78,786	97267 (46)	344,500 (112

Source : CIA Factbook

Table 2. 4. ACP Production cost and Break even prices before and after reform

Country	Prod Cost $/Ton	Fobbing $/Ton	Freight $/Ton	Total costs $/Ton	EUP 05 $/Ton	EUP 09 $/Ton	PreR-BE $/Ton	PostR-BE $/Ton
Barbados	520	15	61	596	680.13	435.32	84.13	-160.7
Belize	330	36	61	427	680.13	435.32	252.9	8.1
Congo	345	64	65	474	680.13	435.32	206.1	-38.7
Fiji	300	8.5	67	375	680.13	435.32	305.1	60.3
Guyana	310	6	61	377	680.13	435.32	303.5	58.7
Ivory Cost	450	10	65	525	680.13	435.32	155.1	-89.7
Jamaica	550	23	61	634	680.13	435.32	46.4	-198.4
Kenya	500	70	65	635	680.13	435.32	45.1	-199.7
Madagascar	575	30	65	670	680.13	435.32	10.1	-234.7
Malawi	215	64	65	344	680.13	435.32	335.9	91.1
Mauritius	335	17	57	409	680.13	435.32	270.8	26.0
St. K&N	475	20	61	556	680.13	435.32	124.1	-120.7
Swaziland	275	30	65	370	680.13	435.32	310.1	65.3
Tanzania	335	30	65	430	680.13	435.32	250.1	5.3
Trinidad	600	12	61	673	680.13	435.32	7.1	-237.7
Zambia	245	92	65	402	680.13	435.32	278.1	33.3
Zimbabwe	154	44	65	263	680.13	435.32	417.0	172.2

Source: LMC, World Bank and own computation

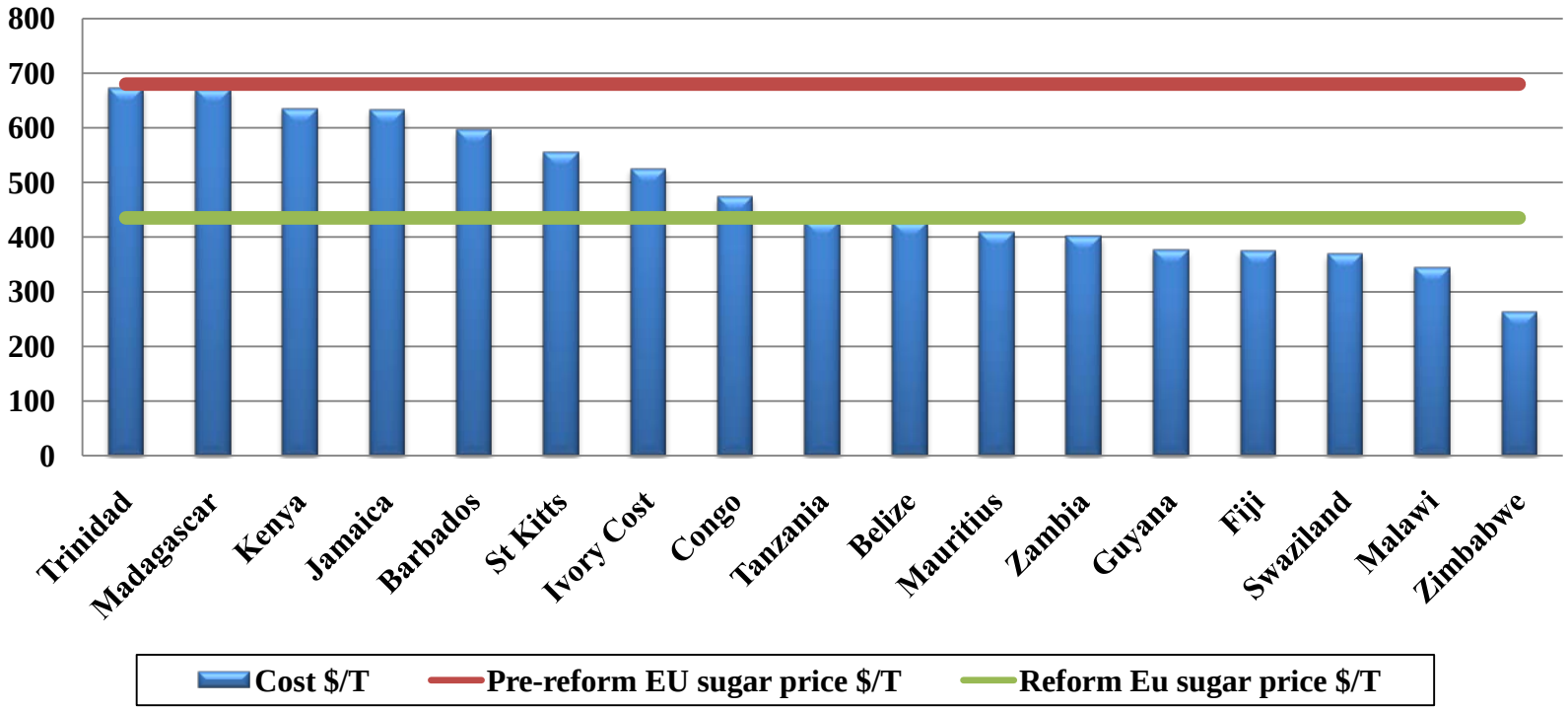

Figure 2.6.: ACP production cost and EU Pre and post-reform prices

Source: LMC, World Bank

CHAPTER 3.THEORETICAL FRAMEWORK AND METHODOLOGY

3.1. Theoretical Framework

3.1.1. Supply and Demand Specification

Supply and demand are based on consumer and producer behavior and describe market relations between prospective sellers and buyers of a good. These relationships are the fundamental basis of microeconomic analysis and are used as the underlying foundation for numerous economic models and theories. For example, in a competitive market the equilibrium will be reached when the quantity demanded by consumers is equal to the quantity supplied by producers. The theory of supply and demand is critical in that it allows economists to understand the market economy by explaining the mechanism by which resource allocation decisions are made. An important concept in understanding supply and demand is that of *elasticity*. The elasticity is a measure of the relative change in supply or demand in response to a relative change of certain variables.

3.1.1.1. Consumer Theory

Economic theory presents demand as the relationship between the price of goods and services and the particular quantity demanded at each price which is based on the theory of consumer choice. The quantity demanded is the quantity of goods or services that a consumer or group of consumers plan to buy at a certain price and time. There are two main factors that influence the demand for a good: taste and ability to buy. Taste, which is the relative desirability of various combinations of goods and services, determines the willingness to buy goods or services at a specific price. Ability to buy means that an individual must possess sufficient wealth or income in order to purchase the goods or services at specific prices. Both factors of demand depend on the market price.

Consumer behavior is analyzed through utility maximization subject to a budgetary constraint.

According to this theory, an individual has a utility function, $U(x)$, which is a function of non-negative commodity vectors, $x = (x_1, x_2 \ldots x_n)$, and seeks to maximize U(x) subject to their budgetary constraint. There is a set of commodities that can achieve utility maximum given the budget constraint, $B(p, w) = \{x \in X \mid p \cdot x \leq w\}$, where p represents prices and w represents wealth. Assuming that prices and wealth are strictly positive, the consumer's problem can be written as:

$$\underset{X \geq 0}{Max}\, U(x) \quad s.t. \;\; p \cdot x \leq w. \qquad (3.1.1)$$

Since this is a constrained maximization problem, the Lagrangian method can be used. The Lagrangian can be written as:

$$L = U(x) + \lambda (w - p \cdot x) \qquad (3.1.2)$$

Where λ is the Lagrange multiplier associated with the budget constraint.

This implies Kuhn-Tucker first-order conditions (FOC) of:

$$U_i (x^*) - \lambda^* p_i \leq 0 \text{ and } x_i (U_i (x^*) - \lambda^* p_i) = 0 \text{ for i} = (1,..., L)$$

$$w - p \cdot x^* \geq 0 \text{ and } \lambda^* (w - p \cdot x^*) = 0 \qquad (3.1.3)$$

Let x^* be the utility maximizing commodity vector. If prices and wealth were different, the utility maximizing point would have been different. For this reason, the endogenous variable, x^*, is written as a function of prices and wealth, $x(p, w) = (x_1 (p, w), x_2 (p, w)..., x_L (p, w))$. This function gives the utility maximizing bundle for any values of p and w, $x(p, w)$ and is called the consumer's demand function. A consumer's demand function represents the amount that a consumer will purchase as a function of prices and available income (Luenberger, 1995). When the market price for a product is high, subsequent demand will be low. When price is low, subsequent demand is high. At depressed prices, many consumers will be able to purchase a

product. However, people usually only want a limited amount of any one particular good. The law of diminishing marginal utility states that acquiring additional increments of a good or service in some time period will contribute decreasing levels of satisfaction. As a result, the demand for a product at low prices is limited by taste and is not infinite even when the price equals zero. As the price increases, the same amount of money will purchase fewer goods. When the price of a good is very high, the demand will decrease because, while consumers may have a strong desire to purchase a product, they are limited by their ability to buy.

3.1.1.2. Producer Theory

Supply is the relationship between the price of a good and the quantity supplied by producers. In many ways, supply is analogous to demand. Willingness and ability to supply goods determine the seller's actions. Just as consumers constitute the demand side of the product market, firms represent the supply side. A firm is an economic agent that converts factors of production (land, labor, and capital) into goods and services. In the process, firms make numerous decisions including what to produce, how much to produce, what inputs to purchase, and what technology to use to produce their product. Economists model a firm's decisions with the goal of maximizing profit. Every decision impacts the benefits to a firm, and is typically measured in terms of revenue but also entails cost. The difference between the revenue generated from a decision and the cost incurred is the profit earned from adopting that particular decision. This general concept is the same regardless of the decision being analyzed. It is important to accurately measure the benefits and the costs of various decisions. There are two types of costs that firms incur. Variable costs are those costs that change directly with output. Fixed costs are those costs that the firm incurs regardless of how much or how little it chooses to produce. Total cost is the sum of variable and fixed costs. Another useful measure that helps firms determine

their level of production is marginal cost, which is the change in total cost after producing an additional unit of output. In general, profit maximizing firms will produce output until their marginal cost is just equal to their marginal revenue. At this point, the firm's profit is maximized, although it is not guaranteed to be positive.

Producer theory is based on profit maximization. According to this theory, producers will choose from among all possible alternatives that strategy which maximizes earned profits. In that case, a firm that is seeking to produce a quantity, q, of an output will look for the set of inputs, z, that maximizes its profit. The relationship between q and z is given by $q = f(z)$. The profit maximization problem can be written as:

$$\underset{Z\geq 0}{Max}\ pq - w.z \quad s.t: f(z) \geq q. \qquad (3.1.4)$$

Where $p>0$ is the price of the output and $w = (w_1, w_2,\ldots, wn) \geq 0$ the n prices of the inputs z. Since $p>0$, the constraint is always binding and equation 3.1.4 can be rewritten as an unconstrained maximization:

$$\underset{Z\geq 0}{Max}\ pq - w.z \qquad (3.1.5)$$

This can be translated as the maximization of the difference between the revenue the firm generates from sales, and the total cost of sold output.

The Kuhn-Tucker first order conditions to maximize (3.1.5) can be derived as follows:

$$Pf_i(z^*) - w_i \leq 0$$

$$Pf_i(z^*) - w_i = 0 \text{ if } z_i^* > 0, \forall i \qquad (3.1.6)$$

$f_i(z^*)$ is the marginal product of input z_i, and indicates the amount by which revenue increases if input z_i is increased by a small amount. Thus $Pf_i(z^*)$ is the amount by which revenue increases if z_i is increased by a small amount and is also referred to as the marginal revenue product. The optimality condition means that the increase in revenue due to a small increase in z_i must be less

than the increase in the cost and that when $z_i^* > 0$, then the increase in revenue must exactly equal the increase in cost.

If we consider two inputs z_i^* and z_j^* that are strictly positive, 3.1.6 can be rearranged to give:

$$f_i(z^*)/ f_j(z^*) = \frac{W_i}{W_j} \qquad (3.1.7)$$

This means that the marginal rate of technical substitution between two inputs is equal to the ratio of their price. In addition 3.1.6 can be restated as:

$$pf'(z^*) = w \text{ or } f'(z^*) = \frac{W}{P} \qquad (3.1.8)$$

Solving this problem will lead to the factor demand function $z(w, p)$ which shows how much of the inputs are used at prices p and w. If $z(w, p)$ is inserted into the production function $q = f(z)$, it gives $q(w,p) = f(z(w,p))$, known as the supply function.

At higher prices, more quantity of that respective commodity will be available to buyers. This is because suppliers will be able to maintain a profit despite the higher costs of production that may result from short-term expansion of their capacity. In a market, when the inventory is less than the desired inventory, manufacturers will raise both the supply of their product and its price. The short-term increase in supply causes manufacturing costs to rise, leading to a further increase in price. The price change in turn increases the desired rate of production. A similar effect occurs if inventory is too high. Neoclassical economic theory approximates this complicated process through the supply curve.

3.1.2. Bilateral Monopoly-Theory Review

A bilateral monopoly situation is said to arise when there is a single seller and a single buyer of a particular commodity. The seller produces an intermediate product and sells it to the buyer who

uses it as an input in producing a final output (Gervais and Devadoss). There has been a historical divergence of opinion concerning the correct outcome under bilateral monopoly and a clear consensus has yet to emerge. The major source of confusion stems from a failure to recognize the importance of joint profit maximization through negotiation on both the price and the quantity of the intermediate good (Blair, Kaserman, and Romano). The description of a bilateral monopoly characterizes quite well the quota market which this analysis seeks to model. Suppose that countries which are no longer competitive under the prevailing EU price (quota sellers) stop producing and instead sell their quota rights to the countries that can still make profit (quota buyers). These quota rights serve as an intermediate product for the buyer who will then use it to produce the final output, which is sugar. Because the ACP sugar protocol is between the EU and a specific number of countries, the sellers possess the quota and are the only ones that can sell them. Likewise, there are a limited number of buyers.

The general model is defined as follows: The seller has *q* amount of the intermediate product available to sell to the buyer who will use it to produce *y* amount of output. One unit of *q* allows for the production of one unit of *y*. Per unit prices of *q* and *y* are respectively, *p* and *r*. The seller's profit π_s and the buyer's profit π_b are given by

$$\pi_s = pq - c_1(q) \qquad (3.1.9)$$

$$\pi_b = rf(q) - c_2(q) - pq \qquad (3.1.10)$$

Where $c_1(q)$ represents the seller's cost function, $c_2(q)$ is the buyer's cost function and $f(q)$ represents buyer's production function.

Four different cases can arise in the determination of equilibrium quantity and price:

1- The monopoly case in which the seller dominates the market and makes the buyer accept his price and quantity decisions.

2- The monopsony case in which the buyer dominates the market and forces the seller to follow his price and quantity decisions.

3- Collusion by the seller and the buyer in which they determine the equilibrium quantity and price by maximizing their joint profit.

4- Noncooperation by the seller and the buyer which results in market failure.

Let us examine each case individually:

Monopoly Case

Suppose the buyer can dictate the price of the intermediate product: The seller will offer q units so that q maximizes $pq - c_1(q)$, p being given.

$$\underset{p}{Max}\,(pq - c_1(q)) \qquad (3.1.11)$$

$$\frac{d\pi s}{dq} = p\text{-}c_1'(q) = 0 \Rightarrow p = c_1'(q) = \text{Offer schedule} \qquad (3.1.12)$$

The seller's gain would then be $c_1'(q)\,q - c_1(q)$ (3.1.13)

The buyer who is then limited by the seller's offer schedule and demand for y dictates p which will maximize $rf(q) - c_2(q) - pq = rf(q) - c_2(q) - c_1'(q)\,q$

$$\frac{d\pi b}{dq} = rf'(q) - c'_2(q) - c'_1(q) - q\,c''_1(q) = 0 \qquad (3.1.14)$$

This equation is solved for q^* and the value of q^* is replaced in the offer schedule to obtain p^*. We can now determine the gain to the buyer which is $rf(q^*) - c_2(q^*) - p^*q^*$.

Monopsony case

Suppose the seller of the intermediate product can dictate its price p to the buyer. The buyer maximizes its profit $rf(q) - c_2(q) - pq$ for a given p.

$$\frac{d\pi_s}{dq} = rf'(q) - c'_2(q) - p = 0 \Rightarrow p = rf'(q) - c'_2(q) = \text{demand schedule} \qquad (3.1.15)$$

The buyer's gain is then $rf(q) - c_2(q) - (rf'(q) - c'_2(q))q$. (3.1.16)

The seller, who is then limited by the buyer's demand schedule and his own cost schedule, dictates the value of p which will maximize $pq - c_1(q) = (rf'(q) - c'_2(q))$ q - $c_1(q)$

$$\frac{d\pi_s}{dq} = (rf''(q) - c''_2(q))q + (rf'(q) - c'_2(q)) - c'_1(q) = 0 \quad (3.1.17)$$

This equation is solved to determine q^* and the value of q^* is replaces q in the demand schedule to obtain p^*.

We can now determine the seller's gain: $p^*q^* - c_1(q^*)$

Collusion

Suppose that the buyer and the seller of a quota combine to maximize their joint gain through bargaining. Many authors reported that optimality in the case of a bilateral monopoly requires joint profit maximization. Henderson and Quandt argue that the bargaining process can be separated into two steps. First, participants determine a quantity that maximizes their joint profit, and then, secondly, determine a price that distributes the joint profit among them.

Joint profit is given by:

$$\pi = \pi_s + \pi_b = [rf(q) - c_2(q) - pq] + [pq - c_1(q)] = rf(q) - c_2(q) - c_1(q) \quad (3.1.18)$$

Joint profit maximization provides only the optimum quantity. Price has to be determined through negotiation.

$$\frac{d\pi}{dq} = rf'(q) - c'_2(q) - c'_1(q) = 0 \Rightarrow rf'(q) - c'_2(q) = c'_1(q) \quad (3.1.19)$$

Equation (3.1.19) shows that the optimal collusive output, q^*, is obtained by equating the seller's marginal cost to the buyer's marginal value product. For the prescribed quantity, the seller desires the highest possible price and the buyer desires the lowest possible price. Price cannot be

set beyond the price that would force the buyer's profit to zero which is equal to $\frac{rf(q) - c_2(q)}{q}$ and represents the upper limit and the condition that would force the seller's profit to zero is equal to $\frac{c_1(q)}{q}$ and represents the lower limit because a negative profit would force one of the firms to discontinue operations. The determination of a specific price within the bargaining limits will depend upon the relative bargaining power of the buyer and seller (Henderson and Quandt).The incentive to pursue joint profit maximization arises because joint profits are not maximized at either of the two boundaries solutions presented in the above standard analysis (Blair, Kaserman, and Romano).

Non-cooperation

This is the case where neither seller nor buyer is willing to behave as a price taker which may lead to market breakdown.

3.2. Methodology

3.2.1. Supply and Demand Estimation

The Nerlove model has been widely used to examine supply and demand responses to price and other incentives. Nerlove (1958) distinguished between short-run and long-run supply and demand elasticities and argues that it is impossible to measure the short-run elasticity of supply or demand and that the long-run elasticity can be measured under special conditions. He concludes that there is no unique short-run elasticity of supply or demand with respect to price or any other variable because short-run elasticity differs depending on the position from which we start and the length of time we allow for adjustment. He goes on to point out that "whenever it takes time for producers or consumers to adjust to changed conditions and wherever the period which is required for full adjustment exceeds the interval of observation, then statistical

relationships among observations on the relevant variables, each of which is taken at the same time, tell us little about the long-run elasticity or any of the short-run elasticities." A distributed lag model was introduced as a suitable method for analyzing dynamic models of consumer and producer behavior. The Nerlove models of demand and supply are, respectively:

$$Qt = a\gamma P_t + b\gamma Y_t + (1 - \gamma)\, Q_{t-1} + c\gamma \quad (3.2.1)$$

$$X_t = d\gamma P_{t-1} + (1 - \gamma)\, Xt_{-1} + e, \text{ where} \quad (3.2.2)$$

With *Qt* represents Current quantity consumed or its logarithm, P_t represents Current price or its logarithm, P_{t-1}represents Price of the commodity lagged one year, Y_t represents Current income or its logarithm, γ represents Constant of proportionality which is the elasticity or coefficient of adjustment according to whether quantity is expressed in logarithms or not, *a* and *d* represents Long-run price elasticity, *b* represents Long-run income elasticity, *c* represents Constant, X_t represents Current planned output, Xt_{-1} represents Current planned output lagged one year. This model has been modified and extensively revised by numerous authors that were investigating the supply and demand function.

In this study, the structure of the country's model framework includes behavioral equations for area harvested, yield, and production on the supply side, and per capita consumption and ending stocks on the demand side. All of the countries in the ACP sugar group have trade relations with countries other than EU countries. In some cases, the volume of exports to those countries is higher than their quota. It is therefore important to determine whether these countries respond to world prices or EU prices.

The general framework for each country's model consists of the following:

Area Harvested at time *t*

$$AH_t = f(AH_{t-1}, P_{t-1}, t) \quad (3.2.3)$$

Yield at time t

$Y_t = f(Y_{t-1}, t)$ (3.2.4)

Production at time *t*

$PRD_t = AH_t * Y_t$ (3.2.5)

Where AH_t is acreage harvvested at time *t*, AH_{t-1} is lagged area harvested, P_{t-1} is lagged producer price at time *t*, Y_t is yield at time t, Y_{t-1} is lagged yield, PRD_t is production at time *t*. Yield improvements are captured by the time trend.

Per capita consumption at time *t*

$PCC_t = f(P_t, PCI_t, PCC_{t-1})$ (3.2.6)

With PCC_t being per capita consumption at time *t*, P_t is the real consumer price of raw sugar at time *t* and PCI_t representing real income per capita at time *t*. Total demand is the product of the population and per capita consumption. The consumer price index is used to change nominal variables into real variables.

Inventory demand at time *t* is

$ES_t = f(ES_{t-1}, PRD_t, CON_t, EXP_t, P_t)$ (3.2.7)

With ES_t representing ending stock at time *t*, CON_t representing consumption at time *t* , PRD_t is production at time *t*, EXP_t is exports at time *t* and P_t is the producer price at time *t*.

Data for area harvested, yield and sugarcane production were gathered from the Food and Agricultural Organization (FAO) of the United Nations, and data for sugar production, consumption and ending stocks were obtained from Production, Supply and Distribution (PS&D) View of the United States Department of Agriculture (USDA). Macroeconomic data such as real GDP, consumer price index, population and exchange rates were gathered from various sources including the USDA Foreign Agricultural Service (FAS). Price data were obtained from the

USDA and the World Bank. The time period considered is from 1975 to 2005.

3.2.2. Derivation of Transfer Benefits

This study assumes that world price is exogenously given, implying that the EU sugar reform is represented as lowering only domestic and preferential prices, and leading to a net income reduction for all protocol countries. We initially estimate the profit of ACP sugar protocol exporters associated with the old regime. We derive the estimates using the notion of a profit function. Next we estimate the profit associated with the EU sugar reform. This will allow us to assess the competitiveness of the ACP sugar protocol exporters and determine the countries that are going to cease their sugar production.

The methodology that we use to identify the net transfer benefit to the ACP countries of the sugar protocol before and after reform is different from earlier studies. Most previous studies identified the gross transfer benefit under the protocol (Milner, Morgan and Zgovu) but, in our study, we depart from this approach and estimate the net transfer benefit based on the notion of profit. Our purpose is to first show the actual benefit that ACP countries are getting and then examine how the CAP sugar reform is going to affect their net gain. We consider the sugar industry in each country as a firm without disaggregating individual farmers. Furthermore, we assume that each industry behaves as a profit maximizing firm. The assumption of profit maximization is used to predict which countries will continue operating their sugar industry and which countries will cease sugar production. We use the profit function property that suggests that there be no losses (i.e. $\pi \geq 0$) as a way to determine the countries decisions. This means that an industry will not tolerate negative profit. In other words, if faced with negative profit, an industry will stop all production. The firm's profit, π, is the difference between revenue and cost. Here revenue is the unit price times quantity: $R = PQ$. The cost is transaction cost plus

production cost. This gives:

$\pi = R(q) - C(q)$ (3.2.8)

3.2.3. A Model of Trade of Quota Rights

The sugar industries of the ACP sugar protocol countries face severe challenges in the coming years as a result of the EU sugar policy reform. There are some countries that will not be able to survive the reform and some that will survive but will see their export revenues reduced. The countries that are no longer profitable may continue to support their sugar industries for a time, but will eventually be cease production.

The model of quota trade developed allows for the countries that can no longer profitably export to the European Union to sell their quota rights to the countries that are still able to make profit. This alternative is very promising in that it will give the potential sellers the opportunity to immediately obtain revenues that can be used for diversification away from sugar. However because in the past when a country was unable to fulfill its quota rights, the European Union would divide the amount among the active countries, the potential buyers might be tempted to wait for the high cost producing countries to close their sugar industries so that they can benefit from a redistribution of their quota as it has always been. Even so, there are many reasons for the potential buyer to want to participate in the negotiations. First, it is likely that the potential sellers will not close their sugar industries at the same time making it more profitable for the potential buyers to consider the quota market model which will allow them to get additional revenue quickly and adjust to the loss of revenues that they will be experiencing. This also opens up the possibility of production expansion and ultimately cost reduction and, hence, more profits. Second, there is the risk that the European Union will further reform its sugar policy. There has been pressure for the European Union to completely eliminate its exports subsidies and in the

event that this happens, the price will decrease further. As a result, the ACP sugar protocol countries will experience further reduction in their exports revenues. Given this, it may be important for the potential buyers to take advantage of the opportunities that they now have because there is no telling what the future holds.

The analysis is an adaptation of the above standard joint profit maximization model. Following the work of Dasgupta and Devadoss, we assume unequal bargaining power. The cause of differential market power is attributed to the fact that the buyer may find a substitute market which is the rest of the world. In fact the buyer can give up the option to buy the quota from the other ACP countries and increase sales to the EU and decide to produce and sell its product on the world market. The seller, in contrast, does not have an alternative market for its quota rights other than the sugar protocol countries. Having the world market as an alternative gives buyers slightly superior bargaining power. Because the world market price of sugar is volatile, ACP sugar protocol countries face volatile export earnings. With price stability being the major goal of the EU agricultural policy, ACP countries gain from the preferential agreement because of stabilized export earnings (Herrmann, Weiss). Furthermore, we suppose that the substitute world market is imperfect, which is consistent with the need for collusion where the buyer has to negotiate with the seller because of the opportunity to get a higher mark up through the ACP sugar protocol. Therefore, despite the availability of other markets, the underlying bilateral monopoly structure is unchanged beyond inducing unequal bargaining powers.

Following Dasgupta and Devadoss, we assume that the buyer and the seller determine the optimal price and quantity profile of the intermediate product by maximizing the product of each party's profits, weighted by their respective bargaining powers.

Let β ($0<\beta<1$) and ($1-\beta$) represent the seller's and buyer's bargaining power, respectively.

Max $\pi^{\beta}_{s} . \pi^{(1-\beta)}_{b} = [pq - c_1(q)]^{\beta} . [rf(q) - pq - c_2(q)]^{(1-\beta)}$ (3.2.9)

The first order condition with respect to price of the intermediate product is:

$\beta.p\,[pq - c_1(q)]^{\beta-1} . [rf(q) - pq - c_2(q)]^{(1-\beta)} - (1-\beta).p\,[rf(q) - pq - c_2(q)]^{-\beta} . [pq - c_1(q)]^{\beta} = 0$

$\beta.p\,\pi^{\beta-1}_{s} . \pi^{(1-\beta)}_{b} - (1-\beta).p\,\pi^{\beta}_{b} . \pi^{\beta}_{s} = 0$

$$= \frac{\beta}{\beta(1-\beta)}\left(\frac{\pi_b}{\pi_s}\right)^{1-\beta} = \frac{1-\beta}{\beta(1-\beta)}\left(\frac{\pi_s}{\pi_b}\right)^{\beta}$$

$$= \frac{1}{1-\beta}\left(\frac{\pi_b}{\pi_s}\right)^{1-\beta} = \frac{1}{\beta}\left(\frac{\pi_s}{\pi_b}\right)^{\beta} \quad (3.2.10)$$

If we substitute q^* into (3.2.10) for q and solve for the intermediate product's price, the solution is:

$$\frac{1}{1-\beta}\left(\frac{rf(q^*) - pq^* - c_2(q^*)}{pq^* - c_1(q^*)}\right)^{1-\beta} = \frac{1}{\beta}\left(\frac{pq^* - c_1(q^*)}{rf(q^*) - pq^* - c_2(q^*)}\right)^{\beta}$$

$$\frac{(rf(q^*) - pq^* - c_2(q^*))^{1-\beta}}{(1-\beta)(pq^* - c_1(q^*))^{1-\beta}} = \frac{(pq^* - c_1(q^*))^{\beta}}{\beta(rf(q^*) - pq^* - c_2(q^*))^{\beta}}$$

$\beta .(rf(q^*) - pq^* - c_2(q^*)) = (1-\beta).(pq^* - c_1(q^*))$

$\beta\, rf(q^*) - \beta\, pq^* - \beta\, c_2(q^*) = (1-\beta) . pq^* - (1-\beta) . c_1(q^*)$

$\beta\, rf(q^*) - \beta\, c_2(q^*) + (1-\beta) . c_1(q^*) = (1-\beta) . pq^* + \beta\, pq^*$

$\beta\, rf(q^*) - \beta\, c_2(q^*) + (1-\beta) . c_1(q^*) = pq^*$

$$\beta\frac{rf(q^*) - c_2(q^*)}{q^*} + (1-\beta)\frac{c_1(q^*)}{q^*} = p^* \quad (3.2.11)$$

Thus the price of the intermediate product is dependent on β.

We can now derive the buyer's and the seller's profit corresponding to p^* and q^*:

$\pi_s(p^*, q^*) = p^*q^* - c_1(q^*)$

$= [\beta\,(rf(q^*) - c_2(q^*)) + (1-\beta)\, c_1(q^*)] - c_1(q^*)$

$$=\beta\,[rf(q^*) - c_2(q^*) - c_1(q^*)] = \beta\,\pi \qquad (3.2.12)$$

$$\pi_b(p^*, q^*) = rf(q^*) - p^*q^* - c_2(q^*)$$

$$= rf(q^*) - [\beta\,(rf(q^*) - c_2(q^*)) + (1-\beta)\,c_1(q^*)] - c_2(q^*)$$

$$= (1-\beta)\,[rf(q^*) - c_2(q^*) - c_1(q^*)\,] = (1-\beta)\,\pi \qquad (3.2.13)$$

Equations (3.2.12) and (3.2.13) show that seller and buyer divide total profits proportional to their respective bargaining power. Furthermore, it shows that the country with superior bargaining power receives a greater share of the total profit, proportional to its bargaining power. This result will be used to determine the bargaining powers and then determine prices and profits that prevail in each case.

CHAPTER4. EMPIRICAL ANALYSIS AND RESULTS

4.1. Econometric Estimation

4.1.1. Model Specification and Validation

This section examines the supply and demand responsiveness of fourteen of the ACP countries to the sugar protocol. Annual data for 1975 through 2005 are used for the analysis. The general supply and demand models outlined previously were estimated for these 14 countries that are still active in the sugar protocol. Adjustments to the standard models have been made in some cases in order to get satisfactory results. To determine whether autocorrelation correction is needed, the Durbin Watson or Durbin h statistics were used. The Durbin Watson test is a widely used method of testing for autocorrelation but when lagged dependent variables are included as explanatory variables, the Durbin Watson statistic is not valid, and the appropriate test statistic is the Durbin h statistic.

4.1.1.1 Time Series Data and Autocorrelation

Economic time series are often characterized by autocorrelation. Autocorrelation occurs when the error term observations in a regression are correlated. When autocorrelation is present, the OLS estimates do not have the minimum variance (not efficient estimates). Also OLS will underestimate the standard errors of the coefficients leading to larger t-statistics and incorrect decisions in hypothesis testing.

4.1.1.2 The Durbin-Watson, the Durbin h and t Tests

The Durbin-Watson test, first published in 1950, has been found to be extremely useful in testing for serial correlation. Consider the residuals e_t from an OLS regression with T observations. To test H_0 that the errors are uncorrelated against the alternative hypothesis H_1 that the errors are AR (1), the DW test statistic is defined as:

$$d = \sum_{t=2}^{T}(e_t - e_{t-1})^2 / \sum_{t=1}^{T} e_t^2 \qquad (4.1.1.1)$$

The cutoff between the acceptance and the rejection region is not clear, as an inconclusive region is present. Therefore, the DW test relies on two limits, d_l and d_u. In a two-tailed test, where both positive and negative autocorrelation are tested, the null hypothesis (of absence of serial correlation) is rejected for values of d below dl or above 4- d_l, and we fail to reject the null hypothesis for values between d_u and 4 - d_u. The test is inconclusive for values between d_l and d_u or between 4- d_u and 4- d_l.

When an explanatory variable in the regression is a lagged dependent variable, the DW statistic will be biased toward 2 (acceptance of the null hypothesis) even when the errors are serially correlated. In order to solve this problem, Durbin (1970) proposed a modification, the *h* test, which under the null hypothesis is approximately normally distributed with unit variance. The test statistic is defined as:

$$h = (1 - \frac{d}{2}) \times (\frac{T}{1 - T\sigma_{\hat{\beta}}^2})^{1/2} \qquad (4.1.1.2)$$

Where $\sigma_{\hat{\beta}}^2$ is the estimated variance of the coefficient of the lagged dependent variable and *T* is the sample size in the regression.

Durbin's h test cannot be used for $T\sigma_{\hat{\beta}}^2 \geq 1$. In this case, Durbin (1970) proposed another statistic, the *t* test. The latter consists of performing the original OLS regression, collecting the residuals and running the following regression:

$$e_t = \beta_1 + \beta_2 X_t + \beta_3 Y_{t-1} + \beta_4 e_{t-1} + \mu_t \qquad (4.1.1.3)$$

Where Y_{t-1} is the lagged dependent variable, and X_t is the (vector of) independent variable(s). Serial correlation is tested by using the t-value of the β_4 coefficient.

4.1.2 Empirical Estimation Results

4.1.2.1 Supply Response

This section presents the results of the estimation of the supply function. This is done to determine the factors that affect the decisions of farmers in the ACP sugar protocol countries. The regression for some countries showed the presence of autocorrelation and, in order to deal with this issue, we assumed that the error terms follow a first-order autoregressive pattern[1]. The maximum likelihood was used as an estimation technique. Estimations were made with both linear and log-linear formulations and the results are mostly reported in linear formulations but in some cases the log linear formulations were reported because they yielded better results. Different functional forms give parameter estimates that have different economic interpretation. The parameters of the linear model have an interpretation as marginal effects. The elasticities will vary depending on the data. In contrast, the parameters of the log-log model are directly interpreted as elasticities. So the log-log model assumes a constant elasticity over all values of the data set.

Four standard linear and log linear specifications of area harvested and two standard linear and log linear specifications of yield are estimated for each country[2]. Equations 4.1.2.1 through 4.1.2.4 are the area harvested equations and the yield equations are given as 4.1.2.5 and 4.1.2.6.

$AH_t = AH_t (AH_{t-1}, PEU_{t-1}, T)$ (4.1.2.1)

$AH_t = AH_t (AH_{t-1}, PW_{t-1}, T)$ (4.1.2.2)

$AH_t = AH_t (AH_{t-1}, PEU_{t-1})$ (4.1.2.3)

$AH_t = AH_t (AH_{t-1}, PW_{t-1})$ (4.1.2.4)

$Y_t = Y_t (Yt_{-1}, T)$ (4.1.2.5)

$Y_t = Y_t (T)$ (4.1.2.6)

[1] The assumption of the first order autoregressive pattern was made since we are only using a one year lag.
[2] For a detailed discussion on the different specifications of the supply model see Askari and Cummings (1977).

Where AH_t is acreage harvested at time t (hectares), AH_{t-1} is lagged area harvested, $PEUt_{-1}$ and PW_{t-1} are respectively the lagged EU and World sugar price converted using the real exchange rate or CPI of the country in question, Y_t is yield at time t (hectogram per hectares), Y_{t-1} is lagged yield, and T denoting time period. PEU and PW are either in Local currency per pound or cents per pound depending on whether the exchange rates or the consumer price indexes were used. Dummies were included in the equations whenever the estimation results did not perform as expected. The parameter estimates are shown in the results below.

4.1.2.1.1 Area Harvested

In the area harvested equation, the coefficient of lagged area harvested is positive and significantly different from 0 for twelve (Barbados, Belize, Ivory Coast, Congo, Fiji, Madagascar, Malawi, Mauritius, Swaziland, Tanzania, Trinidad and Tobago, and Zimbabwe) of the fourteen countries studied. The sign of the coefficient implies a positive lag distribution of area harvested. The exceptions are Guyana and Jamaica, where the estimated coefficient is not statistically different from zero. The price coefficient showed mixed results. It is positive and statistically different form zero in Barbados, Belize, Ivory Coast, Guyana, Jamaica, Swaziland, and Trinidad and Tobago, implying that producers are responsive to price in these countries. In Fiji, Madagascar, Malawi, Mauritius, Tanzania, and Zimbabwe the price coefficient is positive and not significant, but negative and not significant in Congo. This finding can be interpreted to show that supply is not responsive to price in these countries. This might be explained by the fact that the price and quantities have already been negotiated in the sugar protocol and the production by these countries is for the preferential markets provided by the EU and U.S. quotas. Therefore, it is possible that these countries make their production plans without taking into account the fluctuations in price because they have a guaranteed price.

Table 4.1.2.1. Coefficient estimates of the area harvested and yield

Barbados

$Y_t = 514690 + 0.17Yt_{-1} - 2822\ T$
$(4.29)^{***}\quad (0.91)\quad (-2.09)^{**}$
$N = 31 \qquad R^2 = 0.2356 \qquad Dt = 1.1591$

$AH_t = -366.12 + 0.93\ AH_{t-1} + 1182\ PEU_{t-1}$
$(-1.28)\quad (28.58)^{***}\quad (2.49)^{**}$
$N = 31 \qquad R^2 = 0.9870 \qquad Dh = -2.6271$

Belize

$Y_t = 572492 - 0.49Y_{t-1} + 4444\ T$
$(8.46)^{***}\quad (-3.14)^{***}\quad (2.87)^{***}$
$N = 31 \qquad R^2 = 0.3662 \qquad Dt = 0.6220$

$LnAH_t = 3.45 + 0.66\ LnA\ H_{t-1} + 0.08\ LnPEU_{t-1} - 0.0006\ T$
$(3.28)^{***}\quad (6.39)^{***}\quad (2.00)^{*}\quad (-0.95)$
$N = 31 \qquad R^2 = 0.7431 \qquad Dt = -0.5226$

Ivory Coast

$Y_t = 45427 + 0.28Y_{t-1} + 0.10T$
$(4.84)^{***}\quad (1.85)^{*}\quad (0.00)$
$N = 31 \qquad R^2 = 0.1246 \qquad Dh = 1.2880$

$LnAH_t = 1.15 + 0.82LnA\ H_{t-1} + 0.18LnPEU_{t-1}$
$(1.13)\quad (11.29)^{***}\quad (1.59)$
$N = 31 \qquad R^2 = 0.8683 \qquad Dh = 1.4970$

Congo

$Y_t = 10678 + 0.77Y_{t-1} - 41.24\ T$
$(1.72)^{*}\quad (6.86)^{***}\quad (-0.44)$
$N = 31 \qquad R^2 = 0.7199$

$AH_t = 6261 + 0.95A\ H_{t-1} - 20.62PEU_{t-1}$
$(2.33)^{**}\quad (30.93)^{***}\quad (-1.59)$
$N = 31 \qquad R^2 = 0.9750$

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
Dt is the Durbin's t statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Table 4.1.2.1. continued

Fiji

$Y_t = 88058 - 0.60Y_{t-1} - 313.49T$
$(9.89)^{***}\ (-3.84)^{***}\ (-2.33)^{**}$
N = 31 $R^2 = 0.4106$ Dt= - 0.5953

$LnAH_t = 2.58 + 0.77\ LnA\ H_{t-1} + 0.09LnPEU_{t-1}$
$(2.76)^{**}\ (8.96)^{***}\ (0.96)$
N = 31 $R^2 = 0.7861$ Dh= - 1.8687

Guyana

$Y_t = 76883 - 494.43T$
$(26.72)^{***}\ (-3.17)^{***}$
N = 31 $R^2 = 0.27$ DW=0.9484

$AH_t = 49774 - 0.12A\ H_{t-1} + 6.14PW_{t-1}$
$(6.66)^{***}\ (-0.78)\ (3.72)^{***}$
N = 31 $R^2 = 0.3634$ Dh= 0.9816

Jamaica

$Y_t = 39431 + 0.40Y_{t-1} - 236.48\ T$
$(3.30)^{***}\ (2.20)^{**}\ (-1.90)^{*}$
N = 31 $R^2 = 0.3473$ Dt= 0.1713

$AH_t = 21005 - 0.22\ AH_{t-1} + 49.38PEU_{t-1} + 913.52T$
$(2.16)^{**}\ (-1.55)\ (5.25)^{***}\ (2.87)^{***}$
N = 31 $R^2 = 0.6333$ Dt=0.5648

Madagascar

$Y_t = 13262 + 0.69Yt_{-1} + 311.54T$
$(2.43)^{**}\ (4.78)^{***}\ (1.50)$
N = 31 $R^2 = 0.8677$ Dt=-0.2691

$AH_t = 0.58 + 0.94A\ H_{t-1} + 0.006PEU_{t-1} - 0.53DUM82 + 0.37DUM83$
$(0.56)\ (10.95)^{***}\ (0.30)\ (-11.62)^{***}\ (6.84)^{***}$
N = 31 $R^2 = 0.9659$ Dh=1.9790

Ln is the natural logarithm of a variable
DW is the Durbin's Watson statistic
Dh is the Durbin's h statistic
Dt is the Durbin's t statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Table 4.1.2.1. continued

Malawi

$Y_t = 48982 + 0.58Y_{t-1} - 200.92\ T$

$(2.71)^{**} \quad (3.69)^{***} \quad (-1.61)$

N = 31 $R^2 = 0.5525$ Dt= 0.1118

$LnAH_t = 5.20 + 0.37LnAH_{t-1} + 0.08LnPEU_{t-1} + 0.03LnT$

$(3.97)^{***} \quad (2.16)^{**} \quad (1.45) \quad (2.29)^{**}$

N = 31 $R^2 = 0.9033$ Dh=0.5834

Mauritius

$Y_t = 802026 - 0.10Y_{t-1} + 39.04T - 139646DUM99$

$(7.24)^{***} \quad (-0.66) \quad (0.05) \quad (-2.74)^{**}$

N = 31 $R^2 = 0.3318)$ Dh= 0.1732

$AH_t = 2175 + 0.96A\ H_{t-1} + 47.93PEU_{t-1}$

$(0.34) \quad (10.34)^{***} \quad (0.88)$

N = 31 $R^2 = 0.95$ DW=1.92

Swaziland

$Y_t = 107320 - 323.88T$

$(39.03)^{***} \quad (-2.18)^{**}$

N = 31 $R^2 = 0.1495$ DW=0.9552

$LnAH_t = 1.11 + 0.88LnA\ H_{t-1} + 0.05LnPWt_{-1} + 0.006LnT$

$(1.06) \quad (8.82)^{***} \quad (1.54) \quad (1.93)^{*}$

N = 31 $R^2 = 0.9640$ Dh=1.3468

Tanzania

$Y_t = 20487 + 0.73Y_{t-1} + 354.2\ T$

$(2.36)^{**} \quad (5.70)^{***} \quad (1.05)$

N = 31 $R^2 = 0.7563$ Dh=1.3972

$AH_t = 3997 + 0.73AHt_{-1} + 0.14\ PWt_{-1}$

$(2.26)^{**} \quad (6.49)^{***} \quad (1.17)$

N = 31 $R^2 = 0.7890$ Dh=1.6746

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
Dt is the Durbin's t statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Table 4.1.2.1. continued

Trinidad

$Y_t = 78832 - 0.39Yt_{-1} - 79.97T$
$(6.87)^{***}\ (-2.19)^{**}\ (-0.24)$
N = 31 $R^2 = 0.1639$ Dh= 1.3297

$AH_t = 7555 + 0.36AH_{t-1} + 1460PEUt_{-1}$
$(2.05)^{*}\ (1.94)^{*}\ (2.55)^{**}$
N = 31 $R^2 = 0.5371$ Dh= 3.3861

Zimbabwe

$Y_t = 121577 - 0.08Y_{t-1} - 811.18T - 99512DUM84 - 50108DUM85$
$(6.17)^{***}\ (-0.47)\ (-3.39)^{***}\ (-10.86)^{***}\ (-2.43)^{**}$
N = 31 $R^2 = 0.9174$ Dh= -0.6935

$AH_t = 5803 + 0.67LAHt_{-1} + 1.82\ LPWt_{-1} + 285.17T$
$(1.16)\ (4.51)^{***}\ (0.63)\ (1.53)$
N = 31 $R^2 = 0.6930$ Dh= 1.7265

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

4.1.2.1.2 Yield

The yield equation was estimated using lagged yield and/or time. The lag distribution was positive and significant for Ivory Coast, Congo, Jamaica, Madagascar, Malawi, and Tanzania suggesting that the first lagged value of yield helps predict current yield. However, three countries (Belize, Fiji, and Trinidad and Tobago) showed a negative and significant lag distribution implying that yield follows a decline through time. The coefficient of the lagged variable was not significant for Barbados, Mauritius, and Zimbabwe. The estimated time trend variable used to capture technological improvement is positive and significant in only one country (Belize) implying that there was technological advancement in Belize's sugar industry. Interestingly, the coefficient was negative and significant in Barbados, Fiji, Guyana, Jamaica, Swaziland, and Zimbabwe. It was not significant in Ivory Coast, Madagascar, Mauritius,

Tanzania, Congo, Malawi, and Trinidad and Tobago. This suggests that there might have been some natural disasters, neglect or a deterioration of the infrastructure in those countries sugar industries. For instance, Gafar, while estimating the supply responsiveness of Trinidad for sugar cane found that the trend variable was negative and pointed that the Caribbean sugar industry had not had any major capital investment designed to prevent soil erosion, improve irrigation, develop new varieties of sugar cane, or educate farmers on good practices. The obtained results provide strong support for the view that the sugar protocol did not improve the sugar industries of the ACP countries.

4.1.2.2 Demand

The procedure was similar to the supply case. Similar to the area harvested, we have three different linear and log linear specifications of ending stocks for each country. Equations 4.1.2.7 through 4.1.2.9 are the ending stock equations, and per capita consumption is given as 4.1.2.10. The formulations that yielded acceptable results are the ones that are being presented. A time trend and dummies were included in the equations whenever the estimation results did not perform as expected.

$ES_t = ES_t (ES_{t-1}, PRD_t, CON_t, EXP_t, PEU_t)$ (4.1.2.7)

$ES_t = ES_t (ES_{t-1}, PRD_t, CON_t, EXP_t, PW_t)$ (4.1.2.8)

$ES_t = ES_t (ES_{t-1}, PRD_t, CON_t, EXP_t)$ (4.1.2.9)

$PCC_t = PCC_t (PCCt_{-1}, PCI_t, P_t)$ (4.1.2.10)

With ES_t representing ending stock at time t (tonnes), CON_t representing consumption at time t (tonnes), PRD_t is production at time t (tonnes), EXP_t is exports at time t (tonnes). PEU_t and PW_t are EU and world price at time t respectively expressed in local currency per pound or cent per pound. PCC_t is per capita consumption at time t (tonnes), P_t is the real consumer price of raw

sugar at time t (cent per pound), and PCI_t representing real income per capita at time t (US dollars). ES_{t-1} and $PCCt_{-1}$ are lagged ending stock and per capita consumption respectively.

4.1.2.2.1 Per Capita Consumption

The estimated lag variable of per capita consumption was positive and statistically different from zero for all of the countries studied. The results of per capita income are significantly different from zero and have the expected sign (positive) for Barbados, Congo, Fiji, Jamaica, Malawi, Swaziland, and Tanzania. For the linear formulation this translates into: A dollar increase in income will increase sugar consumption by *x* tons (*x* being the value of the coefficient). The log linear formulation can be interpreted as follows: A one per cent increase in income will increase consumption by *x* per cent with *x* being the value of the coefficient. Unfortunately, the coefficient for income was not significant in Belize, Ivory Coast, Guyana, Madagascar, Mauritius, Trinidad and Tobago, and Zimbabwe. This suggests that consumption is not income elastic in these countries. The coefficients of price are as expected (negative) and significantly different from zero in Barbados, Congo, Jamaica, and Trinidad and Tobago. Perhaps the most surprising result is that the coefficient was positive and significant in Guyana and Mauritius suggesting that as price went up consumption went up in those countries. The coefficient was not significant in Ivory Coast, Tanzania, Belize, Fiji, Madagascar, Malawi, Swaziland, and Zimbabwe implying a non- responsiveness of consumption to price in these countries. One explanation of consumers' non-sensitivity to price might be that there is no readily available substitute for sugar in these countries.

4.1.2.2.2 Ending Stock

In the ending stock equation, the coefficient for lag ending stock is positive and statistically different from zero for Barbados, Belize, Ivory Coast, Fiji, Guyana, Jamaica, Madagascar,

Table 4.1.2.2 Coefficient estimates for consumption and ending stock

Barbados

$LnPCC_t = -16.02 + 0.47LnPCC_{t-1} + 1.91LnPCI_t - 0.20LnP_t - 0.02T$
$(-2.17)^{**} \quad (2.93)^{***} \quad (2.43)^{**} \quad (-1.80)^{*} \quad (-2.36)^{**}$
$N=31 \quad R^2 = 0.51 \quad Dh = 2.1792$

$ES_t = 15989 + 0.40ES_{t-1} + 0.56PRD_t - 0.86CON_t - 0.6EXP_t$
$(3.88)^{***} \quad (2.67)^{**} \quad (7.35)^{***} \quad (-3.70)^{***} \quad (-3.13)^{***}$
$N=31 \quad R^2 = 0.7651 \quad Dh = 2.9964$

Belize

$LnPCC_t = 1.44 + 0.55LnPCCt_{-1} + 0.06\ LnPCI_t + 0.05\ LnP_t + 0.41\ DUM86$
$(0.73) \quad (3.37)^{***} \quad (0.28) \quad (1.16) \quad (3.85)^{***}$
$N=31 \quad R^2 = 0.5161 \quad Dt = 0.4526$

$ES_t = 7755 + 0.98ES_{t-1} - 0.83CON_t + 1.03PRD_t - 1.06EXP_t - 3.85PEU_t$
$(1.77)^{*} \quad (13.10)^{***} \quad (-2.06)^{*} \quad (12.63)^{***} \quad (-12.27)^{***} \quad (-1.37)$
$N=31 \quad R^2 = 0.9542 \quad Dh = 0.5872$

Ivory Coast

$LnPCC_t = 0.73 + 0.76LnPCC_{t-1} + 0.01LnPCI_t - 0.06LnP_t$
$(0.46) \quad (4.99)^{***} \quad (0.07) \quad (-1.24)$
$N=31 \quad R^2 = 0.7692 \quad Dh = -2.1382$

$LnES = 6.96 + 0.82LnES_{t-1} - 0.89LnCON_t + 0.64\ LnPRD_t - 0.46\ LnPW_t$
$(2.59)^{**} \quad (7.12)^{***} \quad (-3.10)^{***} \quad (3.80)^{***} \quad (-2.69)^{**}$
$N= 31 \quad R^2 = 0.8867 \quad Dt = -1.8441$

Congo

$LnPCC_t = 0.2 + 0.83LnPCC_{t-1} + 0.08LnPCI_t - 0.1LnP_t$
$(0.81) \quad (9.87)^{***} \quad (1.73)^{*} \quad (-2.89)^{***}$
$N= 31 \quad R^2 = 0.8326 \quad Dh = -1.6381$

$ES_t = -30786 + 0.63ES_{t-1} - 0.38CON_t + 1.51PRD_t - 125.78PW_t$
$(-1.55) \quad (5.41)^{***} \quad (-2.95)^{***} \quad (3.52)^{***} \quad (-1.74)^{*}$
$N=31 \quad R^2 = 0.8988 \quad Dh = -0.1191$

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
Dt is the Durbin's t statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Table 4.1.2.2 continued

Fiji

$PCC_t = -0.23 + 0.41LnPCC_{t-1} + 0.33LnPCI_t + 0.005LnP_t$
(-0.16) (1.93)* (1.78)* (0.15)
N= 31 $R^2 = 0.3116$ Dt= 0.5629

$ES_t = 18363 + 0.94ES_{t-1} - 0.30CON_t + 0.8PRD_t - 0.91EXP_t - 12.86PEU_t$
(1.02) (14.01)*** (-1.52) (15.85)*** (-16.70)*** (-1.44)
N= 31 $R^2 = 0.9617$ Dh= - 0.3122

Guyana

$LnPCC_t = 0.97 + 0.50LnPCC_{t-1} + 0.1LnPCI_t + 0.05LnP_t$
(1.03) (2.87)*** (0.92) (3.06)***
N= 31 $R^2 = 0.7617$ Dt= 0.8076

$ES_t = 31385 + 0.99ES_{t-1} - 0.85CON_t + 0.89PRD_t - 0.98EXP_t - 4.96PEU_t$
(2.78)*** (32.71)*** (-2.90)*** (12.94)*** (-10.12)*** (-2.14)**
N= 31 $R^2 = 0.9917$ Dh= -0.0453

Jamaica

$LnPCC_t = 0.12 + 0.86LnLPCC_{t-1} + 0.06LnPCI_t - 0.05LnP_t$
(0.24) (7.84)*** (2.34)** (-2.40)**
N= 31 $R^2 = 0.7396$ Dh=2.2020

$ES_t = 41238 + 0.36ES_{t-1} - 0.44CON_t + 0.30PRD_t - 0.23EXP_t - 25.06PEU_t$
(3.51)*** (3.47)*** (-3.76)*** (7.29)*** (-6.92)*** (-4.07)***
N= 31 $R^2 = 0.9401$ Dh= -1.6609

Madagascar

$PCC_t = 3.40 + 0.51 LPCC_{t-1} + 0.00004PCI_t + 0.0014P_t$
(3.61)*** (3.90)*** (1.58) (1.49)
N= 31 $R^2 = 0.9052$ Dh= -1.0570

$ES_t = 3.72 + 0.93ESt_{-1} - 0.05CON_t + 0.19PRD_t - 0.44EXP_t - 0.02PEU_t$
(0.81) (5.46)*** (-0.12) (1.18) (-3.45)*** (- 0.11)
N= 31 $R^2 = 0.9581$ Dt= - 0.5208

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
Dt is the Durbin's t statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Table 4.1.2.2 continued

Malawi

$LnPCC_t = -1.36 + 1.05LnPCC_{t-1} + 0.11LnPCI_t + 0.01LnP_t + 0.02T$
$(-2.75)^{**} \quad (13.37)^{***} \quad (2.02)^{*} \quad (0.31) \quad (2.11)^{**}$
N= 31 $R^2 = 0.9764$ Dh= -1.0320

$LnES_t = 7.70 + 0.55LnES_{t-1} - 1.47LnCON_t + 1.68LnPRD_t - 0.44LnEXP_t - 0.33LnPW_t$
$(1.32) \quad (3.70)^{***} \quad (-4.18)^{***} \quad (3.30)^{***} \quad (-2.69)^{**} \quad (-2.35)^{**}$
N= 31 $R^2 = 0.7765$ Dh= 0.6540

Mauritius

$LnPCC_t = 1.08 + 0.63LnPCC_{t-1} + 0.02LnPCI_t + 0.02LnP_t$
$(2.56)^{**} \quad (5.64)^{***} \quad (0.98) \quad (1.94)^{*}$
N=31 $R^2 = 0.9138$ Dh= -1.3631

$LnES_t = -21.77 + 0.69LnES_{t-1} - 0.05LnCON_t + 6.61LnPRD_t - 4.59LnEXP_t - 1.01LnPEU_t$
$(-0.70) \quad (5.08)^{***} \quad (0.02) \quad (3.43)^{***} \quad (-1.82)^{*} \quad (-2.02)^{*}$
N= 31 $R^2 = 0.7685$ Dh= - 0.4816

Swaziland

$LnPCC_t = -6.37 + 0.84LnPCC_{t-1} + 0.94LnPCI_t + 0.03LnP_t$
$(-1.83)^{*} \quad (8.69)^{***} \quad (1.93)^{*} \quad (0.44)$
N=31 $R^2 = 0.9477$ Dh=0.1766

$ES_t = 3699 + 0.81ES_{t-1} - 0.85CON_t + 0.88PRD_t - 0.88EXP_t - 154.43PEU_t$
$(0.46) \quad (15.29)^{***} \quad (-21.83)^{***} \quad (31.56)^{***} \quad (-27.71)^{***} \quad (-0.44)$
N= 31 $R^2 = 0.9936$ Dh= 1.0383

Tanzania

$PCC_t = -2.38 + 0.73PCCt_{-1} + 0.02PCI_t - 0.00003P_t$
$(-1.13) \quad (5.21)^{***} \quad (2.04)^{**} \quad (-0.61)$
N= 31 $R^2 = 0.7227$ Dh= - 0.0432

$LnES_t = 28.45 + 1.34LnES_{t-1} - 2.97LnCON_t + 1.26LnPRD_t - 0.69LnEXP_t - 0.64LnPEU_t$
$(6.02)^{***} \quad (15.13)^{***} \quad (-5.00)^{***} \quad (2.97)^{***} \quad (-5.68)^{***} \quad (-3.33)^{***}$
$+ 0.02T$
(0.88)
N= 31 $R^2 = 0.9823$ Dh=-2.5576

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Table 4.1.2.2 continued

Trinidad

$PCC_t = 24.38 + 0.49PCCt_{-1} + 0.0007PCI - 0.75P$

(2.94)*** (3.13)*** (0.92) (-2.11)**

N= 31 $R^2 = 0.5693$ Dh= 0.2746

$ES_t = 8940 - 0.17\ ES_{t-1} - 0.06CON_t + 0.23\ PRD_t - 0.26\ EXP_t - 26.86PEU_t$

(0.43) (-0.91) (-0.24) (2.66)** (-2.28)** (-0.31)

N= 31 $R^2 = 0.3546$ Dh= 1.9685

Zimbabwe

$PCC_t = -3.69 + 0.92PCC_{t-1} + 0.12PCI_t + 0.0005P_t$

(-0.57) (7.52)*** (1.31) (0.05)

N= 31 $R^2 = 0.7939$ Dh= 0.5768

$ES_t = 92060 + 0.78ES_{t-1} - 0.31CON + 0.19PRD - 0.39EXP - 137.95PW$

(5.77)*** (5.66)*** (-6.23)*** (4.38)*** (-4.74)*** (-2.40)**

N= 31 $R^2 = 0.8442$ Dh= 1.5746

Ln is the natural logarithm of a variable
Dh is the Durbin's h statistic
*** Significantly different from 0 at 99% level of significance
** Significantly different from 0 at 95% level of significance
* Significantly different from 0 at 90% level of significance

Malawi, Mauritius, Swaziland, Tanzania, and Zimbabwe, but it is not significant for Trinidad and Tobago. As expected, the production coefficient is positive and significant in Barbados, Belize, Ivory Coast, Congo, Fiji, Guyana, Jamaica, Malawi, Mauritius, Swaziland, Tanzania, Trinidad and Tobago, and Zimbabwe. Unfortunately, it is not significant for Madagascar. The consumption coefficient is negative and significant in Barbados, Belize, Ivory Coast, Congo, Guyana, Jamaica, Malawi, Swaziland, Tanzania, and Zimbabwe. It has the expected sign (negative) but is not significant for Fiji, Madagascar, Mauritius, and Trinidad and Tobago. The export coefficient is negative as expected and significantly different from zero for Barbados, Belize, Fiji, Guyana, Jamaica, Madagascar, Malawi, Mauritius, Swaziland, Tanzania, Trinidad and Tobago, and Zimbabwe. The price coefficient is negative and significant for Belize, Ivory Coast, Congo, Guyana, Jamaica, Malawi, Mauritius, Tanzania, and Zimbabwe. It is not significant for Fiji, Madagascar, Swaziland, and Trinidad and Tobago.

In this section, supply and demand responsiveness of the ACP countries to the sugar protocol have been examined. The results shed some light on how the sugar protocol has impacted these countries and three main conclusions can be drawn. First, the ACP sugar protocol supply is price sensitive. Second, the sugar protocol created a cycle of dependency reducing the incentives for the countries involved to improve their infrastructure and invest in the education of farmers on better practices. Third, consumption of sugar seems to have become price and income insensitive because consumers don't have any choice. There is no substitute for sugar in these countries and they end up paying even higher internal prices than their European counterparts because of government policy implemented to protect producers.

4.2. Derivation of Transfer Benefits

In this section transfer benefits before and after the EU sugar policy reform are computed and the effect of the reform are examined. As explained earlier, the basic profit function framework is used where the transfer benefit is going to be derived as the difference between revenue and cost.

4.2.1. Pre Reform

Computed transfer benefits are interpreted as maximum welfare gains for participating countries instead of actual estimates of the gains. We assume that each country fulfilled its quota requirement meaning that they were able to export exactly the amounts that are allocated to them. This assumption is made in order to capture the full effect of the protocol but also for simplicity because data on the actual sugar protocol exports for all the countries were difficult to obtain. Results on the calculated transfer benefits are summarized in Table 4.2.1. The table reports on the protocol countries that are still supplying to the EU market. Therefore, out of the 19 countries that are members of the sugar protocol, computations were made on 14 because five of 19 countries considered herein did not supply the EU sugar for that year. In fact, according to

the ACP sugar web site data, Kenya, Suriname, Uganda, and Zambia have not supplied sugar to the EU since 1986, 1980, 1978, and 1975, respectively. The other country, Saint Kitts and Nevis, decided to stop its sugar production after learning about the proposal for the reform. We consider 2005 as a reference year because that is when the EU's proposal was finalized and the reform started in 2006. The first column displays the countries ranked from the highest cost producer to the lowest cost producer, column two presents the computed total cost of production, column three gives the EU price that was prevailing in 2005, column four is the 2005 break even which is the difference between price and total cost, column five presents the quota allocations, column six shows the transfer benefits which is the product of the break even and the quota, and the last column displays the share of each country's transfer benefit to the total benefit. At 2005's EU sugar price, the estimated income transfer of all beneficiary countries under the sugar protocol amounts to 296.3 million U.S. Dollars for that year. As can be seen from the table, all countries can profitably export at the pre-reform EU sugar price but the distribution is uneven. The highest income transfers go to countries with the largest delivery rights while countries with smaller quota rights receive a lower transfer. Accordingly, the largest share goes to Mauritius (42 per cent) followed by Guyana (17 per cent), Fiji (14 per cent) and Swaziland (12 per cent). All together, these four countries receive about 86 per cent of total transfer whereas the rest of the ACP countries experience fairly small transfers. In fact Barbados, Congo, Ivory Coast, Madagascar, Tanzania and Trinidad and Tobago each receive less than one per cent of the total transfer.

The results also show that the most efficient countries are not the ones benefiting the most from the sugar protocol, due to the fact that the quota quantities were assigned arbitrarily. It can be summarized that all countries participating in the sugar protocol gain from the preferential

agreement because export earnings are raised and a significant amount of hidden aid is realized (Herrmann and Weiss).

Table 4.2.1 Results of the pre-reform sugar protocol impact

Country	Total costs ($/Ton)	EUP 05 ($/Ton)	Break even 05 ($/Ton)	Quota 05 (Ton)	Transfer benefits 05 ($)	Share
Trinidad	673	680.13	7.13	43751	311,944.63	0%
Madagascar	670	680.13	10.13	10760	108,998.8	0%
Jamaica	633.69	680.13	46.44	118696	5,512,672.19	2%
Barbados	596	680.13	84.13	50312	4,232,748.56	1%
Congo	560	680.13	120.13	10186	1,223,644.18	0%
Tanzania	531	680.13	149.13	10186	1,519,038.18	1%
Ivory Cost	525	680.13	155.13	10186	1,580,154.18	1%
Belize	497	680.13	183.13	40349	7,389,112.37	2%
Mauritius	424	680.13	256.13	491031	125,767,770	42%
Fiji	423.05	680.13	257.08	165348	42,507,087.51	14%
Swaziland	370	680.13	310.13	117845	36,547,269.85	12%
Guyana	366.63	680.13	313.50	159410	49,975,596.86	17%
Malawi	344.20	680.13	335.93	20824	6,995,328.48	2%
Zimbabwe	263.1	680.13	417.03	30225	12,604,731.75	4%
Total					296,276,097.6	100%

4.2.2. After Reform

The impact of the EU sugar policy reform are reported in table 4.2.2. The table reports the information in the same manner as in table 4.2.1 except for the last column that was omitted. In addition the price considered here is the 2005 EU price reduced by thirty per cent to capture the full effect of the reform. Furthermore, we assume that costs structures stay the same for all countries. The estimates of the post reform transfers are reported in table 4.2.2.

The results presented above show a considerable loss in export revenues for all countries. Under the sugar policy reform scenario, production costs in many countries (Trinidad and Tobago, Madagascar, Jamaica, Barbados, Congo, Tanzania, Ivory Coast and Belize) are too high and the new EU price cannot make exports to the European Union profitable. The Caribbean countries which were found to be medium to high costs producers are the most affected.

Table 4.2.2 Results of the post-reform sugar protocol impact

Country	Total costs ($/Ton)	EUP 09 ($/Ton)	Break even 09 ($/Ton)	Quota 05 (Ton)	Transfer benefits 09 ($)
Trinidad	673	435.32	-237.68	43751	0
Madagascar	670	435.32	-234.68	10760	0
Jamaica	633.69	435.32	-198.37	118696	0
Barbados	596	435.32	-160.68	50312	0
Congo	560	435.32	-124.68	10186	0
Tanzania	531	435.32	-95.68	10186	0
Ivory Cost	525	435.32	-89.68	10186	0
Belize	497	435.32	-61.68	40349	0
Mauritius	424	435.32	11.32	491031	5,558,470.92
Fiji	423.05	435.32	12.27	165348	2,028,243.63
Swaziland	370	435.32	65.32	117845	7,697,635.4
Guyana	366.63	435.32	68.69	159410	10,950,434.76
Malawi	344.20	435.32	91.12	20824	1,897,405.04
Zimbabwe	263.1	435.32	172.22	30225	5,205,349.5

However, there are some countries (Mauritius, Fiji, Swaziland, Guyana, Malawi and Zimbabwe) that are still efficient and can expand their production and export to the European Union. These countries can take over the quotas allocated to countries which cannot fill their quotas rights at the post reform price. If that is the case, the countries that cannot make profit will find themselves losing everything because they would have to stop producing. In light of the possible losses that are going to be experienced we develop a quota trade model with bilateral monopoly behavior as a method to compensate the ACP sugar protocol countries as a whole. Our aim is to allow the inefficient countries to have some revenue that they can use to invest in other sectors where comparative advantage can be found.

4.3. Empirical Quota Market Analysis

This analysis is an adaptation of a bilateral monopoly model developed by Devadoss that makes a reasonable representation of the sugar protocol. The model developed allows for a possible solution to the EU sugar policy reform. Moreover, it provides a way for the quota to be

redistributed to the most efficient sugar producing countries. The model of trade of quota rights, described in the previous chapter, is applied here using the results presented in the previous section. We investigate the economic return of the model using different scenarios. Our emphasis is on deriving profits using the relative bargaining weighs, with the pricing and quantity decision rule being of second order importance. In what follows, we assume that quantity decisions are made by an outside party the European Union and for the sake of simplicity that the quota rights are equally divided among the potential buyers.

4.3.1. Equal Bargaining Power Scenario

We begin with the computation of the profit distribution by assuming that all the parties involved have equal bargaining power. When the buyer and seller have equal bargaining power, this implies that 1-β is equal to β so that each party's profit would be equal to the total profit divided by two. The total profit is first derived and then equally divided among the countries. Equation 3.1.18 is used to derive the profit in each bilateral trade case and the results are reported in table 4.3.2.1 below. In Table 4.3.2.2, the first column displays the respective country. The second column presents the calculated profits from the bilateral trade model. The third column is the transfer benefits after the reform. The fourth column is the total which is the sum of the bilateral trade profit and the transfer benefit after the reform.

The fifth column reports the transfer benefits before the reform and the sixth column shows the gains or losses which is the difference between the total transfer and the transfer that prevailed in 2005. The profit results show that there is a wide variation among potential sellers and potential buyers. Zimbabwe (which is a potential buyer) is the country that makes the most out of the model followed by Jamaica which is a potential seller. The comparison with the 2005 transfer shows that even though most of the countries still experience losses as a result of the

sugar policy reform, there are income gains across all countries. One interesting result is that potential sellers are able to receive a compensation that otherwise would not be available. Perhaps the most interesting finding is that Madagascar and Trinidad and Tobago experience a gain as a result of the bilateral trade with equal bargaining power.

Table 4.3.2.2 Results of the equal bargaining power model

Country	Profit ($)	Transfer benefits 09 ($)	Total ($)	Transfer benefits 05 ($)	Gain or loss ($)
Zimbabwe	4,225,504	5,205,349.5	9,430,853	12,604,731.75	-3,173,878.4
Jamaica	4,163,621	0	4,163,621	5,512,672.19	-1,349,050.9
Malawi	2,235,583	1,897,405.04	4,132,988	6,995,328.48	-2,862,340.4
Barbados	1,764,846	0	1,764,846	4,232,748.56	-2,467,903
Guyana	1,685,430	10,950,434.76	12,635,865	49,975,596.86	-37,339,732
Swaziland	1,602,659	7,697,635.4	9,300,294	36,547,269.85	-27,246,976
Trinidad	1,534,699	0	1,534,699	311,944.63	1,222,754.05
Belize	1,415,363	0	1,415,363	7,389,112.37	-5,973,749.1
Madagascar	377,439.6	0	377,439.6	108,998.8	2,684,40.75
Congo	357,304.8	0	357,304.8	1,223,644.18	-866,339.42
Ivory Cost	357,304.8	0	357,304.8	1,580,154.18	-1222849.4
Tanzania	357,304.8	0	357,304.8	1,519,038.18	-1,161,733.4
Fiji	300,965.1	2,028,243.63	2,329,209	42,507,087.51	-40,177,879
Mauritius	277,741.9	5,558,470.92	5,836,213	125,767,770	-119,931,557

4.3.2. Unequal Bargaining Power Scenario

We apply the unequal bargaining framework described in chapter three to create and analyze a market for ACP sugar protocol countries quota. We consider an unequal bargaining framework because we assume that in each bilateral trade case one party is going to have a superior bargaining power over the other. We also assume quantity and price being determined independently. We begin by using equation 3.2.11 to determine the bargaining power and then 3.2.12 and 3.2.13 are used to identify the profits in each case. Recalled 3.2.11

$\beta \frac{rf(q^*) - c_2(q^*)}{q^*} + (1-\beta)\frac{c_1(q^*)}{q^*} = p^*$. From this equation we can derive β such that:

$$\beta = \frac{p^* q^* - c_1(q^*)}{rf(q^*) - c_2(q^*) - c_1(q^*)} \qquad (4.3.3.1)$$

In our analysis, $f(q^*)$ = q*, $c_1(q^*)$ = c_1.q*, $c_2(q^*)$ = c_2.q* with c_1, c_2 representing the unit cost for the seller and the buyer respectively.

The world price plays a major role in the bargaining process that is being analyzed. We use world price as the determining factor in deriving the bargaining powers. The intuition behind using the world price is that if the world price is high enough, there would be an incentive in the part of the potential buyer not to participate in the quota trade and just produce and sell to the world market. However in the case where the world price would be low it would be profitable for the potential buyers to participate in the quota trade. Most market analysts expect world market price to rise if the European Union cuts back production and export subsidies, as total supply will decrease. Since the European Union is currently a major producer and exporter, the European Union reform is expected to have an impact on world market, though the precise effect would be difficult to quantify. Estimates of the impact of sugar policy reforms on world sugar prices vary within a range of one to sixty per cent (Milner, Morgan, Zgovu). It should be noted that Brazil, the world's largest and most competitive producer of sugar, has been able to increase production levels (and exports) dramatically in recent years. In the period from 1995/96 to 2004/05, Brazilian exports almost quadrupled from 5.5 to 19.2 million tons. If Brazilian export supply continues to grow at a rapid pace, Brazil could expand into other markets as the European Union withdraws from exports markets. Thus, any price increase resulting from lower EU exports might be insignificant or non-existent (Busse and Jerosch). Therefore, two scenarios will be examined. The first is to examine the effect of a price (p^*) set at the actual world price and the

second is varying the world price by taking into account the effect that the EU sugar policy reform might have on the world price for sensitivity purposes. An intermediate increase in value of 30% of the world sugar price will be considered for the sensitivity analysis. Using the above information combined with the cost and quota allocations provided in chapter II, β and (1- β) were first derived and used to compute the profits for each party.

4.3.2.1. Unequal Bargaining Power with no World Price Effect

The results are shown in tables 4.3.3.1 through 4.3.3.14.

In this section we derive the bargaining power and profits under the condition that the EU sugar policy reform does not affect the world sugar price. Tables 4.3.3.1 through 4.3.3.8 present the sellers' results. The tables report the seller's bargaining power, total profit and the seller's profit in each bilateral trade case. For example, the bargaining power of Barbados, when it is selling to Fiji, is 0.53, the total profit is 88164.70 U.S. dollars and Barbados' share of total profit is 47092.99 U.S. dollars. All sellers, with a few exceptions, (Belize, Ivory Coast, Tanzania), exercise superior bargaining power compared to that of buyers. This implies that sellers make more profit than buyers (Tables 4.3.3.9-4.3.3.14) in the case of unequal bargaining powers with no world market price effect. The overall impact of the scenario indicates that by implementing a quota trade market, it is possible to increase the income transfers of those countries that were still able to fill their quota allocation. Moreover, and perhaps a key result, those countries that are obliged to cease production because it is no longer profitable under the new pricing scheme to sell sugar to the European Union will receive income revenues that they can use to diversify their economies toward more profitable activities.

4.3.2.2. Unequal Bargaining Power with World Price Effect

For sensitivity purposes we carry out the same exercise under the scenario of a 30% increase in

world sugar price. These results are reported in Tables 4.3.3.15 through 4.3.3.29 below. The results suggest that the price increase gives superior bargaining power to buyers. For the most part, buyers have a substantial (almost double) increase in their bargaining power. The large changes in bargaining power may be explained by the fact that as the world price goes up, buyers have an alternative market opening to them. They can choose to expand their production of sugar and sell to the world market instead of buying quota rights from the sellers. Because sellers are also aware of this, they become less rigid during the bargaining process and lose some of their power.

Table 4.3.3.1 Barbados-Unequal no WP effect

Barbados			
Buyers	β	Total profit ($)	Partial profit1($)
Fiji	0.534	102,858.81	54,941.82
Guyana	0.591	576,018.10	340,603.52
Malawi	0.618	764,040.23	471,846.74
Mauritius	0.533	94,921.97	50,620.29
Swaziland	0.588	547,729.97	321,817.68
Zimbabwe	0.736	1,444,122.11	1,062,526.01
Total			2,457,180.65

Table 4.3.3.2 Belize - Unequal no WP effect

Belize			
Buyers	β	Total profit ($)	Partial profit1($)
Fiji	0.439	82,490.27	36,213.57
Guyana	0.497	461,952.50	229,516.71
Malawi	0.524	612,741.68	321,253.15
Mauritius	0.438	76,125.11	33,354.11
Swaziland	0.493	439,266.11	216,539.63
Zimbabwe	0.655	1,158,150.80	758,835.18
Total			1,595,712.35

Table 4.3.3.3 Congo - Unequal no WP effect

Congo			
Buyers	β	Total profit ($)	Partial profit1($)
Fiji	0.504	20,824.45	10,485.73
Guyana	0.561	116,618.71	65,465.12
Malawi	0.588	154,685.04	90,986.59
Mauritius	0.503	19,217.59	9,659.93
Swaziland	0.558	110,891.59	61,825.62
Zimbabwe	0.711	292,372.15	207,943.27
Total			446,366.27

Table 4.3.3.4 Ivory Coast - Unequal no WP effect

Ivory Coast			
Buyers	β	Total profit ($)	Partial profit1($)
Fiji	0.470	20,824.45	9,779.99
Guyana	0.528	116,618.71	61,541.50
Malawi	0.555	154,685.04	85,848.25
Mauritius	0.469	19,217.59	9,008.71
Swaziland	0.524	110,891.59	58,089.75
Zimbabwe	0.683	292,372.15	199,566.91
Total			423,835.10

Table 4.3.3.5 Jamaica - Unequal no WP effect

Jamaica			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.563	242,664.37	136,556.31
Guyana	0.619	1,358,941.10	841,151.36
Malawi	0.645	1,802,522.64	1,161,857.79
Mauritius	0.562	223,939.79	125,827.52
Swaziland	0.615	1,292,203.79	795,092.08
Zimbabwe	0.758	3,406,970.85	2,582,308.05
Total			5,642,793.11

Table 4.3.3.6 Madagascar - Unequal no WP effect

Madagascar			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.587	21,997.95	12,903.11
Guyana	0.642	123,190.39	79,039.31
Malawi	0.666	163,401.83	108,899.98
Mauritius	0.586	20,300.53	11,890.37
Swaziland	0.638	117,140.53	74,738.40
Zimbabwe	0.775	308,847.87	239,369.82
Total			526,840.99

Table 4.3.3.7 Tanzania - Unequal no WP effect

Tanzania			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.476	20,824.45	9,907.74
Guyana	0.534	116,618.71	62,256.31
Malawi	0.561	154,685.04	86,787.18
Mauritius	0.475	19,217.59	9,126.58
Swaziland	0.530	110,891.59	58,770.06
Zimbabwe	0.688	292,372.15	201,118.92
Total			427,966.79

Table 4.3.3.8 Trinidad - Unequal no WP effect

Trinidad			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.588	89,445.38	52,632.97
Guyana	0.643	500,901.73	322,271.23
Malawi	0.668	664,404.60	443,938.35
Mauritius	0.588	82,543.55	48,502.20
Swaziland	0.640	476,302.55	304,743.34
Zimbabwe	0.776	1,255,799.54	974,988.74
Total			2,147,076.83

Table 4.3.3.9 Fiji - Unequal no WP effect

Fiji			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.465852	102,858.8	47,917.00
Belize	0.560996	82,490.27	46,276.70
Congo	0.49647	20,824.45	10,338.73
Ivory Cost	0.53036	20,824.45	11,044.46
Jamaica	0.437263	242,664.4	106,108.06
Madagascar	0.41344	21,997.95	9,094.84
Tanzania	0.524226	20,824.45	10,916.72
Trinidad	0.411563	89,445.38	36,812.41
Total			278,508.91

Table 4.3.3.10 Guyana - Unequal no WP effect

Guyana			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.408693	576,018.1	235,414.58
Belize	0.50316	461,952.5	232,435.79
Congo	0.43864	116,618.7	51,153.58
Ivory Cost	0.472284	116,618.7	55,077.21
Jamaica	0.381024	1,358,941	517,789.74
Madagascar	0.358397	123,190.4	44,151.07
Tanzania	0.466155	116,618.7	54,362.39
Trinidad	0.356618	500,901.7	178,630.50
Total			1,369,014.87

Table 4.3.3.11 Malawi - Unequal no WP effect

Malawi			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.382432	764,040.2	292,193.49
Belize	0.475712	612,741.7	291,488.53
Congo	0.411794	154,685	63,698.45
Ivory Cost	0.445013	154,685	68,836.80
Jamaica	0.355427	1,802,523	640,664.85
Madagascar	0.333545	163,401.8	54,501.85
Tanzania	0.438943	154,685	67,897.86
Trinidad	0.331825	664,404.6	220,466.25
Total			1,699,748.08

Table 4.3.3.12 Mauritius - Unequal no WP effect

Mauritius			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.466717	94,921.97	44,301.68
Belize	0.561851	76,125.11	42,771.00
Congo	0.497339	19,217.59	9,557.66
Ivory Cost	0.531226	19,217.59	10,208.88
Jamaica	0.438119	223,939.8	98,112.27
Madagascar	0.414283	20,300.53	8,410.17
Tanzania	0.525092	19,217.59	10,091.01
Trinidad	0.412405	82,543.55	34,041.36
Total			257,494.02

Table 4.3.3.13 Swaziland - Unequal no WP effect

Swaziland			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.412452	547,730	225,912.29
Belize	0.507042	439,266.1	222,726.48
Congo	0.442468	110,891.6	49,065.96
Ivory Cost	0.476157	110,891.6	52,801.84
Jamaica	0.384701	1,292,204	497,111.71
Madagascar	0.361977	117,140.5	42,402.13
Tanzania	0.470022	110,891.6	52,121.52
Trinidad	0.36019	476,302.6	171,559.21
Total			1,313,701.15

Table 4.3.3.14 Zimbabwe - Unequal no WP effect

Zimbabwe			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.264241	1,444,122	381,596.10
Belize	0.344787	1,158,151	399,315.62
Congo	0.288772	292,372.2	84,428.89
Ivory Cost	0.317422	292,372.2	92,805.24
Jamaica	0.242052	3,406,971	824,662.80
Madagascar	0.224959	308,847.9	69,478.05
Tanzania	0.312113	292,372.2	91,253.23
Trinidad	0.223611	1,255,800	280,810.80
Total			2,224,350.72

Table 4.3.3.15 Barbados - Unequal with WP effect

Barbados			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.388	102,858.81	39,918.28
Guyana	0.430	576,018.10	247,467.36
Malawi	0.449	764,040.23	342,822.83
Mauritius	0.387	94,921.97	36,778.45
Swaziland	0.427	547,729.97	233,818.40
Zimbabwe	0.535	1,444,122.11	771,984.10
Total			1,672,789.42

Table 4.3.3.16 Belize - Unequal with WP effect

Belize			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.263	82,490.27	21,704.32
Guyana	0.298	461,952.50	137,559.03
Malawi	0.314	612,741.68	192,540.54
Mauritius	0.263	76,125.11	19,990.52
Swaziland	0.295	439,266.11	129,781.32
Zimbabwe	0.393	1,158,150.80	454,801.87
Total			956,377.60

Table 4.3.3.17 Congo - Unequal with WP effect

Congo			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.348	20,824.45	7,244.20
Guyana	0.388	116,618.71	45,227.43
Malawi	0.406	154,685.04	62,859.27
Mauritius	0.347	19,217.59	6,673.69
Swaziland	0.385	110,891.59	42,713.03
Zimbabwe	0.491	292,372.15	143,660.30
Total			308,377.91

Table 4.3.3.18 Ivory Coast - Unequal with WP effect

Ivory Coast			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.303	20,824.45	6,317.19
Guyana	0.341	116,618.71	39,751.51
Malawi	0.358	154,685.04	55,451.98
Mauritius	0.303	19,217.59	5,819.00
Swaziland	0.338	110,891.59	37,521.92
Zimbabwe	0.441	292,372.15	128,906.30
Total			273,767.91

Table 4.3.3.19 Jamaica - Unequal with WP effect

Jamaica			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.425	242,664.37	103,242.65
Guyana	0.468	1,358,941.10	635,947.87
Malawi	0.487	1,802,522.64	878,416.22
Mauritius	0.425	223,939.79	95,131.21
Swaziland	0.465	1,292,203.79	601,125.01
Zimbabwe	0.573	3,406,970.85	1,952,339.86
Total			4,266,202.82

Table 4.3.3.20 Madagascar - Unequal with WP effect

Madagascar			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.457	21,997.95	10,051.58
Guyana	0.500	123,190.39	61,571.99
Malawi	0.519	163,401.83	84,833.59
Mauritius	0.456	20,300.53	9,262.65
Swaziland	0.497	117,140.53	58,221.56
Zimbabwe	0.604	308,847.87	186,470.20
Total			410,411.59

Table 4.3.3.21 Tanzania - Unequal with WP effect

Tanzania			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.311	20,824.45	6,484.99
Guyana	0.349	116,618.71	40,749.13
Malawi	0.367	154,685.04	56,805.51
Mauritius	0.311	19,217.59	5,973.69
Swaziland	0.347	110,891.59	38,467.25
Zimbabwe	0.450	292,372.15	131,640.00
Total			280,120.57

Table 4.3.3.22 Trinidad - Unequal with WP effect

Trinidad			
Buyers	β	Total profit ($)	Partial profit1 ($)
Fiji	0.459	89,445.38	41,091.08
Guyana	0.502	500,901.73	251,600.34
Malawi	0.522	664,404.60	346,587.06
Mauritius	0.459	82,543.55	37,866.14
Swaziland	0.500	476,302.55	237,916.14
Zimbabwe	0.606	1,255,799.54	761,183.34
Total			1,676,244.08

Table 4.3.3.23 Fiji - Unequal with WP effect

Fiji			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.612	102,858.8	62,940.53
Belize	0.737	82,490.27	60,785.95
Congo	0.652	20,824.45	13,580.25
Ivory Cost	0.697	20,824.45	14,507.26
Jamaica	0.575	242,664.4	139,421.72
Madagascar	0.543	21,997.95	11,946.36
Tanzania	0.689	20,824.45	14,339.46
Trinidad	0.541	89,445.38	48,354.30
Total			365,875.85

Table 4.3.3.24 Guyana - Unequal with WP effect

Guyana			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.570	57,6018.1	328,550.74
Belize	0.702	461,952.5	324,393.48
Congo	0.612	116,618.7	71,391.28
Ivory Cost	0.659	116,618.7	76,867.19
Jamaica	0.532	1,358,941	722,993.23
Madagascar	0.500	123,190.4	61,618.39
Tanzania	0.651	116,618.7	75,869.58
Trinidad	0.498	500,901.7	249,301.40
Total			1,910,985.29

Table 4.3.3.25 Malawi - Unequal with WP effect

Malawi			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.551	764,040.2	421,217.40
Belize	0.686	612,741.7	420,201.14
Congo	0.594	154,685	91,825.77
Ivory Cost	0.642	154,685	99,233.06
Jamaica	0.513	1,802,523	924,106.42
Madagascar	0.481	163,401.8	78,568.24
Tanzania	0.633	154,685	97,879.53
Trinidad	0.478	664,404.6	317,817.54
Total			2,450,849.10

Table 4.3.3.26 Mauritius - Unequal with WP effect

Mauritius			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.613	94,921.97	58,143.52
Belize	0.737	76,125.11	56,134.59
Congo	0.653	19,217.59	12,543.90
Ivory Cost	0.697	19,217.59	13,398.59
Jamaica	0.575	223,939.8	128,808.58
Madagascar	0.544	20,300.53	11,037.88
Tanzania	0.653	19,217.59	12,551.19
Trinidad	0.541	82,543.55	44,677.41
Total			337,295.66

Table 4.3.3.27 Swaziland - Unequal with WP effect

Swaziland			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.573	547,730	313,911.57
Belize	0.705	439,266.1	309,484.79
Congo	0.615	110,891.6	68,178.55
Ivory Cost	0.662	110,891.6	73,369.66
Jamaica	0.535	1,292,204	691,078.78
Madagascar	0.503	117,140.5	58,918.97
Tanzania	0.653	110,891.6	72,424.34
Trinidad	0.500	476,302.6	171,559.21
Total			1,758,925.88

Table 4.3.3.28 Zimbabwe - Unequal with WP effect

Zimbabwe			
Sellers	1-β	Total profit ($)	Partial profit2 ($)
Barbados	0.465	1,444,122	672,138.01
Belize	0.607	1,158,151	703,348.92
Congo	0.509	292,372.2	148,711.86
Ivory Cost	0.559	292,372.2	163,465.85
Jamaica	0.427	3,406,971	1,454,631.00
Madagascar	0.396	308,847.9	122,377.66
Tanzania	0.550	292,372.2	160,732.16
Trinidad	0.394	1,255,800	494,616.20
Total			3,920,021.65

CHAPTER5. CONCLUSION AND LIMITATIONS OF THE STUDY

5.1. Summary and Conclusion

The pressures for reform within the World Trade Organization (WTO) have led to the European Union reforming its sugar policy with a price cut phased from 2006 to end in 2009. The impact of this reform would be felt not only by EU sugar producers but also by the ACP sugar protocol countries that have a preferential market access to the European Union protected price embodied in the Lomé and Cotonou Agreements. The study investigates the effect of the EU sugar policy reform on these ACP sugar countries.

This research makes two main contributions to the body of research literature. First, by examining the supply and demand of the ACP sugar protocol countries, innovations were made based upon the existing literature on the ACP-EU sugar market. The behavior of ACP sugar protocol countries' supply and demand functions during the protocol years and prior to the reform were examined. While the determinants of supply in some countries performed as expected, others did not show sign of an improvement due to the sugar protocol. This suggests that there has been neglect or deterioration of the infrastructure in the sugar industry. On the demand side it was found that, in some countries, price does not affect the decision of the consumer due to the fact that there are no ready substitutes for sugar in those countries.

Second, results of the quota market model under the simplifying assumptions of a bilateral monopoly model are in part a test of whether there could be a solution to the impact of the EU sugar policy reform on the ACP sugar protocol countries. This research explored how the protocol countries are affected by the former regime and how they would be affected when the full reform takes place. The results of the pre reform scenario

show that the countries were enjoying substantial transfer benefits and that the size of the transfer depends on the total cost, but mostly on the quota allocation. In the post-reform scenario, results revealed that there are some countries that will no longer be able to make profits if they were to continue producing and selling to the European Union.

Finally, the study develops a quota market analysis using a bilateral monopoly methodology to examine negotiated transfer quota outcomes between ACP countries. We allow for the countries that can no longer make profits to sell their quota rights to the countries that can still make profit. Moreover different scenarios are examined, alternatively assuming equal bargaining power and unequal bargaining power. In the equal bargaining power case the total profit is equally divided between seller and buyer. In the unequal bargaining power, we consider two cases. The case where the world price is not affected by the EU sugar policy reform shows that sellers would have increased bargaining power and a higher share of profit. A case where the world price is increased by thirty per cent shows that the buyer will exercise superior bargaining power than the seller and obtain the larger share of the profit. The results show that buyers and sellers benefit from the quota market scenario and, most importantly, sellers that would have ended up with a complete loss obtain revenue that can be invested in other activities to enhance competitiveness.

5.2. Limitations of the Study

This research attempted to analyze the ACP sugar protocol countries supply and demand and create a quota market model as a response to the EU sugar policy reform. The research was challenged by data availability. On the supply and demand side the price data was difficult to obtain and proxies had to be used in several cases, which may have

affected the results in some cases. For example the data on producer price was not available for each country. This led to the use of either the world or EU price, which was then converted into producer price using each country's respective exchange rate. In addition, for the consumer price the closest proxy was the world price converted into domestic price, once again using the respective exchange rates.

The second limitation was in the costs estimations. A complete data set on transportation and production costs for the ACP countries could not be constructed. Estimation was not possible because a time series data set of the variables that needed to be used was not available. Because of confidentiality, we were not able to obtain the full data from the recognized consulting company that has an up to date and reliable data. Computed proxies were used as alternatives in the cases where data were not available. Total cost was the sum of freight rates, fobbing costs and production costs. For production costs, USDA attaché reports were used. For transportation costs, a data set was provided by LMC International. Of the seventeen countries, data on freight rates and fobbing costs were obtained for ten. LMC reports that all southern African countries ship from either the ports of Maputo or Beira in Mozambique and therefore have the same or similar freight rates. Following this rationale, freight rates are derived for the remaining seven countries based on the assumption that countries from the same region are shipping from the same port, and hence, all have the same rates. The fobbing rates for the remaining seven countries were derived using the available fobbing costs in association with the factors that explain differences in transport costs such as distance, country's geographical and infrastructure measures, and common borders.

Lastly because of the nature of the sugar protocol (form of aid to the ACP

countries), the application of the quota market model using the bilateral monopoly methodology called for the relaxation of some assumptions. It was challenging to justify the model theoretically and empirically but the use of the methodology was worth performing in this case. In the theoretical model, the buyer and seller decide the optimal price and quantity profile of the intermediate product by maximizing the product of each party's profit, weighted by their bargaining powers. Our goal diverges from the framework in that we assume that quantity is predetermined by an external party. This is due to the nature of the sugar protocol and considering the fact that in previous cases where a country could not fulfill it quota requirement, the European Union was deciding the reallocation of that quota. Also, considering the nature of the sugar protocol, the price decision was clearly going to depend on the world price which led us to use the world price to solve for bargaining powers and profits.

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