# The 2005 WTO arbitration and the new EU import regime for bananas: a cut too far?

## Giovanni Anania

*Department of Economics and Statistics, University of Calabria, Italy*

## Summary

In 2001 an agreement was reached at the WTO for the EU to introduce a '*tariff-only*' regime which '*would result in at least maintaining total market access for MFN banana suppliers*'. The analysis shows that, contrary to the WTO 2005 ruling, the import regime proposed by the EU in the second step of the arbitration would have satisfied the requirement. The regime introduced on 1 January 2006 is expected to yield in 2007 MFN imports 400,000 t above the level that would have occurred under the previous regime. In the longer run, MFN countries will see their exports expand, while the opposite would have happened had the new regime not been introduced.

**Keywords:** bananas, European Union, ACP countries, trade preferences, WTO arbitration

**JEL classification:** Q17, Q18, F13

## 1. Introduction

Over the years bananas have caused continuous headaches to the European Union (EU), both internationally and internally. Internationally, the Common Market Organization for bananas (CMOB) has generated heated controversies since its introduction in 1992 (Thagesen and Matthews, 1997; Read, 2001; Josling, 2003; Tangermann, 2003b). Internally, bananas have been a serious issue ever since the negotiations to establish the European Economic Community in 1957 (Tangermann, 2003a). In fact, the CMOB has often been identified as the most controversial single Common Agricultural Policy market regime.

However, many thought that the 'banana war' had come to an end when, at the November 2001 WTO Ministerial Conference in Doha, two Decisions were taken: for a transitional EU import regime for bananas (WTO, 2001b) and for the introduction, no later than 1 January 2006, of a '*tariff-only*' regime which '*would result in at least maintaining total market access for*

*MFN banana suppliers*' (WTO, 2001c).[1] An Annex to the 14 November 2001 WTO Decision (WTO, 2001c) spelled out the details of the two-step procedure to be followed in determining the tariff equivalent to the EU import regime for bananas in place at the time. Should an 'interested party' consider the proposal by the EU unsatisfactory, it had the right to request arbitration; if the arbitrator judged that the proposed regime would not '*result in at least maintaining total market access for MFN banana suppliers*', the EU had the right to modify its proposal; if the revised proposal was also considered unsatisfactory by an interested party, the same arbitrator was to determine once more whether the new proposal satisfied the requirement. If the arbitrator considered that the requirement was still not met, the procedure would come to an end and the WTO waiver allowing the EU to grant preferential treatment to bananas imported from ACP countries would cease to apply upon the introduction of the 'tariff-only' import regime.

In January 2005, the EU proposed a €230/t tariff on bananas imported from MFN countries, without specifying the regime under which bananas would be imported from ACP countries. In August 2005, the arbitrators ruled that this regime did not satisfy the requirement (WTO, 2005a). In September 2005, the EU proposed a significantly lower MFN tariff (€187/t) along with a duty-free tariff rate quota (TRQ) of 775,000 t for its imports from ACP countries only. In October 2005, the arbitrators ruled that this import regime too would not '*result in at least maintaining total market access for MFN banana suppliers*' (WTO, 2005b). This decision put the CMOB back on the table of multilateral international trade negotiations. In November 2005, the EU decided, unilaterally, to adopt a 'tariff-only' regime on 1 January 2006 that entails a €176/t MFN tariff and a 775,000 t tariff-free annual import quota reserved for imports from ACP countries. At the Hong Kong WTO Ministerial Conference in December 2005, the opposing interests of ACP and MFN banana exporters meant that no agreement was reached on bananas.[2] MFN countries decided not to veto the final Declaration although their requests on bananas had remained unanswered, but no waiver was granted to allow the EU to give preferential treatment to bananas imported from ACP countries. Meanwhile, Honduras, Nicaragua and Panama announced their intention of challenging the new 'tariff-only' regime by initiating a new WTO dispute. The 'banana war' had broken out once more.

Using an original model of the banana market, this paper analyses the policy issue of the replacement of the previous EU import regime for bananas with the 'tariff-only' regime.

The precise interpretation of the phrase '*at least maintaining total market access for MFN banana suppliers*' was one of the areas of disagreement

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1 These Decisions follow the 'mutually satisfactory solution' to end the banana dispute agreed between the EU and the US, and then accepted by Ecuador, in April of the same year (WTO, 2001a).

2 It was only agreed to introduce a monitoring procedure for EU banana imports, in order to verify the impact of the new regime, if any, in terms of changes in trade patterns, volume imported and prices.

between the parties in the arbitration. The ruling by the arbitrators was that their mandate required '*a determination as to whether the proposed new EC tariff for bananas would preserve, at a minimum, the effective opportunities to enter the EC banana market afforded to MFN suppliers by the existing condition of entry. . . .because it relates to certain opportunities to enter the market, "total market access for MFN banana suppliers" is not a guarantee of any particular level or volume of trade or price. Rather, it relates to the opportunity for MFN suppliers to enter and compete on the EC banana market*' (WTO, 2005a: 11). This decision, by itself, does not imply a usable benchmark for assessing the EU proposals. However, in their rulings the arbitrators agreed that a properly used 'price gap' methodology could effectively assess whether the proposed EC tariff would '*at least maintain total market access for MFN banana suppliers*' (WTO, 2005a: 18; 2005b: 10–11 and 13). Taken together, these two parts of the ruling imply that equivalence was to be achieved between MFN exports to the EU under its previous import regime and those under the new regime, taking into consideration expected changes in other market conditions. Accordingly, the benchmark used in this study for assessing whether the import regimes proposed by the EU in the arbitration and the one introduced on 1 January 2006 comply with the 2001 WTO Decision is the level of MFN exports to the EU that would have occurred had the pre-2006 EU import regime remained in place.

Our paper addresses the following questions. Would the EU regime proposed in the second step of the arbitration have resulted '*in at least maintaining total market access for MFN banana suppliers*'? And the one the EU proposed in the first step? Were MFN countries right in claiming the tariffs proposed by the EU were too high, suggesting a €75/t tariff instead? Which tariff would result '*in at least maintaining total market access for MFN banana suppliers*'? Was the 'price gap' approach used by the EU and accepted by the arbitrators actually an appropriate methodology for calculating the tariff that would satisfy the requirement? Finally, what are the expected effects on prices and trade flows of the new EU 'tariff-only' regime in place since 1 January 2006?

The main conclusion, based on the simulations reported here, is that the import regime proposed by the EU in the second step of the arbitration would have met the equivalence requirement (as the import regime introduced in January 2006 is expected to do). In addition, under the circumstances of this specific arbitration, the appropriateness of a 'price gap' approach for calculating the tariff that would satisfy the requirement is questioned.

The next section uses a graphical approach to discuss the expected impact of replacing the pre-2006 EU import regime with a 'tariff-only' regime yielding an unchanged volume of MFN exports. Section 3 describes the structure of the model, the assumptions made and the data used and explains how the model of the banana market used differs from other models. The main results of the simulations are presented in Section 4; Section 5 outlines the results obtained for some of the policy scenarios assuming a medium-term time horizon. Section 6 sums up the main results and discusses their implications.

## 2. Expected policy impacts

The EU import regime for bananas in place before 1 January 2006 included two TRQs, quota A/B and quota C. Quota A/B was open to all exporters, with imports from ACP countries entering duty-free and imports from MFN countries being subject to a €75/t tariff. Quota C was allocated to duty-free imports from ACP countries only. Out-of-quota imports were subject to an MFN import tariff of €680/t, and those originating from ACP countries faced a preferential tariff of €380/t. However, both out-of-quota tariffs proved to be prohibitive.

This import regime is depicted in Figure 1. $ES_{ACP}$, $ES_{MFN}$ and $ED_{EU}$ represent the export supplies of ACP and MFN countries to the EU market (i.e. their export supply functions net of exports to other countries, at any given price) and the import demand of the EU, respectively. $ES'_{ACP}$ and $ES'_{MFN}$ are the export supplies of the two groups of countries, expressed as a function of the equilibrium price in the EU, when quotas A/B (equal to $X_{MFN}$) and C (equal to $X_{ACP}$) and the in- and out-of-quota tariffs are taken into account. $ES'_{MFN+ACP}$ in the right-hand-side diagram is the resulting aggregate export supply of countries ACP and MFN (transport costs are ignored). The market equilibrium is identified by point A. EU imports $M_{EU}$ and exports from MFN and ACP countries equal quotas A/B ($X_{MFN}$) and C ($X_{ACP}$), respectively. Quota A/B and C licences are allocated to traders free of charge; as a result, equilibrium prices in ACP and MFN countries equal $p_{MFN}$ and $p_{ACP}$, whereas $QR_{ACP}$ and $QR_{MFN}$ in Figure 1 give the per unit quota rents. No out-of-quota exports take place and ACP countries are not competitive enough to be able to export to the EU within quota A/B (their entry price, $p^e_{ACP}$, is higher than the equilibrium price in the MFN countries plus the tariff). The shaded area in the central diagram in Figure 1 gives the tariff revenue collected by the EU.

A 'tariff-only' import regime (like the one proposed by the EU in the second step of the arbitration) that results in MFN exports equal to those under the pre-2006 regime is represented in Figure 2. $ES^*_{MFN}$ is the export supply of the MFN countries when quota A/B is removed and a higher MFN tariff ($t^*_{EQV}$) is imposed such that MFN exports remain unchanged. Quota C is expanded from $X_{ACP}$ to $X^*_{ACP}$[3] and the out-of-quota tariff faced by ACP countries is now equal to the new MFN tariff. $ES^*_{MFN+ACP}$ represents the aggregate export supply of MFN and ACP countries on the EU market as a function of the equilibrium price in the latter and point B represents the market equilibrium. The MFN tariff is such that MFN exports and the equilibrium price are unchanged with respect to those under the previous regime. ACP exports to the EU equal the enlarged quota ($X^*_{ACP}$). The equilibrium price in the EU drops from $p_{EU}$ to $p^*_{EU}$; EU imports ($M^*_{EU}$) exceed those under the previous regime by the increase in quota C. The tariff that leaves

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3  In the pre-2006 import regime, quota C was equal to 750,000 t, whereas in the regime proposed by the EU in the second step of the arbitration and in the regime the EU introduced on 1 January 2006, quota C equals 775,000 t.
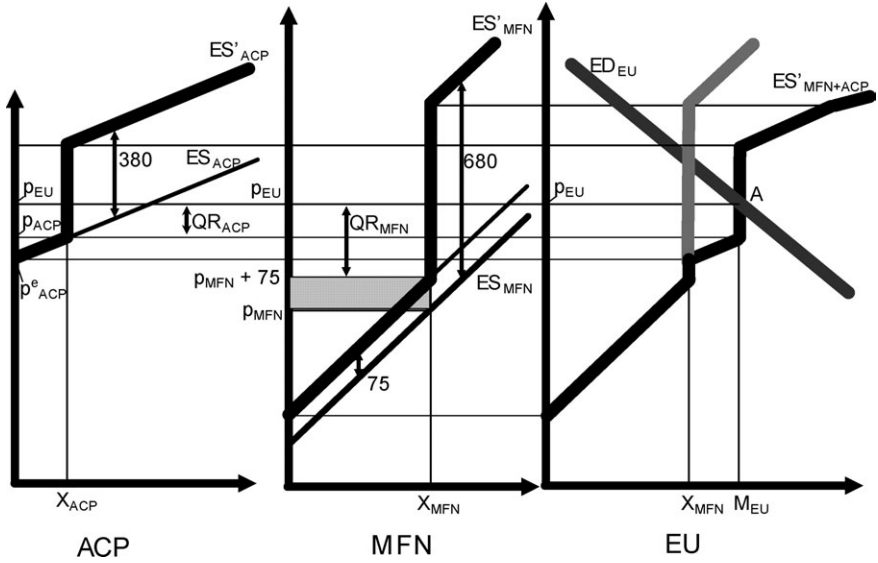
**Figure 1.** The pre-2006 EU import regime for bananas.

MFN exports unchanged is smaller than the sum of the in-quota A/B tariff (€75/t) and the per unit quota rent under the previous regime ($QR_{MFN}$ in Figure 1); the difference equals the reduction in the EU equilibrium price (which is solely driven by the expansion of quota C). The per unit rent



**Figure 2.** A 'tariff-only' EU import regime for bananas resulting in MFN exports to the EU equal to those under the pre-2006 regime.

associated to quota C falls by a larger amount, as a result of the lower price in the EU and the higher price ($p^*_{ACP}$) in the A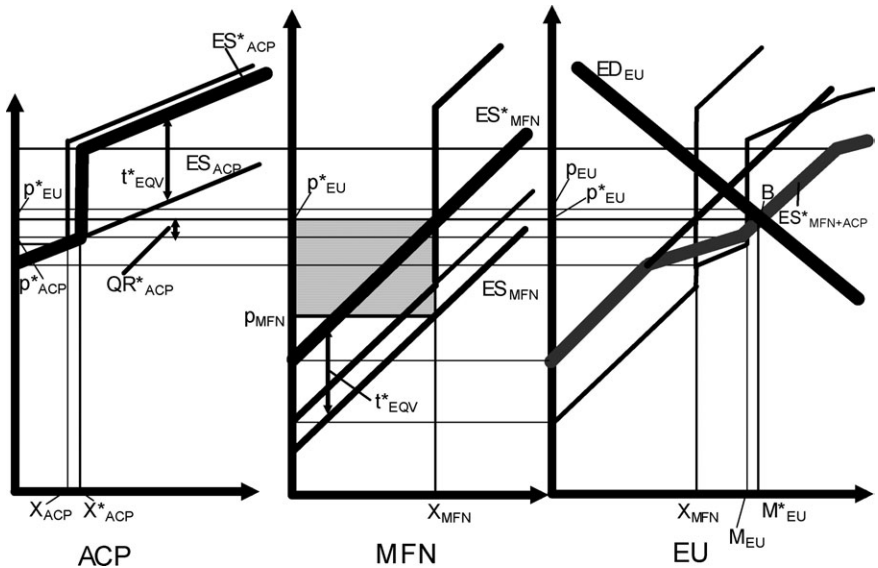CP countries. The cross-hatched area in Figure 2 represents the tariff revenue now collected by the EU; because of the lower EU equilibrium price, this is less than the sum of the tariff revenue collected by the EU and the quota A/B rents enjoyed by licence holders under the previous regime.

Finally, were the MFN tariff set below $t^*_{EQV}$, $ES^*_{MFN}$ would shift downwards, inducing a shift to the right of $ES^*_{MFN+ACP}$ and shifting point B downward along $ED_{EU}$. MFN exports to the EU would now increase; however, within a certain range of values for the applied MFN tariff, ACP exports and prices would not be affected.[4]

The 'Everything but arms' (EBA) initiative[5] dramatically changed the relative competitiveness of EBA exports *vis à vis* MFN exports although, even under the more favourable conditions, the short-run capacity of EBA countries to export bananas to the EU profitably cannot be taken for granted. It can be shown that, when the EBA initiative is taken into account, ACP and MFN prices and exports do not change while EU imports increase by the same amount as its imports from EBA countries. The EU equilibrium price, which is the price of bananas in the EBA countries as well, declines; the tariff that makes MFN exports equal those under the pre-2006 import regime and the per unit quota C rent are now lower than without considering the EBA initiative.

Two conclusions arise from this graphical analysis, which relate directly to the questions raised in the introductory section of the paper.

The fact that the 'equivalent' tariff is smaller than the sum of the in-quota A/B tariff and the per unit quota A/B rent of the pre-January 2006 regime—as a result of both the increase in quota C and the implementation of the EBA initiative—has an important implication for the assessment of the WTO arbitration. In the WTO arbitration, the EU used the 'price gap' methodology agreed upon in the 1994 Agreement on Agriculture for the tariffication of non-tariff barriers to trade to calculate the tariff equivalent for MFN exports to its pre-2006 import regime.[6] The EU probably did so because, having been approved by WTO members, this was the only methodology that could not be queried by the other parties; in fact, the arbitrators did not object to the use of the 'price gap' approach to identify a tariff level that would satisfy the requirement. However, because of both the enlargement of quota C and the implementation of the EBA initiative, in this case this approach yields a tariff level above the 'equivalent' one, i.e. a tariff that would have *not* resulted '*in at least maintaining total market access for MFN banana suppliers*'.

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4  This holds as long as the tariff reduction leaves the resulting EU equilibrium price above $p^*_{ACP}$ in Figure 2.

5  With the EBA initiative (EC Regulation 416 of 28 February 2001) the EU granted duty-free and unlimited market access to all exports except arms and ammunitions from Least-Developed Countries. Full implementation of the EBA initiative for bananas occurred on 1 January 2006.

6  This methodology is described in Annex 5 to the Agreement on Agriculture. Essentially, the tariff equivalent is calculated as the difference between observed relevant internal and external prices.

The existence of a binding TRQ on ACP banana exports to the EU makes them independent of the MFN tariff level, at least over a certain range of tariff values. Hence, the MFN tariff level proposed by the EU in the second step of the arbitration (along with a 775,000 t tariff-free TRQ for its imports originating in ACP countries) was (at least within certain limits) irrelevant from the point of view of ACP interests, and should not have constituted a source of friction in the arbitration between the two groups of developing countries.

## 3. The model

The model used is a single-product, spatial, partial equilibrium, mathematical programming model. Based on Samuelson (1952) and Takayama and Judge (1971), the model is solved by maximising a 'quasi-welfare' function with respect to bilateral trade flows, subject to a set of constraints describing relevant demand and supply functions, price linkages (due to, for example, transport costs and tariffs), and policy interventions that cannot be represented through an exogenously determined price wedge (such as a deficiency payment or an import quota).[7]

The model developed in this study is different in many respects from other models of the banana market proposed in recent years. First, it is the only model we are aware of that simulates the introduction of the EU 'tariff-only' import regime for bananas taking into account the implementation of the EBA initiative. To ignore this initiative implies, *ceteris paribus*, under-estimating EU imports and non-EBA ACP exports and over-estimating non-EBA MFN exports.

Second, the EU 'compensatory aid' deficiency payment to domestic banana producers is explicitly modelled, including the existing financial stabiliser mechanism, and an assessment of the budget implications for the EU (cost of the policy) and for the member states (tariff revenue) of the policy regimes simulated is provided. Most models of the banana market ignore the domestic components of the EU policy regime;[8] to the best of our knowledge, the effects of the financial stabiliser mechanism have never been considered and no assessment of the budget implications for the EU of the policy changes addressed has been offered. Ignoring EU 'compensatory aid' deficiency payments to domestic banana producers overlooks the fact that banana production decisions in the EU, being independent of the domestic banana price, are not influenced by changes in the import regime; if domestic production is such that the stabiliser mechanism comes into play, ignoring it leads to over-estimation of the budget expenditure for the domestic policy intervention.

Third, the fact that the model is 'spatial'—i.e. in addition to net trade positions, it is able to generate bilateral trade flows—makes it particularly suitable for representing policies that apply different regimes to imports

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7 A detailed description of the model is provided in the Appendix.
8 Kersten (1995) modelled the 'compensatory aid' as a minimum constraint on EU domestic production; Guyomard *et al.* (1999a) as a fixed production subsidy. Guyomard *et al.* (2006) and Arias *et al.* (2005) modelled the 'compensatory aid' as a deficiency payment, in a similar way to this study.

from different countries without having to make unrealistic assumptions. This holds for the current and previous EU trade regimes for bananas as well as for the two 'tariff-only' import regimes proposed by the EU that went to WTO arbitration, all of which include TRQs applied on imports originating in specific groups of countries and preferential tariffs.

Spatial models have been used to analyse the banana market by Kersten (1995), Lorca *et al.* (2004) and Spreen *et al.* (2004). More often, however, non-spatial models have been used (Borrell, 1997; Guyomard *et al.*, 1999a, 1999b and 2006; Guyomard and Le Mouël, 2003; Arias *et al.*, 2005; and Vanzetti *et al.*, 2005). In most cases, the inability of a non-spatial model to generate bilateral trade flows has been bypassed by assuming *a priori* that the existing TRQs are either binding or not binding (Guyomard *et al.*, 1999a and 1999b; Arias *et al.*, 2005; Vanzetti *et al.*, 2005). Although the premise that quotas A/B and C are binding under the pre-January 2006 EU import regime is probably not a very strong assumption, this is no longer the case when the current regime is considered; in this case, increased competition from unconstrained MFN exports may push ACP exports to the EU within the limit of the TRQ (in fact, this happens in some of the simulations presented in this study). Under the new import regime, whether the quota is binding or not becomes a relevant empirical question, which needs to be settled endogenously by the modelling exercise. In addition, non-spatial models cannot include the possibility of out-of-quota imports taking place subject to a tariff higher than that imposed on in-quota imports. Finally, non-spatial models cannot consider the EBA initiative in the simulations of the current EU import regime. In the model developed by Vanzetti *et al.* (2005), the limitations of non-spatial models in dealing with discriminatory trade policies are circumvented by assuming imperfect substitution between bananas produced in different countries (the so called 'Armington assumption'; Armington, 1969), implying that bananas are not a homogeneous good and that consumers are able to differentiate them by their country of origin. Were this not the case, the results of the simulations would be severely distorted. Vanzetti *et al.* (2005: 7, footnote 5) warn the reader of these implications and acknowledge that bananas are a homogeneous product, making it clear that the results obtained are highly sensitive to the arbitrary value they use (5, across all countries) for the elasticity of substitution (Vanzetti *et al.*, 2005: 13).

Our model considers three sources of domestic supply in the EU—France (Martinique and Guadeloupe), Spain (Canary Islands), and "Other EU-15" countries (Portugal and Greece)—fourteen exporting and eight importing countries/regions.[9] Per unit international transaction costs—defined as the sum of all costs incurred by the operators in moving bananas from border to border,

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9 Five ACP (Ivory Coast; Cameroon; Dominican Republic, Belize and Suriname; Jamaica, Windward Islands and other ACP non-EBA countries; ACP EBA countries), and nine non-ACP exporting countries/regions (Ecuador; Colombia; Costa Rica; Panama; Honduras; Brazil; Guatemala; other MFN exporting countries; non-ACP EBA countries) are considered in the model. The importing countries/regions are: EU-15, Czech Republic, Slovakia, Poland, Hungary, other EU new member states, USA and other importers.

including transport and handling costs—are assumed to be constant with respect to volume exchanged and time. The matrix of the transaction costs has been generated by expanding the available information regarding transport costs, and imposing internal coherence as well as consistency with observed trade.

The base model time reference is 2002. Import demand and export supply functions, as well as domestic supply functions in the EU, are assumed to be linear or well approximated by linear functions in the portion relevant for the simulations conducted. Import demand and export supply functions in the base year were obtained from observed trade quantities, observed import and export prices, and import demand and export supply price elasticities at the equilibrium in each country/region (Table 1). EU supply functions were obtained analogously from observed quantities produced and relevant prices and supply price elasticities. The values of the elasticities used are based on those used in other studies (Kersten, 1995; Guyomard *et al.*, 1999a; Spreen *et al.* 2004; Arias *et al.*, 2005; Vanzetti *et al.*, 2005). Sensitivity analyses have been performed showing the results are robust with respect to the values of the elasticities used.[10]

Net imports, net exports and average import and export unit values were computed from information in the FAOSTAT database. From a preliminary analysis of the statistical information, four data issues emerged. These concerned the average import value for Hungary and the average export value for Cameroon, the aggregate 'Jamaica, Windward Islands and other ACP non-EBA countries' (JWIO) and Brazil. Values for Hungary, Cameroon and Brazil appeared to be unrealistically low, and the average export value for JWIO unrealistically high.[11] The average import and export values obtained from the United Nations Statistics Division's Commodity Trade Statistics Database (COMTRADE) were used in the model for Hungary, Cameroon and Brazil (Table 1).[12] However, these prices too seem lower than expected and should be treated with caution; this implies that, everything else held constant, the model is expected to *under-estimate* banana imports and consumption in Hungary, to *over-estimate* banana exports from Cameroon and Brazil and to *under-estimate* exports from the aggregate 'JWIO'.

The €/$ exchange rate used in the 2002 base model is 0.95, the average exchange rate in that year.

The representation of the EU-15 import regime in the 2002 base model includes:

(a) quota A/B: a 2,653,300 t import quota, with all exports occurring on a non-preferential basis subject to a €75/t tariff (ACP exports can enter quota A/B duty-free);

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10 Selected results of the sensitivity analyses performed are presented in Section 4.

11 The average import value for Hungary was $243.4/t, compared, for example, with $446.3/t for Poland, $458.4/t for Slovakia and $495.7/t for the Czech Republic. The average export values for Cameroon, Brazil and JWIO were $189.7/t, $139.3/t and $455.1/t, respectively, compared, for example, with $223/t for Ecuador, $283.7/t for Colombia and $289.1/t for Ivory Coast.

12 The average export value for JWIO derived from COMTRADE was even larger than the one from FAOSTAT.

**Table 1.** Base model input data and model Calibration (2002)

| Country/region | Base net imports[a] (000 t) | Estimated net imports (000 t) | % difference | Base net exports[b,c] (000 t) | Estimated net exports (000 t) | % difference | Import price ($/t) | Export price ($/t) | Export supply price elasticities | Import demand price elasticities | Domestic demand income elasticities |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EU-15 | 4059.7 | 4248.9 | 4.7 | | | | 588.6 | | | −0.50 | 0.5 |
| Czech Republic | 99.6 | 103.0 | 3.4 | | | | 495.7 | | | −0.75 | 1 |
| Slovakia | 46.0 | 46.4 | 0.9 | | | | 458.4 | | | −0.80 | 1 |
| Poland | 232.0 | 233.3 | 0.6 | | | | 446.3 | | | −0.80 | 1 |
| Hungary | 101.6 | 75.5 | −25.7 | | | | 391.5 | | | −0.75 | 1 |
| Other EU new member states | 60.3 | 60.8 | 0.8 | | | | 549.3 | | | −0.80 | 1 |
| USA | 3490.4 | 3410.1 | −2.3 | | | | 272.4 | | | −0.40 | 0.4 |
| Other importers | 4510.3 | 4432.1 | −1.7 | | | | 375.0 | | | −0.80 | 0.5 |
| Spain | | | | 376 | 376.0 | 0.0 | | 408.1 | 1.0 | | |
| France | | | | 435.8 | 435.8 | 0.0 | | 246.5 | 1.0 | | |
| Other EU-15 | | | | 34.1 | 34.1 | 0.0 | | 325.2 | 1.0 | | |
| Ivory Coast | | | | 256.0 | 247.5 | −3.3 | | 289.1 | 1.5 | | 0.5 |
| Cameroon | | | | 238.4 | 231.1 | −3.1 | | 217.1 | 1.5 | | 0.5 |

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|---|---|---|---|---|---|---|
| Dominican Republic, Belize and Suriname | 179.2 | 171.7 | −4.2 | 404.5 | 1.0 | 0.5 |
| Jamaica, Windward Islands and other ACP non-EBA | 156.2 | 97.0 | −37.9 | 455.1 | 1.0 | 0.5 |
| ACP EBA exporters | 2.6 | 2.6 | 0.0 | 205.1 | 1.5 | 0.5 |
| Ecuador | 4199.2 | 4323.3 | 3.0 | 223.0 | 1.3 | 0.5 |
| Colombia | 1418.1 | 1349.0 | −4.9 | 283.7 | 1.3 | 0.5 |
| Costa Rica | 1873.2 | 1864.5 | −0.5 | 264.3 | 1.0 | 0.5 |
| Panama | 403.9 | 399.7 | −1.0 | 270.9 | 1.0 | 0.5 |
| Honduras | 437.2 | 441.6 | 1.0 | 246.4 | 1.5 | 0.5 |
| Brazil | 241 | 267.2 | 10.9 | 156.1 | 1.0 | 0.5 |
| Guatemala | 974.0 | 983.0 | 0.9 | 221.7 | 1.5 | 0.5 |
| Other MFN exporters | 1327.9 | 1339.8 | 0.9 | 186.4 | 1.0 | 0.5 |
| EBA non-ACP exporters | 47.1 | 46.2 | −1.9 | 190.6 | 1.5 | 0.5 |

[a]For EU-15 apparent consumption (imports + domestic production − exports).
[b]For Spain the volume of production which is not consumed locally in the Canary Islands; for Guadaloupe, Martinique, and 'other EU-15' the volume of production.
[c]For 'other MFN exporters' net exports adjusted for the difference in FAOSTAT data between total country exports and total country imports.

(b) quota C: a 750,000 t quota allocated to duty-free imports from ACP countries only;

(c) an out-of-quota MFN import tariff of €680/t (€380/t for imports from ACP countries).

In the 2002 base model Hungary, 'other EU new member states' and 'other importers' impose a tariff of 20, 3 and 7 per cent, respectively, on their banana imports.

The EU 'compensatory aid' domestic policy regime for bananas is modelled as a 'fully coupled' deficiency payment. The per unit payment is calculated as the difference between the given reference price and the market price. This means that, as long as the domestic market price remains below the reference price, the relevant domestic producer price in the EU (market price + per unit 'compensatory aid') does not change and domestic production does not adjust to changes in the EU domestic market price; what does change with the latter is the per unit 'compensatory aid' paid to producers. In the model, compensatory payments are calculated according to the existing 'stabilisation' mechanism.[13]

In modelling the banana market, the (explicit or, more often, implicit) assumptions made about where rents from A/B and C quotas end up are crucial (Arias *et al.*, 2005; FAO, 2005; Guyomard *et al.*, 2006; Vanzetti *et al.*, 2005). In this study, quota rents are endogenously determined and are assumed to be captured by international traders. This means that quota rents do not 'show' either in export or import prices, but are part of the difference between observed EU import prices and export prices in ACP and MFN countries. Should this assumption not hold, the model would underestimate EU imports from countries previously subject to a quota. Perfect competition conditions are assumed to hold both in domestic and international markets.[14]

The 2002 base model calibration appears satisfactory (Table 1), apart from large percentage differences between observed and predicted net trade positions for Brazil, Hungary and the aggregate JWIO.[15] The simple (trade-weighted) average absolute percentage difference between observed and predicted values in 2002 is 4.3 (2.7) per cent for exports and 5.0 (3.0) per cent for imports.

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13 If total domestic banana production exceeds the sum of the maximum guaranteed volumes in the producing countries, then the volume on which aid is paid is cut in those countries where production exceeded the maximum guaranteed volume; this cut is reduced by taking into account the difference between maximum guaranteed volume and production in the countries where this difference exceeds zero. The automatic 'stabiliser' is triggered in both the 2007, and 2013 simulations; in 2007, it determines a cut in deficiency payments in France, in 2013 in France and Spain.

14 Although a few firms control a very large share of the banana market (FAO, 2003: Chapter 6; Taylor, 2003), empirical analyses (Deodhar and Sheldon, 1996; McCorriston, 2000; Herrmann and Sexton, 2001) do not agree as to whether they exert market power.

15 These relatively large differences arise because of the somewhat unrealistic average export/import values in 2002 available for these countries (see discussion above).

In the 2002 base model solution, both EU-15 TRQs—quotas A/B and C—are binding and no imports take place at out-of-quota tariff rates. ACP exports to the EU-15 equal the C quota (750,000 t) and no ACP exports occur within quota A/B; exports to the EU-15 by non-ACP countries are equal to the A/B quota (2,653,000 t).

## 4. Simulation results (2007)

Alternative policy regimes are simulated for 2007, the first year in which the EU policy change introduced in January 2006 could affect market outcomes,[16] and 2013, which is considered an adequate time horizon to assess the medium-term implications of the policy changes examined.

The 2002 base model has been 'extended' to 2007 by (a) modelling the 2004 enlargement of the EU-15 to the 10 new member states, (b) modelling the implementation of the EBA initiative, (c) modifying import demand and export supply functions in all countries/regions as a result of expected shifts in domestic demand and supply functions, and (d) assuming a €/$ exchange rate equal to 1.15.[17]

Import demand and export supply functions shift depending on expected changes in the quantities produced and consumed in each country/region. Consumption is assumed to change over time in line with population growth (projected from the period 1990–2003), and per capita income growth (projected from the period 1997–1999 to 2000–2002), both based on World Bank data. Income elasticities of demand used are provided in Table 1. Production growth rates are based on changes in banana yields from 1991–1993 to 2000–2002 from FAOSTAT. FAOSTAT was the source used for production and consumption in 2002 in all countries/regions.

Table 2 presents these parameters, as well as net imports and exports for all countries/regions in 2007 as generated by the model keeping prices constant at 2002 levels. That is, the changes in exports and imports reported in Table 2 are due solely to the shifts in export supply and import demand functions driven by changes in domestic consumption and production as a result of the expected growth in population, incomes and yields.[18] Some of the parameters governing these shifts were judged to be unsustainable over time; in particular, this was the case for (a) negative, (b) very high rates of change in yields and (c) for extreme (both, positive and negative) rates of change in per capita incomes. As a result, annual yield changes above 5 per cent were replaced by 5 per cent, and below 0 per cent by 0 per cent. Annual per capita income changes above 7 per cent were replaced by 7 per cent,

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16  The production cycle of bananas is around 9 months.

17  This is the exchange rate the EU assumes in its medium term forecasts for 2007. For the new member states, it was assumed that the exchange rates between their currencies and the US dollar change with the €/$ exchange rate (i.e., their exchange rates with respect to the euro remain constant).

18  For a given set of parameters, the difference between the size of the expected changes in country exports (imports) crucially depends on the difference in the share of their production (consumption) which is exported (imported).

**Table 2.** Time shifts impact under different parameters. Net imports and exports in 2007 at observed 2002 prices (000 t)

| Country | 2002 imports or exports | 2007 imports or exports (unadjusted parameters) | 2007 imports or exports (adjusted parameters) | Unadjusted per cent yearly change in | | | Adjusted[a] per cent yearly change in | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Population | Per capita income | Yields | Population | Per capita income | Yields |
| Spain | 376 | 396.2 | 396.2 | | | 1.05 | | | 1.05 |
| France | 435.8 | 508.4 | 508.4 | | | 3.13 | | | 3.13 |
| Other EU-15 | 34.1 | 30.6 | 34.1 | | | **−2.15** | | | **0** |
| Ivory Coast | 256.0 | 289.0 | 288.9 | 2.7 | **−3.28** | 2.38 | 2.7 | **−3** | 2.38 |
| Cameroon | 238.4 | 0[b] | 215.0 | 2.5 | −2.6 | **−8.28** | 2.5 | −2.6 | **0** |
| Dominican Republic, Belize and Suriname | 179.2 | 112.3 | 112.3 | 1.6 | 4.34 | 0.36 | 1.6 | 4.34 | 0.36 |
| Jamaica, Windward Islands and other ACP non-EBA | 156.2 | 124.9 | 142.1 | 2 | −0.25 | **−1.17** | 2 | −0.25 | **0** |
| ACP EBA exporters | 2.6 | 0[b] | 2.6 | **2.5** | **0.37** | **−0.24** | **0** | **0** | **0** |
| Ecuador | 4199.2 | 4885.8 | 4846.6 | 1.8 | **−4.16** | 2.3 | 1.8 | **−3** | 2.3 |
| Colombia | 1418.1 | 1420.0 | 1419.4 | 1.8 | **−6.54** | 0.02 | 1.8 | **−3** | 0.02 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Costa Rica | 1873.2 | 1803.3 | 1843.8 | 2.1 | **13.75** | 0.26 | 2.1 | **7** | 0.26 |
| Panama | 403.9 | 364.9 | 378.0 | 1.7 | 4.62 | **−0.51** | 1.7 | 4.62 | **0** |
| Honduras | 437.2 | 0[b] | 248.2 | 2.8 | 6.83 | **−8.84** | 2.8 | 6.83 | **0** |
| Brazil | 241 | 1649.3 | 424.1 | 1.4 | **−11.57** | 0.45 | 1.4 | **−3** | 0.45 |
| Guatemala | 974.0 | 1440.2 | 1245.1 | 2.6 | 2.11 | **8.03** | 2.6 | 2.11 | **5** |
| Other MFN exporters | 1327.9 | 701.8 | 701.8 | 1.7 | 1.04 | 1.77 | 1.7 | 1.04 | 1.77 |
| EBA non-ACP exporters | 47.1 | 0[b] | 47.1 | **2** | **5.11** | **−2.12** | **0** | **0** | **0** |
| EU-15 | 4059.7 | 4339.8 | 4339.8 | 0.3 | 2.08 | | 0.3 | 2.08 | |
| Czech Republic | 99.6 | 104.0 | 104.0 | −0.1 | 0.97 | | −0.1 | 0.97 | |
| Slovakia | 46.0 | 48.8 | 48.8 | 0.1 | 1.08 | | 0.1 | 1.08 | |
| Poland | 232.0 | 287.0 | 287.0 | 0 | 4.35 | | 0 | 4.35 | |
| Hungary | 101.6 | 116.2 | 116.2 | −0.2 | 2.93 | | −0.2 | 2.93 | |
| Other EU new member states | 60.3 | 68.4 | 68.8 | −0.5 | 3.54 | **5.49** | −0.5 | 3.54 | **5** |
| USA | 3490.4 | 4093.8 | 4093.8 | 1.2 | 5.04 | 3.17 | 1.2 | 5.04 | 3.17 |
| Other importers | 4510.3 | 3699.3 | 3699.3 | 1.1 | 0.44 | 3.44 | 1.1 | 0.44 | 3.44 |

[a]Per cent yearly yield changes above 5 per cent replaced by 5 per cent, below 0 per cent by 0 per cent; per cent yearly per capita income changes above 7 per cent replaced by 7 per cent, below −3 percent by −3 percent. ACP EBA and EBA non-ACP countries per capita income and population per cent yearly changes have been set equal to zero to put these regions in a relatively more favourable export condition.
[b]The country/region becomes a net importer.

and below −3 per cent by −3 per cent. Using observed population and per capita income growth rates in the EBA countries, both ACP and non-ACP ones, would have had a marked negative effect on their export supply over time, leading to decreased or to no exports. In order to make these countries more responsive to the preferential treatment under the EBA initiative, population and per capita income growth rates for ACP and non-ACP EBA exporters were set equal zero. Forecast imports and exports in 2007 for all countries/regions under the parameters adjusted as specified above, everything else held constant, are presented in Table 2 along with those obtained by using the original unadjusted parameters.

The 2004 EU enlargement was modelled by removing barriers to trade between the 10 new member states and the EU-15, and by extending the more protectionist trade regime in place in the EU-15 to the new member states; quota A/B was increased by 460,000 t.[19] Banana exports from EBA countries are assumed to enter the EU tariff-free and are not subject to any constraint.

The main results of the simulations are summarised in Table 3.

The 'Pre-2006 regime' column presents the market equilibrium predicted for 2007 under the EU import regime in place before 1 January 2006; it includes the impact of (a) the May 2004 EU enlargement, (b) the implementation of the EBA initiative, (c) the higher €/$ exchange rate, and (d) the shifts in the import demand and export supply functions due to changes in domestic supply and demand in each country/region. Under the pre-2006 EU policy regime, in 2007 both quotas A/B and C would still be binding. However, the EU would import 133,200 t of bananas from EBA countries outside quotas A/B and C. EU-25 imports in 2007 under the pre-2006 regime are predicted to be larger than those in 2002 (Table 1) by 74,200 t. This is the result of increased domestic production[20] and of lower consumption and imports in the new member states because of the higher prices after adoption of the more restrictive EU import regime, only partly compensated by increased consumption and imports by EU-15 countries.[21] Per unit quota rents predicted for 2007 are significantly higher than those in 2002; quota A/B rent equals $223/t (was $94.8/t in 2002) and that for quota C $174.5/t (was $56.1/t).[22] This is due to the increased exchange rate, higher

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19  In 2005, imports within this additional 460,000 t were constrained to enter the EU-25 through a new member state (although no constraint existed on the point of sale or consumption within the EU-25). However, this constraint was not imposed in the model on the assumption that by 2007 it will no longer exist because of its inconsistency with EU single market rules.

20  As a result of increased yields, EU domestic production is forecast to increase between 2002 and 2007 by 93,000 t.

21  This means that part of the expansion of quota A/B as a result of the enlargement is forecast to end up in increased MFN imports by EU-15 countries.

22  Estimates of pre-2006 quota rents vary between zero and over €250/t (FAO, 2005; Guyomard *et al.*, 2006). This wide variation depends on differences in approach, data and assumptions used (the most common approaches being based on available information on the price of the licenses, 'price gap' calculations and model simulations).

**Table 3.** Simulation results (2007) (SIM1-SIM7: pre-2006 regime = 100).

| | Pre-2006 regime (includes enlargement, implementation of EBA, demand and supply time shifts; €/$ exchange rate = 1.15) | SIM1 EU proposal in step II of the arbitration $t_{MFN} = €187/t$; duty-free ACP-specific TRQ = 775,000 t | SIM2 EU proposal in step I of the arbitration (with TRQ for ACPs) $t_{MFN} = €230/t$; duty-free ACP-specific TRQ = 775,000 t | SIM3 EU proposal in step I of the arbitration (with no TRQ for ACPs) $t_{MFN} = €230/t$; $t_{ACP} = €0/t$ | SIM4 MFN countries proposal $t_{MFN} = €75/t$; $t_{ACP} = €0/t$ | SIM5 Equivalent $t_{MFN}$ (with TRQ for ACPs) $t_{MFN} = €264/t$; duty-free ACP-specific TRQ = 775,000 t | SIM6 Equivalent $t_{MFN}$ (with no TRQ for ACPs) $t_{MFN} = €200/t$; $t_{ACP} = €0/t$ | SIM7 Current regime $t_{MFN} = €176/t$; duty-free ACP-specific TRQ = 775,000 t |
|---|---|---|---|---|---|---|---|---|
| EU-25, total imports (000 t) | **3996.2** | 108.8 | 104.2 | 104.7 | 120.5 | 100.6 | 107.8 | 109.9 |
| EU-25, total consumption (000 t) | **4934.8** | 107.1 | 103.4 | 103.8 | 116.6 | 100.5 | 106.3 | 108.0 |
| EU-15 import price (€/t) | **583.3** | 86.7 | 93.6 | 92.8 | 68.8 | 99.1 | 88.2 | 84.9 |
| EU-25 imports from MFN countries (000 t) | **3113.0** | 111.6 | 105.1 | 92.1 | 132.9 | 100.0 | 100.0 | 113.2 |
| EU-25 imports from ACP non-EBA countries (000 t) | **750.0** | 103.3 | 103.3 | 160.3 | 83.5 | 103.3 | 145.4 | 103.3 |
| EU-25 imports from EBA countries (ACP + non-ACP) (000 t) | **133.2** | 73.9 | 87.5 | 85.9 | 38.8 | 98.3 | 76.8 | 70.3 |
| MFN countries, total exports (000 t) | **10842.9** | 102.7 | 101.2 | 98.2 | 107.6 | 100.0 | 100.0 | 103.1 |

Table 3. (*continued*)

| | Pre-2006 regime (includes enlargement, implementation of EBA, demand and supply time shifts; €/$ exchange rate = 1.15) | SIM1 EU proposal in step II of the arbitration $t_{MFN}$ = €187/t; duty-free ACP-specific TRQ = 775,000 t | SIM2 EU proposal in step I of the arbitration (with TRQ for ACPs) $t_{MFN}$ = €230/t; duty-free ACP-specific TRQ = 775,000 t | SIM3 EU proposal in step I of the arbitration (with no TRQ for ACPs) $t_{MFN}$ = €230/t; $t_{ACP}$ = €0/t | SIM4 MFN countries proposal $t_{MFN}$ = €75/t; $t_{ACP}$ = €0/t | SIM5 Equivalent $t_{MFN}$ (with TRQ for ACPs) $t_{MFN}$ = €264/t; duty-free ACP-specific TRQ = 775,000 t | SIM6 Equivalent $t_{MFN}$ (with no TRQ for ACPs) $t_{MFN}$ = €200/t; $t_{ACP}$ = €0/t | SIM7 Current regime $t_{MFN}$ = €176/t; duty-free ACP-specific TRQ = 775,000 t |
|---|---|---|---|---|---|---|---|---|
| EU tariff revenue (million €) | **233.5** | 278.2 | 322.3 | 282.5 | 132.9 | 351.9 | 266.7 | 265.7 |
| EU 'Compensatory aid' budget expenditure (million €) | **243** | 127.3 | 113.0 | 114.7 | 164.0 | 101.8 | 124.2 | 131.0 |
| Quota A/B per unit rent ($/t) | **223.0** | — | — | — | — | — | — | — |
| Quota C per unit rent ($/t) | **174.5** | 44.8 | 71.6 | — | — | 92.7 | — | 37.9 |

import prices in the EU-25 and the downward shifts in MFN countries and Ivory Coast export supply functions.[23]

Seven simulations, representing different EU banana import regimes, were performed:

SIM1: €187/t MFN tariff on EU banana imports, plus preferential duty-free access up to 775,000 t for imports from ACP countries (out-of-quota ACP exports to the EU are subject to the MFN tariff).

SIM2: €230/t MFN tariff on EU banana imports, plus preferential duty-free access up to 775,000 t for imports from ACP countries (out-of-quota ACP exports to the EU are subject to the MFN tariff).

SIM3: €230/t MFN tariff on EU banana imports, plus unlimited preferential duty-free access to imports from ACP countries.

SIM4: €75/t MFN tariff on EU banana imports, plus unlimited preferential duty-free access to imports from ACP countries.

SIM5: the EU imposes an MFN tariff on banana imports such that its imports from MFN countries equal those that would have occurred under the pre-2006 EU import regime; ACP countries have preferential duty-free access up to 775,000 t (out-of-quota ACP exports to the EU are subject to the MFN tariff).

SIM6: the EU imposes an MFN tariff on banana imports such that its imports from MFN countries equal those that would have occurred under the pre-2006 EU import regime; ACP countries are granted unlimited preferential duty-free access.

SIM7: €176/t MFN tariff on EU banana imports, plus preferential duty-free access up to 775,000 t for imports from ACP countries (out-of-quota ACP exports to the EU are subject to the MFN tariff).

SIM1 is the regime the EU proposed in the second step of the arbitration. In SIM2 and SIM3, the MFN tariff is the one the EU proposed in January 2005, which was the focus of the first step of the arbitration (at the time the EU did not provide an explicit indication of the trade regime it intended to apply to its imports from ACP countries). MFN countries reacted to the EU proposals by insisting that the 'equivalent tariff' could not exceed €75/t, the tariff considered in SIM4. SIM7 is the EU import regime for bananas in place since 1 January 2006.

Under the regime modelled by SIM1, MFN exports to the EU increase by 8.8 per cent, from 3,113,000 to 3,473,100 t. However, total exports of MFN countries increase by a smaller amount (289,700 t), as they divert part of their exports previously directed elsewhere to the EU. Contrary to the arbitrators' decision, the results suggest the trade regime for bananas proposed by the

23 Aggregate export supplies expand both for MFN and EBA countries, whereas this is not the case for ACP countries. Not only is there a change in the relative aggregate competitiveness of exports of the different groups of countries, but also in the relative competitiveness of countries within each group. Within the MFN country aggregation, Ecuador, Guatemala and Brazil see the largest downward shifts in export supplies; among the ACP countries export supply expands in Ivory Coast only.

EU in September 2005 would have resulted '*in at least maintaining total market access for MFN banana suppliers*'. ACP exports to the EU-25 equal the (expanded) TRQ (775,000 t); the per unit quota rent ($78.2/t) is now significantly lower (−55.2 per cent) than under the pre-2006 regime, mostly as a result of the lower prices in the EU. Exports by EBA countries are lower than under the pre-2006 regime (they decline by 26.1 per cent, from 133,200 to 98,400 t) because of increased competition from MFN exports, which are no longer constrained by a quota. EU import prices decline; consumption increases by 7.1 per cent, from 4,934,800 to 5,285,100 t. As a result of the 'compensatory aid' deficiency payment scheme, EU domestic production does not change but, because of the lower domestic price, the budgetary cost of the policy increases by €66.4 million. The elimination of quota A/B implies transforming most of the quota rents under the pre-2006 regime into tariff revenue for the EU; the transfer of income from the holders of the quota licenses to the member state budgets is $416 million.

In determining the MFN tariff that '*would result in at least maintaining total market access for MFN banana suppliers*', the conditions offered by the EU to imports from ACP countries are important. With a €230/t MFN tariff, as proposed in January 2005, and unconstrained duty-free access to bananas originating in ACP countries (SIM3), ACP exports would enjoy a marked increase in competitive advantage on the EU market. ACP exports to the EU would increase by 60.3 per cent, from 750,000 to 1,201,900 t, whereas exports from MFN countries would drop below the 3,113,000 t mark, to 2,868,300 t. However, if the €230/t MFN tariff is coupled with a 775,000 t duty-free TRQ reserved for ACP imports only (SIM2), EU imports from MFN countries would increase by 5.1 per cent, to 3,271,800 t, whereas those from the ACP countries will equal the TRQ. In both scenarios, EBA exports to the EU fall compared to the pre-2006 regime because of the increased competition.

At the other end of the spectrum, if the EU allows duty-free access to bananas from ACP countries while imposing, as suggested by Latin American countries, a €75/t MFN tariff (SIM4), MFN countries enjoy a strong increase in their competitive advantage on the EU market. ACP exports to the EU fall by 16.5 per cent, whereas MFN exports increase by 32.9 per cent, from 3,113,000 to 4,138,200 t. As ACP exports to the EU-25 in SIM4 remain below 775,000 t, the same market equilibrium would occur if the EU were to impose a €75/t MFN tariff while limiting duty-free access to ACP imports to 775,000 t.

What is the value of the tariff that would result '*in at least maintaining total market access for MFN banana suppliers*'? If duty-free ACP exports to the EU are limited to 775,000 t (SIM5), the MFN tariff that would yield in 2007 MFN exports to the EU equal to those that would take place under the pre-2006 regime is €264/t. If, however, the EU grants ACP exports unconstrained duty-free access (SIM6), the equivalent tariff drops to €200/t. Although from the point of view of MFN countries these two trade regimes are equivalent, this is not the case for the other countries. When no TRQ is in place, the EU's ACP imports are higher at the expense of EBA imports, while the

EU's total imports and 'compensatory aid' budgetary expense are higher and tariff revenue lower.

Finally, under the EU's post-January 2006 banana import regime (SIM7), the model predicts EU imports from MFN countries in 2007 of 3,524,600 t, 13.2 per cent above their expected volume under the pre-January 2006 regime. ACP and EBA exports to the EU equal the TRQ and 93,700 t, respectively. EU tariff revenue is now lower than under the two trade regimes proposed in the arbitration, whereas the budget expenditure for the 'compensatory aid' domestic support policy is higher.

As the EU banana regime is likely to be the focus of a new WTO dispute, it is worth considering additional policy options. In Figure 3, EU-25 imports from MFN, ACP and EBA countries are shown as a function of the MFN tariff when the 775,000 t TRQ for ACP exports is in place, considering three different exchange rates; the middle line in each diagram represents EU imports from these three sources for the exchange rate used in the simulations presented so far (€1 = $1.15). MFN exports to the EU-25 increase as the MFN tariff declines, whereas those from the EBA countries decline as they face increasing competition from MFN countries. ACP exports to the EU are not affected by changes of the MFN tariff; only for MFN tariff values below €130/t is the decline of ACP competitiveness such that the TRQ is not filled.

The results proved to be robust with respect to the assumptions made for the most relevant parameters in the model. Sensitivity analyses were performed for the €/$ exchange rate, the price and income elasticities of the demand function in the EU-15, and some of the export supply elasticities. Due to space constraints, only the results for SIM1 are discussed here. When the €/$ exchange rate falls to 1, MFN exports to the EU-25 equal 3,272,900 t; even under an extremely pessimistic assumption such as the €/$ exchange rate being 0.95 (the exchange rate observed in 2002 and used in the base model), MFN exports to the EU-25 remain above the 3,113,000 t mark (they equal 3,192,300 t). However, with an exchange rate of 0.9, MFN exports to the EU-25 would be only 3,102,900 t. In Figure 3, expected MFN, ACP and EBA exports to the EU-25 as a function of the MFN tariff when the exchange rate equals 1 and 1.3 are represented.

If the price elasticity of the demand function in the EU-15 is set equal to −0.3 and −0.1 instead of −0.5, banana consumption in the EU-25 declines from 5.285 to 5.128 and 4.966 million tons, respectively, whereas imports from MFN countries equal 3.317 and 3.155 million tons, remaining above the 3.113 million tons mark. When the income elasticity of the same demand function is lowered from 0.5 to 0.3 or 0.1, EU-25 banana consumption remains above 5 million tons and MFN exports to the EU-25 are 3.381 and 3.291 million tons, respectively. Finally, sensitivity analyses were performed assuming different values of both elasticities of the EU-15 demand function. When the price elasticity is equal −0.3 and the income elasticity 0.3, EU-25 imports from MFN countries equal 3.227 million tons; however, if the
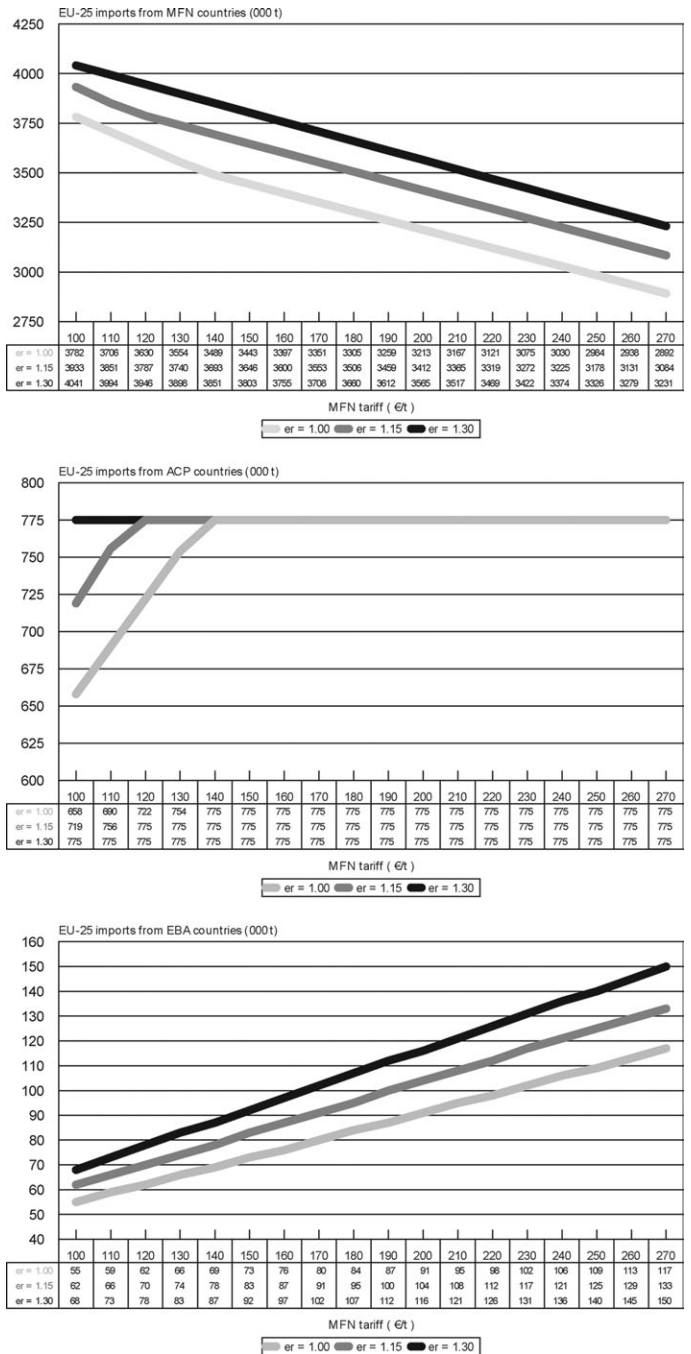
EU-25 imports from MFN countries (000 t)

| MFN tariff (€/t) | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| er = 1.00 | 3782 | 3708 | 3630 | 3554 | 3489 | 3443 | 3397 | 3351 | 3305 | 3259 | 3213 | 3167 | 3121 | 3075 | 3030 | 2984 | 2938 | 2892 |
| er = 1.15 | 3933 | 3851 | 3787 | 3740 | 3693 | 3646 | 3600 | 3553 | 3506 | 3459 | 3412 | 3365 | 3319 | 3272 | 3225 | 3178 | 3131 | 3084 |
| er = 1.30 | 4041 | 3994 | 3946 | 3898 | 3851 | 3803 | 3755 | 3708 | 3660 | 3612 | 3565 | 3517 | 3469 | 3422 | 3374 | 3326 | 3279 | 3231 |

er = 1.00 ● er = 1.15 ● er = 1.30

EU-25 imports from ACP countries (000 t)

| MFN tariff (€/t) | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| er = 1.00 | 658 | 690 | 722 | 754 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 |
| er = 1.15 | 719 | 756 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 |
| er = 1.30 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 |

er = 1.00 ● er = 1.15 ● er = 1.30

EU-25 imports from EBA countries (000 t)

| MFN tariff (€/t) | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| er = 1.00 | 55 | 59 | 62 | 66 | 69 | 73 | 76 | 80 | 84 | 87 | 91 | 95 | 98 | 102 | 106 | 109 | 113 | 117 |
| er = 1.15 | 62 | 66 | 70 | 74 | 78 | 83 | 87 | 91 | 95 | 100 | 104 | 108 | 112 | 117 | 121 | 125 | 129 | 133 |
| er = 1.30 | 68 | 73 | 78 | 83 | 87 | 92 | 97 | 102 | 107 | 112 | 116 | 121 | 126 | 131 | 136 | 140 | 145 | 150 |

er = 1.00 ● er = 1.15 ● er = 1.30

**Figure 3.** EU-25 imports from MFN, ACP and EBA countries as a function of the MFN tariff and the €/$ exchange rate, with a 775,000 t tariff-free TRQ for ACP exports in place (2007).

elasticities are set at −0.1 and 0.1, then they equal 2.980 million tons (consumption in EU-25 is now forecasted to equal 4.8 million tons).

The results are very stable with respect to the values used for the export supply elasticities. If those for Cameroon and Ivory Coast are equal to 5 (instead of 1.5) ACP aggregate exports to the EU remain constrained by the TRQ; the increased price responsiveness of Cameroon and Ivory Coast cannot overcome their gap in competitiveness *vis à vis* Latin American producers at MFN conditions, although their exports increase at the expense of those of other ACP countries, as does the quota rent. If export supply elasticities of all MFN countries are set at 0.8 (in the model they range between 1 and 1.5) their total exports remain almost unchanged, with only minor changes in their distribution between countries.

## 5. Simulation results (2013)

Results from medium term (2013) simulations for four of the policy scenarios considered above—the pre-2006 import regime, SIM1, SIM2 and SIM7—are presented in Table 4.

For each policy regime, the differences between the results in the two time horizons are determined by the expected shifts between 2007 and 2013 of domestic demand and supply functions in each country/region.

If the pre-2006 EU import regime for bananas were retained, EU-25 imports from ACP and MFN countries in 2013 would still be constrained by quotas C and A/B, with no over-the-quota imports from these countries taking place. EBA countries would take advantage of the constraints faced by exports from the other two groups and their exports to the EU would increase from 133,200 t in 2007 to 160,700 t.

Although their exports to the EU-25 would not change, total MFN exports would decline between 2007 and 2013; this results from the significant reduction in banana imports by 'other importers' (due to their increased capacity to satisfy their consumption with domestically produced bananas (Table 2)), only partially compensated by increased imports by the US, and by "other MFN" countries not exporting bananas any more.

On the contrary, under all three 'tariff-only' regimes considered in Table 4, MFN exports (in total and to EU-25) increase between 2007 and 2013; without the quota limitation MFN exports benefit from an expanding EU-25 demand for bananas and exploit their increased competitiveness. For example, under the current regime (SIM7), MFN exports to the EU are forecast to increase between 2007 and 2013 from 3.525 to 3.941 million tons (the increase in MFN total exports is less pronounced). Ecuador, Brazil and Guatemala are able to benefit the most from the EU 'tariff-only' regime in the medium term.

Under the three 'tariff-only' policy regimes considered, ACP exports do not change between 2007 and 2013; the lower aggregate relative competitiveness of their exports with respect to those from MFN countries leads only to a reduction in the per unit quota rent. However, in all scenarios, Cameroon and Ivory Coast see increase their exports at the expense of the other ACP

**Table 4.** Simulation results (2007 and 2013; €/$ exchange rate = 1.15) (SIM1, SIM2 and SIM7: pre-2006 regime = 100).

| | Pre-2006 regime (includes enlargement, implementation of EBA, demand and supply time shifts; €/$ exchange rate = 1.15) | | SIM1 EU proposal in step II of the arbitration $t_{MFN}$ = €187/t; duty-free ACP-specific TRQ = 775,000 t | | SIM2 EU proposal in step I of the arbitration (with TRQ for ACPs) $t_{MFN}$ = €230/t; duty-free ACP-specific TRQ = 775,000 t | | SIM7 Current regime $t_{MFN}$ = €176/t; duty-free ACP-specific TRQ = 775,000 t | |
|---|---|---|---|---|---|---|---|---|
| | 2007 | 2013 | 2007 | 2013 | 2007 | 2013 | 2007 | 2013 |
| EU-25, total imports (000 t) | **3996.2** | **4023.7** | 108.8 | 118.2 | 104.2 | 113.1 | 109.9 | 119.4 |
| EU-25, total consumption (000 t) | **4934.8** | **5091.2** | 107.1 | 114.4 | 103.4 | 110.4 | 108.0 | 115.4 |
| EU-15 import price (€/t) | **583.3** | **644.6** | 86.7 | 77.4 | 93.6 | 83.6 | 84.9 | 75.7 |
| EU-25 imports from MFN countries (000 t) | **3113.0** | **3113.0** | 111.6 | 124.8 | 105.1 | 117.7 | 113.2 | 126.6 |
| EU-25 imports from ACP non-EBA countries (000 t) | **750.0** | **750.0** | 103.3 | 103.3 | 103.3 | 103.3 | 103.3 | 103.3 |
| EU-25 imports from EBA countries (ACP + non-ACP) (000 t) | **133.2** | **160.7** | 73.9 | 59.2 | 87.5 | 70.6 | 70.3 | 56.4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MFN countries, total exports (000 t) | **10842.9** | **10544.1** | 102.7 | 106.1 | 101.2 | 104.3 | 103.1 | 106.5 |
| Ecuador | **4803.7** | **5235.2** | 102.9 | 106.5 | 101.3 | 104.6 | 103.3 | 106.9 |
| Colombia | **1307.4** | **1222.4** | 102.4 | 105.4 | 101.1 | 103.9 | 102.8 | 105.8 |
| Costa Rica | **1789.3** | **1642.4** | 101.9 | 104.2 | 100.8 | 103.0 | 102.2 | 104.5 |
| Panama | **364.9** | **311.0** | 101.9 | 104.1 | 100.8 | 102.9 | 102.1 | 104.4 |
| Honduras | **240.8** | **34.9** | 103.1 | 100.0 | 101.3 | 100.0 | 103.5 | 100.0 |
| Brazil | **452.3** | **635.9** | 102.9 | 106.6 | 101.3 | 104.7 | 103.4 | 107.1 |
| Guatemala | **1201.2** | **1462.3** | 103.4 | 107.8 | 101.5 | 105.6 | 103.9 | 108.4 |
| Other MFN | **683.3** | **0.0** | 102.7 | — | 101.2 | — | 103.1 | — |
| ACP countries, total exports (000 t) | **750.0** | **750.0** | 103.3 | 103.3 | 103.3 | 103.3 | 103.3 | 103.3 |
| Cameroon | **236.0** | **241.4** | 104.4 | 104.0 | 104.4 | 104.0 | 104.4 | 104.0 |
| Ivory Coast | **307.1** | **406.8** | 103.4 | 103.2 | 103.4 | 103.2 | 103.4 | 103.2 |
| Other ACP | **206.9** | **101.8** | 102.0 | 102.3 | 102.0 | 102.3 | 102.0 | 102.3 |
| EU tariff revenue (million €) | **233.5** | **233.5** | 278.2 | 311.0 | 322.3 | 360.9 | 265.7 | 297.0 |
| EU 'Compensatory aid' budget expenditure (million €) | **243** | **190.7** | 127.3 | 165.4 | 112.9 | 147.2 | 131.0 | 179.5 |
| Quota A/B per unit rent ($/t) | **223.0** | **306.8** | — | — | — | — | — | — |
| Quota C per unit rent ($/t) | **174.5** | **215.1** | 44.8 | 18.5 | 71.6 | 40.1 | 37.9 | 12.9 |

countries. Finally, when quota A/B is replaced by a tariff, EBA exports are predicted to decline slightly by 2013 (under the current regime from 93,700 to 90,600 t) as their increased *absolute* competitiveness is insufficient to avoid a reduction of their *relative* competitiveness with respect to MFN exports.

## 6. Conclusions

Contrary to the ruling of the arbitrators, the import regime for bananas proposed by the EU in the second phase of the arbitration would have satisfied the requirement of '*at least maintaining total market access for MFN banana suppliers*' as stipulated by the 14 November 2001 WTO Decision (WTO, 2001c). An MFN tariff equal to €187/t, coupled with a tariff-free 755,000 t TRQ for exports from ACP countries, would have led to MFN countries exporting 360,000 t more to the EU-25 in 2007 than under the pre-2006 regime. The current EU import regime for bananas, which includes the same preferential quota for ACP countries and a lower MFN tariff, allows an even larger volume of EU imports from MFN countries. Even the MFN tariff proposed by the EU in the first step of the arbitration, had it been coupled with a tariff-free 775,000 t TRQ for ACP countries, would have satisfied the conditions spelled out in the November 2001 WTO Decision.

The analysis yields two conclusions that appear relevant to the 'economics' used in the arbitration.

The existence of a duty-free 775,000 t TRQ for imports originating in ACP countries is crucial for assessing the impact of an MFN tariff to replace quota A/B. An MFN tariff of €187/t would satisfy the requirement both with and without the TRQ in place. However, this would no longer hold for a tariff of €230/t (with no TRQ in place, the 'equivalent' tariff suggested by the model is €200/t). This means that, in order to assess whether a proposed import regime would result '*in at least maintaining total market access for MFN banana suppliers*', both the existence and volume of the quota for ACP countries and the level of the MFN tariff have to be taken into account. Hence, it was impossible to verify whether the import regime unsuccessfully proposed by the EU in the first arbitration step, which did not specify the regime for ACP imports, would have satisfied the requirement laid down in the 2001 Decision.

Because (a) under the 'tariff-only' regime which was the focus of the second step of the arbitration quota C is larger than under the previous regime, and (b) on 1 January 2006 the EBA initiative was fully implemented for bananas, the tariff yielding the same volume of MFN exports as under the previous regime after this date is smaller than the 'equivalent' tariff obtained by applying the 'price gap' approach to pre-2006 information (the sum of the in-quota A/B tariff and the per unit quota A/B rent). This means that the 'price gap' approach as defined in Annex 5 of the URAA, which the EU used in the

arbitration to demonstrate the 'equivalence' of its proposed tariffs and which the arbitrators found appropriate, was to yield a tariff that would have *not* resulted '*in at least maintaining total market access for MFN banana suppliers*'.

Table 5 summarises the impact and preference rankings over the seven policy regimes of banana producers in MFN, ACP and EBA countries, and stakeholder groups in the EU.

The ranking of the regimes from the perspective of MFN banana producers is straightforward: with a 775,000 t TRQ for ACP exports to the EU in place, the lower the MFN tariff the better; for any given MFN tariff, a binding TRQ is preferred to unconstrained duty-free ACP exports to the EU. The TRQ has the effect of 'isolating' MFN exports to the EU from competition from duty-free ACP imports. Under the current regime, a wide range of downward shifts in ACP export supply functions (whether due to exchange rate changes or to productivity gains in the more competitive ACP countries) does not translate into increased competition for MFN exports on the EU market (the shifts end up in increased quota rents instead). Among the policy scenarios simulated here, only an import regime with no TRQ for ACP exports and an MFN tariff of €230/t would have yielded MFN exports to the EU below the pre-2006 level. On the contrary, had the MFN tariff been set equal to €75/t, as suggested by the MFN countries, the model predicts an increase in their exports to the EU of over 1 million tons with respect to those which would have occurred under the pre-2006 regime; under this scenario, the ability of less-competitive ACP countries to export bananas to the EU is doubtful. For MFN exporters, the introduction of a 'tariff-only' regime has even more relevant implications in a medium-term perspective. In fact, whereas under the previous regime total MFN banana exports are predicted to decline and benefits from productivity gains over time in MFN countries to be captured by quota A/B licence holders, under a 'tariff-only' regime MFN exports are expected to expand and benefits from increased productivity are enjoyed by EU consumers and MFN producers.

Since the November 2001 Decision (WTO, 2001b) does not refer to the impact of the 'tariff-only' regime on ACP countries, this was not an issue in the arbitration. It has, however, certainly been an important factor in defining the proposals put forward by the EU as well as in the choice of the current regime. For ACP banana producers, the best option would have been a policy regime with a high MFN tariff and no TRQ imposed on their exports, such as those considered in SIM3 and SIM6. ACP producers are better off in the policy scenarios that include a TRQ relative to the pre-2006 regime because of the increased TRQ volume. With the quota in place, ACP producers remain unaffected by the level of the MFN tariff over a wide range of values;[24] hence, once the decision to include a preferential

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24 Based on the results of the simulations, ACP exports remain equal to the TRQ as long as the MFN tariff is set above €130/t (Figure 3).

**Table 5.** A comparison of the impact of the alternative scenarios considered with respect to the pre-2006 import regime.

| | SIM1<br>EU proposal in step I of the arbitration<br>$t_{MFN}$ = €187/t;<br>duty-free ACP-specific TRQ = 775,000 t | | SIM2<br>EU proposal in step II of the arbitration (with TRQ for ACPs)<br>$t_{MFN}$ = €230/t;<br>duty-free ACP-specific TRQ = 775,000 t | | SIM3<br>EU proposal in step II of the arbitration (with no TRQ for ACPs)<br>$t_{MFN}$ = €230/t;<br>$t_{ACP}$ = €0/t | | SIM4<br>MFN countries proposal<br>$t_{MFN}$ = €75/t;<br>$t_{ACP}$ = €0/t | | SIM5<br>Equivalent $t_{MFN}$ (with TRQ for ACPs)<br>$t_{MFN}$ = €264/t;<br>duty-free ACP-specific TRQ = 775,000 t | | SIM6<br>Equivalent $t_{MFN}$ (with no TRQ for ACPs)<br>$t_{MFN}$ = €200/t;<br>$t_{ACP}$ = €0/t | | SIM7<br>Current regime<br>$t_{MFN}$ = €176/t;<br>duty-free ACP-specific TRQ = 775,000 t | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Impact | Ranking | Impact | Ranking | Impact | Ranking | Impact | Ranking | Impact | Ranking | Impact | Ranking | Impact | Ranking |
| MFN (non-EBA) producers | + | 3 | + | 4 | − | 7 | + | 1 | = | 5 | = | 5 | + | 2 |
| ACP (non-EBA) producers | + | 3 | + | 3 | + | 1 | − | 7 | + | 3 | + | 2 | + | 3 |
| EBA producers | − | 5 | − | 2 | − | 3 | − | 7 | − | 1 | − | 4 | − | 6 |
| EU | | | | | | | | | | | | | | |
|   Producers | = | | = | | = | | = | | = | | = | | = | |
|   Consumers | + | 3 | + | 6 | + | 5 | + | 1 | + | 7 | + | 4 | + | 2 |
|   Tax payers | | | | | | | | | | | | | | |
|     tariff revenue | + | 4 | + | 2 | + | 3 | + | 7 | + | 1 | + | 5 | + | 6 |
|     'compensatory aid' budget expenditure | − | 5 | − | 2 | − | 3 | − | 7 | − | 1 | − | 4 | − | 6 |

quota in the new regime had been taken, the level of the tariff imposed on MFN imports was, within this range, irrelevant and should not have been a source of friction in the arbitration between the two groups of developing countries.

EBA producers are the losers from the change in the EU import regime, as they export less than under the pre-2006 regime in all scenarios considered, even when MFN exports do not increase. This is because of the increased competition from duty-free ACP exports to the EU resulting from the expansion or the elimination of the TRQ.

EU banana producers are indifferent to changes in the import regime because of the 'deficiency payment' policy scheme. Although producer per unit revenue (market price plus 'deficiency payment') and domestic production do not change, the budgetary cost of the policy changes as a function of the market price of bananas in the EU: in all import regimes considered here, it is higher than it would have been under the pre-2006 import regime. The increases in budget expenditure are positively correlated with those in the degree of market openness. The ranking of the policy regimes by EU consumers is the opposite, as they will pay a lower price and consume more bananas as the import regime becomes less trade restrictive. Tariff revenue increases with respect to the pre-2006 import regime in all policy scenarios considered; the largest increases occur in the scenarios where a large tariff is imposed on MFN imports and duty-free ACP imports are constrained by the TRQ.

Holders of quota A/B licences under the previous regime lose from the policy switch to a 'tariff-only' EU import regime for bananas: had the policy not changed, in 2007 the value of their quota rents would have increased to $694.2 million.

Finally, it must be stressed that our results depend, to a certain extent, on the information used and the assumptions made. An effort has been made to provide readers with all the elements needed to make their own informed judgement. The main issues to keep in mind when considering the results of a model such as the one used in this paper are data quality, the assumptions that (a) the relevant actors apart from the EU (i.e. multinationals involved in banana production and trade, and other countries) behave competitively and do not change their behaviour under a new regime that radically changes the structure of the market, (b) bananas are a homogeneous product, (c) the supply of transport services is infinitely elastic (i.e. banana trading is not constrained by transport capacity), and (d) transport and other transaction costs do not vary either as a function of the volume traded or over time. The assumption that the banana market is perfectly competitive has been used in all previous analyses of policy issues in this market. However, even if there is no definite evidence of multinationals exerting market power, this assumption seems particularly sensitive and the sign of the impact of the 'tariff-only' regime on the structure of the banana market remains *a priori* ambiguous (will the elimination of quota A/B licences make the banana market more or less competitive?).

## Appendix

### Specification of the model

The model is solved by maximising a 'quasi-welfare' function, $W$, subject to a set of constraints (Samuelson, 1952; Takayama and Judge, 1971)[25]:

Max $W(x_{ij}, xab_{ie}, xc_{ie}, xoq_{ie})$

$$= \sum_j \int_0^{q_j^d} p_j^d(m)\,dm - \sum_i \int_0^{q_i^s} p_i^s(r)dr$$

$$- \sum_i \sum_j (TC_{ij} + t_{ij})x_{ij}$$

$$- \sum_i \sum_e (xab_{ie}\,tab_{ie} + xc_{ie}\,tc_{ie} + xoq_{ie}\,toq_{ie}) \tag{A1}$$

subject to :

$$q_i^s = \sum_j x_{ij} \tag{A2}$$

$$q_j^d = \sum_i x_{ij} \tag{A3}$$

$$fc_i = AC_i \left( \left(1 + \frac{PC_i}{100}\right)^N \right) \left( \left(1 + YDE_i \frac{YC_i}{100}\right)^N \right) \tag{A4}$$

$$fp_j = PR_j \left(1 + \frac{YLC_j}{100}\right)^N,$$

for $j$ = 'other EU new member states', 'USA' and 'other importers'
(i.e. for banana producing importing countries) (A5)

$$fi_j = \Big\{ \text{for } j \neq \text{'other EU new member states, 'USA'}$$

and 'other importers' (i.e. for importing countries
with no banana production):

$$BDQ_j \left( \left(1 + \frac{PC_j}{100}\right)^N \right) \left( \left(1 + YDE_j \frac{YC_j}{100}\right)^N \right);$$

for $j$ = 'other EU new member states', 'USA'
and 'other importers' (i.e. for banana producing
importing countries):

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25 The model is solved with GAMS (Brooke *et al.*, 1997).

$$\mathrm{AC}_j \left( \left( 1 + \frac{\mathrm{PC}_j}{100} \right)^N \right) \left( \left( 1 + \mathrm{YDE}_j \frac{\mathrm{YC}_j}{100} \right)^N - fp_j \right\}^{26} \tag{A6}$$

$$\mathrm{bsqfor}_i = \mathrm{PR}_i \left( \left( 1 + \frac{\mathrm{YLC}_i}{100} \right)^N \right) - fc_i{}^{27} \tag{A7}$$

$$\mathrm{ss}_i = \left( \mathrm{BSP}_i \frac{\mathrm{ER}_i}{\mathrm{ERB}_i} \right) \left( \frac{1}{\mathrm{bsqfor}_i \ \mathrm{ES}_i} \right) \tag{A8}$$

$$\mathrm{si}_i = \left( \mathrm{BSP}_i \frac{\mathrm{ER}_i}{\mathrm{ERB}_i} \right) - (\mathrm{ss}_i \ \mathrm{bsqfor}_i) \tag{A9}$$

$$p_i^s = \mathrm{si}_i + \mathrm{ss}_i q_i^s \tag{A10}$$

$$\mathrm{ds}_j = \left( \mathrm{BDP}_j \frac{\mathrm{ER}_j}{\mathrm{ERB}_j} \right) \left( \frac{1}{fi_j \mathrm{ED}_j} \right) \tag{A11}$$

$$\mathrm{di}_j = \left( \mathrm{BDP}_j \frac{\mathrm{ER}_j}{\mathrm{ERB}_j} \right) - \left( \mathrm{ds}_i fi_j \right) \tag{A12}$$

$$p_j^d = \mathrm{di}_j + \mathrm{ds}_j \ q_j^d \tag{A13}$$

$$t_{ij} = \frac{\mathrm{AVT}_{ij}}{100} (p_i^s + \mathrm{TC}_{ij})^{28} \tag{A14}$$

$$tab_{ie} = \mathrm{TABE}_i \ \mathrm{ER}_{\mathrm{EU15}} \tag{A15}$$

$$tc_{ie} = \mathrm{TCE}_i \ \mathrm{ER}_{\mathrm{EU15}} \tag{A16}$$

$$toq_{ie} = \mathrm{TOQE}_i \ \mathrm{ER}_{\mathrm{EU15}} \tag{A17}$$

$$\sum_i \sum_e xab_{ie} \leq \mathrm{TRQAB} \tag{A18}$$

$$\sum_i \sum_e xc_{ie} \leq \mathrm{TRQC} \tag{A19}$$

$$x_{ie} = xab_{ie} + xc_{ie} + xoq_{ie} \tag{A20}$$

$$p_\eta^s = \{ \text{if } \mathrm{RP} > (p_{\mathrm{EU15}}^d/\mathrm{ER}_{\mathrm{EU15}}), \text{ then } p_\eta^s = \mathrm{RP};$$
$$\text{otherwise, } p_\eta^s = \mathrm{si}_\eta + \mathrm{ss}_\eta \ q_\eta^s \} \tag{A21}$$

$$\mathrm{ca} = \{ \text{if } \mathrm{RP} > (p_{\mathrm{EU15}}^d/\mathrm{ER}_{\mathrm{EU15}}), \text{ then }$$
$$\mathrm{ca} = \mathrm{RP} - (p_{\mathrm{EU15}}^d/\mathrm{ER}_{\mathrm{EU15}}); \text{ otherwise, ca} = 0 \} \tag{A22}$$

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26 For $j$ = 'other EU new member states', 'USA' and 'other importers', when $N=0$ $fi_j$ equals $bdq_j$.

27 When $N=0$ $bsqfor_i$ equals $BSQ_i$, country $i$'s net exports in base year (2002) (t).

28 The problem of the endogeneity of $t_{ij}$ has been overcome by solving the model using a recursive procedure; in the first iteration, $p_i^s$ is replaced by $BSP_i$.

$$op = \sum_{\eta} q_{\eta}^s - \sum_{\eta} \text{MAX}_{\eta} \tag{A23}$$

$$fs_{\eta} = \{ \text{if } op < 0, \text{ then } fs_{\eta} = 0, \forall \eta;$$
$$\text{otherwise}: \text{ if } q_{\eta}^s \leq \text{MAX}_{\eta}, \text{ then } fs_{\eta} = 0;$$
$$\text{otherwise}, \text{ } fs_{\eta} = 1\} \tag{A24}$$

$$be = ca \left( \sum_{\eta} (1 - fs_{\eta}) q_{\eta}^s + \left( \sum_{\eta} fs_{\eta} \, q_{\eta}^s - op \right) \right) \tag{A25}$$

$$x_{ij}, xab_{ie}, xc_{ie}, xoq_{ie}, p_i^s, p_j^d \geq 0 \tag{A26}$$

**Table A1.** Definitions

| Symbol[29] | Definition |
|---|---|
| $i$ | Index for exporting countries and the sources of domestic supply in the EU |
| $j$ | Index for the importing countries |
| $e$ | Index for the importing EU member states (EU-15 in the 2002 base model, EU-25 in 2007 and 2013; $e \subset j$) |
| $\eta$ | Index for EU banana producing member states (France, Spain and Other EU-15 member states) ($\eta \subset i$) |
| $AC_i$ | Apparent consumption in country $i$ in base year (2002) (t) |
| $AC_j$ | Apparent consumption in country $j$ in base year (2002) (t) |
| $AVT_{ij}$ | *Ad valorem* applied import tariff imposed by country $j$ on its imports from country $i$ |
| $BDP_j$ | Country $j$'s import price (cif) in base year (2002) ($/t) |
| $BDQ_j$ | Country $j$'s net imports[30] in base year (2002) (t) |
| $be$ | EU budget expenditure for the 'compensatory aid' (€) |
| $BSP_i$ | Country $i$'s export price (fob) in base year (2002) ($/t) |
| $bsqfor_i$ | Forecast base net exports by country $i$ in year $2002 + N$ (t) |
| $ca$ | Per unit 'compensatory aid' paid to banana producers in the EU (€/t) |
| $di_j$ | Country $j$'s import demand intercept |
| $ds_j$ | Country $j$'s import demand slope |
| $ED_j$ | Country $j$'s import demand elasticity in base year (2002) |
| $ER_i$ | Country $i$'s €/$ exchange rate (equal to 1 for all countries but for EU member states; 1 € = $ER_i$ US$) |
| $ER_j$ | Country $j$'s €/US$ exchange rate (equal to 1 for all countries but for EU member states; 1 € = $ER_j$ US$) |
| $ERB_i$ | Country $i$'s €/US$ exchange rate in base year (2002) (equal to 1 for all countries but for EU member states; 1 € = $ERB_i$ US$) |

*(Continued on next page)*

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29 Exogenous parameters are in capital letters.
30 For EU-15, it is the apparent consumption.

| | |
|---|---|
| $ERB_j$ | Country $j$'s €/$ exchange rate in base year (2002) (equal to 1 for all countries but for EU member states; $1 € = ERB_j$ US$) |
| $ES_i$ | Country $i$'s export supply elasticity in base year (2002) |
| $fc_i$ | Predicted base consumption in country $i$ in year $2002 + N$ (t) |
| $fi_j$ | Predicted base net imports[31] by country $j$ in year $2002 + N$ (t) |
| $fp_j$ | Predicted base production in country $j$ in year $2002 + N$ (t) |
| $fs_\eta$ | $=1$ if in member state $\eta$ the 'compensatory aid' is to be paid on part of the production only, as a result of the financial stabiliser mechanism; 0 otherwise |
| $MAX_\eta$ | Maximum quantity member state $\eta$ is entitled to receive 'compensatory aid' payments for (t) |
| $N$ | Time shift with respect to the base year, in years (in 2002 $N = 0$) |
| op | Difference between total production in EU member states and overall maximum volume of production entitled to receive 'compensatory aid' payments, as a result of the financial stabiliser mechanism (t) |
| $p_j^d$ | Country $j$'s (cif) border price ($/t) |
| $p_j^d(m)$ | Country $j$'s inverse import demand function ($/t) |
| $p_i^s$ | Country $i$'s (fob) border price ($/t) |
| $p_i^s(r)$ | Country $i$'s inverse export supply function ($/t) |
| $PC_i$ | Per cent yearly change in population in country $i$ between 1990 and 2003 |
| $PC_j$ | Per cent yearly change in population in country $j$ between 1990 and 2003 |
| $PR_i$ | Production in country $i$ in 2002 (t) |
| $PR_j$ | Production in country $j$ in 2002 (t) |
| $q_j^d$ | Country $j$'s total imports (t) |
| $q_i^s$ | Country $i$'s total exports (t) |
| RP | 'Reference price' used to calculate the 'compensatory aid' deficiency payment (€/t) |
| $si_i$ | Country $i$'s export supply intercept |
| $ss_i$ | Country $i$'s export supply slope |
| $t_{ij}$ | Per unit specific (or specific-equivalent) import tariff imposed by country $j$ on its imports from country $i$ ($/t) |
| $tab_{ie}$ | Per unit in-quota A/B import tariff imposed by EU member state $e$ on its imports from country $i$ ($/t) |
| $TABE_i$ | Per unit in-quota A/B import tariff imposed by EU member states on their imports from country $i$[32] (€/t) |
| $tc_{ie}$ | Per unit in-quota C import tariff imposed by EU member state $e$ on its imports from country $i$ ($/t) |
| $TC_{ij}$ | Per unit international transaction cost for shipments from country $i$ to country $j$ (border to border) ($/t) |
| $TCE_i$ | Per unit in-quota C import tariff imposed by EU member states on their imports from country $i$[33] (€/t) |

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31 For EU-15, it is the predicted base consumption.

32 EU in-quota A/B 'imports' from Spain, France and other EU-15 member states and imports from EBA countries in 2007 and 2013 are inhibited by artificially setting in-quota tariffs for these sources at a prohibitive level.

33 EU in-quota C imports from all sources but ACP countries are inhibited by artificially setting in-quota tariffs at a prohibitive level.

Table A1. (*continued*)

| Symbol[29] | Definition |
|---|---|
| toq$_{ie}$ | Per unit out-of-quotas A/B and C import tariff imposed by EU member state $e$ on its imports from country $i$ ($/t) |
| TOQE$_i$ | Per unit out-of-quotas A/B and C import tariff imposed by EU member states on their imports from country $i$ (€/t) |
| TRQAB | EU 'A/B' TRQ (t) |
| TRQC | EU 'C' TRQ (t) |
| $x_{ij}$ | Trade flow from country $i$ to country $j$ (t) |
| xab$_{ie}$ | In-quota A/B trade flow from country $i$ to EU member state $e$ (t) |
| xc$_{ie}$ | In-quota C trade flow from country $i$ to EU member state $e$ (t) |
| xoq$_{ie}$ | Out-of-quotas trade flow from country $i$ to EU member state $e$ (t) |
| YC$_j$ | Per cent yearly change in per capita income in country $j$ between 1997–1999 and 2000–2002 |
| YC$_i$ | Per cent yearly change in per capita income in country $i$ between 1997–1999 and 2000–2002 |
| YDE$_i$ | Income demand elasticity of country $i$ |
| YDE$_j$ | Income demand elasticity of country $j$ |
| YLC$_i$ | Per cent yearly change in banana yields in country $i$ between 1991–1993 and 2000–2002 |
| YLC$_j$ | Per cent yearly change in banana yields in country $j$ between 1991–1993 and 2000–2002 |

# Acknowledgement

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Corresponding author: Giovanni Anania, Department of Economics and Statistics, University of Calabria, Ponte P. Bucci, Edificio OC, I-87030 Arcavacata di Rende (CS), Italy. Telephone: +39 0984492406. Fax: +39 0984492409. E-mail: ganania@unical.it.